Targeted Seed Aid and Seed-System Interventions:

Strengthening Small-Farmer Seed Systems in East and Central Africa

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Preface

This document presents the initial reflections of a working group on "Targeted Seed Aid and Seed-System Interventions: Strengthening Small Farmer Seed Systems in East and Central Africa: Individuals from 11 institutions joined together from June 21-24, 2000, to compare and contrast practical experiences on supporting farmers' seed systems, particularly in times of severe stress. What united the small group (drawn from IARCs , NARS, and NGOs) was a highly practical orientation, substantial first-hand field experience, and a strong belief that seed-aid interventions have to look well beyond the component of seed—or seed and tools—if they are to be effective on a sustainable basis.

Precisely, the workshop—or thinking sessions set in motion three major objectives:

- **the exchange** and synthesis of 'better practices' among seed-system interventions in East and Central Africa

- **the refinement** of specific guidelines for seed-system interventions (these continue to build on and evaluate several existing models— as well as pushing these guidelines further)

- **the development** and modification of conceptual tools for more informed design of seedsystem interventions, including the following:

  - practical models of seed-system components
  - diagnostic tools (and indicators) to determine the 'problem'/constraint and the causes of seed insecurity
  - tools to determine options for strategies for seed-system interventions (which link a honed diagnosis to appropriate action)

Reflection on and discussion of these three themes is woven throughout the presentations, as well as the working group notes elaborated in the annexes. While many of the concrete case scenarios draw from East and Central Africa, select examples from Honduras (related to the "Mitch" hurricane disaster intervention) serve to unite the institutional and technical context in which development-relief interventions unfold.

Seed aid as distinct from food aid is a relatively new phenomenon in much of the world (for example, in the Horn of Africa, it dates only from the last decade). The substantial amounts spent on seed aid as well as the potentially longer-term effects such aid can have on small farmers' systems—negative as well as positive—demand that critical assessments of such interventions be accelerated. At this point in time, as workshop participants contribute to this document, the practice of seed aid is a relatively blunt assistance instrument; that is, one solution—giving seed (or "seed and tools")—seems to be proffered to fit a varied set of problems and opportunities.

These workshop proceedings are part of an ongoing discussion: it is neither the beginning nor the end of a set of collaborations that aim to test and evaluate the effect of different types of development relief in supporting and sustaining the seed systems farmers regularly use.

L. Sperling
Workshop compiler

Analyzing Farmers' Seed Systems: Some Conceptual Components

Shawn McGuire
Technology and Agrarian Development, Wageningen University

Introduction: Systems approaches and seed systems

Considering the various processes involved in seed provision, selection, and storage as a system permits a holistic analysis of strengths and weaknesses, and possibly helps us choose more appropriate seed interventions. This approach has been successfully applied to ecosystem management, so here I briefly introduce the field of ecosystem health, to draw possible parallels.

In recent years, the growing field of ecosystem health has applied systems analysis to the environment and to agriculture in order to assess (and maintain) the "health" of these systems (e.g., Schaeffer et al. 1988; Okey 1996). The goal is to define health in an operational manner, based as much as possible on objective criteria, so that analysis can determine the important components and thus indicate possible interventions to help maintain health (Rapport 1998).

This is explicitly normative, often defining health in terms of the goods and services these systems provide humans.[1] Health also reflects how these systems react to stress. Some desired parameters include the following:

- stability
- resilience
- sustainability
- diversity
- efficiency
- equity

For most natural (relatively unmanaged) ecosystems, key processes can be readily identified, and the health or sustainability of the system can be reflected by how well the structure and function of these processes are maintained. Agroecosystems, however, are more complex. Along with ecological processes, cultural, social, and economic dimensions interact. Agroecosystems are thus a good example of an "emergent complex system," since structure and function alone cannot fully explain all the interactions between practices, processes, and culture (Waltner-Toews and Wall 1997).

Hierarchy can help make sense of such complex systems, partly reflecting how biological and social processes organize themselves in space and time (farm➔community➔valley➔region, or individual➔family➔community) and partly as a methodological tool to help us grasp complexity (e.g. Checkland 1981; O'Neil et al. 1986). Here, hierarchy does not imply a particular chain of control.

This approach could be usefully applied to farmers' seed systems. The parameters listed above have often been ascribed to healthy farmer seed systems (e.g., resilience, efficiency), or are seen as important development goals (e.g., equity). As for agroecosystems, no single factor determines farmers' seed systems: they reflect complex interactions between biological, economic, and social processes. Hierarchy is also important: different scales of space and time have a great bearing on how key seed-system processes appear (e.g., rates of adoption, seed diffusion, or genetic change). Like ecosystem health, analysis could best proceed by identifying key indicators for health. But to do that, there needs to be a better understanding of processes in seed systems. I begin to outline some of these processes below, taking the perspective of flows of genetic material and information, and

1. This approach has recently become part of mainstream conservation policy, where the Convention of Biodiversity has adopted the "ecosystem approach" as its conceptual framework and now plans to focus efforts on maintaining key ecosystem processes that provide crucial goods and services to humanity (D. Cooper, personal communication, 1999)

concentrating mainly on the household level.

Some basic definitions

While basic, these distinctions help clarify the discussion.

- Seed new varieties. It is helpful to conceptually distinguish between seed as planting material and seed as new germplasm

Therefore,

- **Seed security # variety security.** Both are key goals. *Seed security* is having enough material to meet planting needs, with access and *seed health* being important aspects. *Variety security* implies access to desired types. It is possible to be seed secure and variety insecure.

- Farmers access seed though multiple channels. I use **seed supply** as a general term for supply of planting material in general (which could also be cuttings for vegetatively propagating crops), but also call this **introduction** if it involves material new to the farmer).

Introduction and seed supply have a strong bearing on both types of seed security.

Comparing farmer and formal seed systems

A simple description of formal national seed systems could show a chain of processes, following a designated sequence, with a limited number of actors involved in doing or regulating each process (Tripp 1997). These processes would include the following:

- seeking germplasm
- variety development and selection
- testing
- certification
- distribution
- extension
- maintenance
- storage

Farmers' seed systems, like formal seed systems, can also be seen as managing the flow of genetic material and information, including most of the above processes, although the flow does not typically follow a sequence as clearly defined as the one in formal systems. I will briefly discuss some of the main processes: variety choice, variety testing, variety loss, introduction, seed supply, selection, and storage, summarizing some analytical questions at the end of each part.

Variety choice

Farmers choose varieties in accordance with their needs, which for particular crop varieties, are affected by the following, among other factors:

- available resources, such as land, labor, income, inputs
- market orientation and the strictness of market demand
- environmental situation: land quality and stresses on crop
- cultural values

Many argue that where ecological and/or socioeconomic conditions are risky and diverse, farmers have diverse needs that can only be met with a range of crop types (e.g., ITDG 2000a; 2000b). While this is certainly true to some extent, it is easy to over generalize. In some cases, farmers may come to use less varietal diversity with greater market involvement, substituting services from some varieties with purchased goods (Bellón 1996).

regional levels. Also, loss (both voluntary and otherwise) may reflect historical rates of variety turnover. Some questions that would help our understanding of whether there is varietal insecurity at the household or community level include the following:

- What is the scale of variety loss?
- Do households choose to abandon a given variety?
- Can varieties be re-obtained if opinions or conditions change?
- Do households no longer feel they have the varieties they need?

Introduction and seed supply

Households acquire planting material or new varieties through multiple channels: formal outlets, local (informal) merchants, exchange with family or neighbors, or from hybridization in their own field. Patterns of introduction can be influenced by communication and transportation links: roadways and trade or migration routes may help move material along established paths. Proximity to sources of new material, such as research stations, may also help. Moreover, new types may appear as hybrids or off-types in the field or in seed supplied from off-farm, or they may be mechanically mixed into off-farm seed (e.g., in sorghum MV seed handed out to Ethiopian farmers, a number of unreleased lines under testing at the station were found mixed in). Such mixtures and hybridizations may be important souices for novelty, even in crops that are largely self-pollinating, such as rice (Jusu 1999).

Social factors also shape introduction and exchange. Exchange of planting material or of new varieties is involved in social relationships, often occurring more within a particular cultural group, family, or local institution. Migration, or marriage exchange, however, may help move seed across different clans or ethnic groups. A survey of the anthropological literature on farmers' varieties suggests that, while there is rarely a monopoly on ownership, there can still be local conceptions of variety "ownership," usually linking this to particular responsibilities (Cleveland and Murray 1997). Though seed is often given as a gift, this is rarely absolutely free, but serves to reinforce social ties.

Wealth plays an important role in seed supply and exchange. Farmers who purposefully seek and screen new types tend to be wealthier; those finding interesting material may share it to increase their status or strengthen social ties In seed exchanges, those giving out the most seed to needy neighbors also tend to be wealthier than average, while those chronically needing seed are often poorer. Although poorer farmers may also have less access to desired seed types (less variety security, as well as seed security) because they cannot afford terms of supply, this may not be as great a barrier to the poor's variety access as feared Poorer farmers may be able to access new varieties through their social networks, though this should be verified for any specific situation.

Some analytical questions include the following:

- What is the relative importance of different channels, in terms of both absolute amounts of seed and introduction of new types?
- Are there social barriers to exchange outside of families or social institutions?
- How far do varieties travel?
- How accessible are terms?
- What type of farmer typically gives seed, or introduces new types? Are these different groups?
- What type of farmer typically receives seed?
- Is there chronic seed insecurity at the household level but not at the community level?
- Since wealth plays a role with introduction, seed supply, and innovation in general (Sumberg and Okali 1997), what happens when crises remove the cushion, or "room for maneuver" of even the wealthiest farmers? Does innovation and the purposeful selection and introduction of new varieties suffer? Do the poorest farmers lose their most accessible seed source?

- What are typical quantities of introduction and rates of multiplication and dissemination?
- Does quality from different sources vary, and if so, how?

Overall, the implications of different sources– and farmers' preferences for them—vary between good and bad seasons, and with wealth (see table 1).

Selection

Selection of seed for the following season varies among farmers in goals and methods, particularly around timing and intensity of selection. Hybridization, off-types, and unknown types may be treated positively or negatively, and seed quality and health are often key selection goals themselves.

Selection alone is a huge area, and a thorough treatment raises a host of analytical questions around goals, the actual effectiveness of selection, and the roles of genetic and environmental variation (cf. Soleri and Cleveland 2000; Soleri et al. 2000). For the current discussion, I restrict the analytical questions to the following:

- Does farmer selection play a role in maintaining desired traits (in either farmer or modern varieties)?
- Does selection play a role in maintaining seed health?
- Do changes in wealth or resources resulting from crisis (e.g., labor available for farm-based work) affect farmers' ability to select and hinder their ability to maintain traits or seed health?

Storage

Important aspects of seed storage are accessibility and the cost of different storage methods, as well as the quality and quantity of seed they maintain. In some situations (small-grain cereals, dry areas) local storage methods may be quite effective in maintaining seed quality and quantity. For others (tubers, wetter climates), this could be quite different.

Improved methods could help in some cases, although input costs may be prohibitive. Central stores may also incur administrative costs, raise issues of privacy, or institutionalize new types of barriers to access without offering many tangible improvements. Some questions include the following:

- What are the typical pest, disease, and security threats to seed in storage?
- What storage practices are used to address these threats?
- What scope is there for improvement, such as using simple modifications to local methods or following local "best practice"? What is the cost?

Cross-cutting issues

Wealth

Evidence suggests that relatively wealthy farmers play key roles in seed supply, variety introduction, and innovation. Furthermore, wealth seems closely related to seed needs and to household seed security. Most evidence on coping strategies for chronic disasters, particularly for famine (e.g., Sen 1991), suggest sequential responses, as people deplete resources and lose entitlements. The poorest are most vulnerable, although wealthier farmers may gradually lose their room for maneuver as well. This may also be the case with HIV/AIDS-affected families.

- Do wealthy farmers play an important buffering role for the seed (and variety) security of others?
- Do acute disasters affect the coping ability of all families to equal degrees? Or do wealthy farmers still have scope to play a supporting role in seed systems?
- How far does chronic stress (or chronic repeated stress) have to go for wealthy farmers to stop playing a buffering role, or a role in innovation?

Table 1. Some Factors Commonly Associated with Different Seed-Supply Channels for Farmers

Consideration	On-farm supply	Informal exchange	Semi-formal (local markets)	Formal seed distribution
Key *limitation*	household seed security	social relations	means for exchange	limited choice or conditional supply
Accessibility	good	good, if material present	fair to good	fair—limited choice or conditional supply
Typical costs	labor, storage inputs	favors, reciprocal ties	cash, exchange, credit	cash, requirement to follow package, or free gift
Geographical extent for supply	farm	community	regional	national
How information is obtained	direct experience	from neighbor or visits	from merchant, others, extension	formal extension
Risks around var. identity	low, except with F1 hybrids	low—neighbor certification	potentially high if merchant not local	low—formal certification
Risk to seed health	low—household monitoring	low-medium—sometimes grain (with poor germination) supplied as 'seed'	medium-high—sometimes grain (with poor germination) supplied as 'seed'	low—formal monitoring and treatment
Typical gender involvement	women—storage	women or men	women in markets	more men (cash)
Potential for new material	low	low-medium	medium-high	high
Potential to supply desired material	usually high, unless varieties have been lost	high—can choose source	medium—can sometimes respond quickly	low—formal breeding and seed-system failures
Resilience to stress	?	?	?	?

Dramatic social changes, such as war or revolution, transform social relations and may affect processes like exchange. For example, Ethiopia no longer has wealthy farmers to introduce varieties to their tenants as part of a client relationship.

Labor

The availability of labor within a household deserves attention on its own, as it is a key factor in the functioning of the seed system. Labor availability may relate to a farmer's varietal needs and ability to seek distant varieties, as well as the amount of effort given to husbandry, seed selection, and storage treatments. The allocation of labor (to off-farm activities or away from school, for example) is an important way households cope with stresses but may present tradeoffs between different areas.

- Is seed security or other seed-system processes affected by changes in labor use and availability in response to crises?
- How do these changes vary according to level of wealth or type of disaster?

Gender

Women often manage seed-system processes, especially storage and seed exchange. However, management does not always mean control. Intra-household negotiations may be involved in some activities, such as decisions about which varieties to plant, seed selection, or the consumption of stored seeds.

Social relationships

The level of "social capital" may strongly affect access to new varieties, seed from exchange, information, or other resources in a community. Thus, the degree of social isolation could be strongly correlated with a household's seed insecurity.

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Seed Systems and Their Potential for Innovation: Conceptual Framework for Analysis

E. Weltzien and K. vom Brocke
Hohenheim University

Introduction

Seed systems can be analyzed from different perspectives and with different objectives. One common perspective for analysis is that of a seed market and its associated regulatory controls (Tripp 1997) or of local farmers vs public- and private-sector control and involvement leading to the differentiation between local and formal seed systems (Almekinders et al. 1994; Cromwell 1997). In this paper, we propose using the farmers' perspective for analyzing seed systems for the identification of specific strengths and weaknesses.

Functions of a seed system from a farmers' perspective

Seed systems, formal or informal, fulfil a series of functions that are basic prerequisites for expecting the best possible productivity from a crop in a specific situation. Healthy, *viable seed of the preferred variety* needs to be available at *the right time*, under *reasonable conditions*, so that farmers can use their land and labor resources with the best yield expectations. The wrong variety, sown at the wrong timewith infected seed of poor germination potential, will seriously limit a farmer's expectation of production and productivity. Thus, any seed system has multiple functions to fulfill—for a range of farmers, farming conditions, and crops in a village, region, or country. A seed system can be assessed at any time according to how well it fulfills these functions. Conditions, situations, groups of farmers, or crops can be identified under which the specific system works well. Similarly, factors that constitute stresses to a particular system can be revealed in terms of these four functions.

Seed quality refers to the ability of the seed to germinate under field conditions and to establish a desired plant stand. This is affected by the viability of the seed itself, the health of the seed, and the degree of contamination with foreign matter that could contribute to introducing pests and diseases into the crop. These are often referred to as the "physical qualities" of the seed.

The *appropriateness* of the variety is a function of its traits, its adaptation to specific growing conditions and biotic or abiotic stresses, and its specific food and processing qualities. Another aspect of the appropriateness of a variety is its genetic makeup, which is often referred to as "variety type" (single-cross hybrid, homozygous line, multi-line, or open-pollinated variety, for example). Since all this is controlled by the genetic constitution of the seed, a third aspect is important: the genetic purity of a particular seed stock, which is often referred to as the "genetic" or "inner quality" of the seed, in contrast to the physical quality of seed described above.

Timeliness of seed availability is crucial in most farming systems for obtaining the expected yield and optimum results. Delays in sowing usually result in yield losses and can have a serious impact from disease or insect populations, which again, affect yield and quality at harvest. Timeliness can be specific to individual varieties. Farmers often use different varieties for different sowing dates.

The *conditions* under which a seed is available could be the price in the market but could also refer to the conditions under which a farmer can obtain seed from a relative or neighbor, i.e., how much and when the grain or seed has to be returned to the donor and the type of repercussions this may have for the individual in the community. Another alternative would be the investments required for producing one's own seed in terms of additional time spent as well as equipment, facilities, or knowledge required.

Seed systems and varietal innovations

This type of analysis tends to focus on a specific time: it is a snapshot description of these four basic functions. Viewed over a longer time frame, however, there is a fifth function: looking at seed systems as vehicles for change and innovation. Seed systems can provide farmers with changing varietal options and with opportunities for adapting to changing conditions for growing, marketing, or family needs. They provide farmers with new options for allocating and using their farming resources. Seed systems that do not provide such opportunities for change and for diversity tend to be vulnerable: they increase production risks for farmers and limit a farmer's capacity to adapt to changes and to exploit new opportunities.

There can be several sources of genetic innovation, one of which is the farmers, themselves, who

- carefully select within their populations to identify new types, which they then make available to others
- travel, bring back seed samples, test them in their own fields, and distribute them to others
- grow interesting grain samples obtained from the market, test them, and distribute to others

In systemswith public-sector agricultural research organizations, the source of new varieties can include a whole range of different actors—extension agents, development organizations, farmers' cooperatives, and so on organizing farm inputs and direct interactions with researchers. Similarly, the private sector can make new germplasm available to farmers, often on a more regular basis.

We base the analysis of this fifth function—the capacity to innovate—as well as the four basic functions described above, on four different process-oriented components. Each of these focuses on a specific research discipline, with overlaps and interactions between the components.

1. **Germplasm base:** This describes the existing germplasm base in the system, or the different components of a system. It includes the varieties presently under cultivation, the key varietal characteristics, their extent of cultivation, as well as their history and origin. Such analysis leads directly to an investigation of processes for varietal change, such as methods that farmers use for variety testing and sources for new varieties. It thus includes an analysis of interactions among farmers and institutions that enhance the germplasm base of a crop in a country or region.

2. **Seed production and quality:** The second component relates to all activities leading to the production of good quality seed at the time of sowing; it includes all operations of production and storage. Specific issues to explore are whether seed is actually produced and/or stored separately from food grain, whether selection is practiced to identify individual plants that will contribute seed for sowing the next season's crop. Here, questions relating to selection criteria, the person who is carrying out the selection, and possibly the regulations governing this process can be important. These questions are also important for understanding and assessing the potential of a system for maintaining diversity and utilizing it. Issues of seed storage facilities and their effectiveness are key to assessing the quality function, but, except in cases were they are extremely dysfunctional, they have less relevance for assessing diversity-related issues. Seed preparation before sowing can also result in dramatic changes in the genetic composition of a population, and thus have to be considered.

3. **Seed availability and distribution:** A third component of any seed system concerns the availability and distribution of seed that has been produced (and stored). It is crucial to know whether all farmers have access to the appropriate seed at the appropriate time. What is the actual origin of seed that farmers are sowing? Is it really their own production? Do local or regional seed stocks exist? What role do they play in seed availability for specific groups of farmers? What role does the market play? Is seed grain marketed at all? Seed exchange, distribution, or marketing work only under certain conditions of barter or payment, but it is often also accompanied by prestige factors. Specific quality concerns can be the reason for using specific channels of seed procurement.

4. **Information flow:** With a view towards change and innovation, it is especially important to understand how information regarding new varieties of a crop and good sources of seed is exchanged among farmers. Not only is it important to know what type of information farmers are really searching for, but also what information is actually available to them about new varieties and new seed sources. Who looks for new information? Where and from whom do they search for new information? And what kind of information are they looking for?

Application of analytical framework

Let us examine two cases where this framework for analysis is being applied to arrive at better targeted research on crop improvement, in terms of both technology development and technology dissemination and exchange. In both cases, the perceived impact of modern cultivars is low and, based on productionstatistics, increases in productivity in the production systems are difficult to demonstrate.

The first case is for pearl millet. In particular, it examines the needs of poor farmers and women farmers in a very dry area western Rajasthan in India (Dhamotharan et al. 1997; Christinck et al. 2000). The second case study involves on-going work with sorghum in the soudanian zone in Mali, a relatively well-endowed production system, mostly labor limited—not land limited as in India.

1. **Germplasm base:** The poorer pearl millet farmers in Rajasthan clearly prefer to grow the local variety of pearl millet that tillers well, matures early, is well adapted to the poor fertility conditions in their fields, and has good grain qualities (i.e., gives a person strength and allows good storage of food products). Varietal diversity is low. They regularly grow modern varieties (single-cross hybrids and open-pollinated varieties), which they obtain from the market, even though they know about the problems with adaptation to the local conditions of these varieties.

   In the sorghum case, each farmer grows at least three to four varieties, each of which differs in (a) maturity, with different dates of optimal sowing, (b) adaptation to fertility conditions, and (c) food processing and feed characteristics. Farmers have introduced varieties from other regions and have abandoned some local varieties in response to changing growing conditions, notably the shortening of the rainy seasons. One variety originating from a research program was introduced approximately 25 years ago; since then no modern variety has been adopted. Farmers regularly test new varieties and use methods for testing that are very similar to scientific approaches.

2. **Seed production and storage:** The pearl millet farmers in Rajasthan rarely produce their own seed. When they do, they usually do not practice selection among plants or panicles. The conditions for storage they have at their disposal are often less than perfect. Farmers usually winnow grain before sowing to remove damaged grains, as well as small ones.

   Essentially all the sorghum farmers in Mali produce their own seed by selecting panicles in the fields just prior to general harvest. Seed panicles are stored separately, in the safest possible manner: on the upper portion of a granary or in the smoke of the kitchen fire.

3. **Seed availability:** Because the pearl millet farmers normally do not produce their own seed, they rely on others as seed suppliers. Traditionally, this role is played by relatives in the first instance, then by better-off farmers in the same village. As commercial seed of modern varieties (mostly F1 hybrids) is becoming more available, these farmers often buy it from dealers in the village or from bigger shops in nearby market towns. These seeds have to be paid for with cash, and usually shop keepers do not give credit. Buying seed of modern varieties creates something of a positive image of being a "progressive farmer."

   Pearl millet seed is usually easily shared among family members if there is anything to share. It is food grain that is usually shared with others, not selected seed grain. If seed is scarce, a women who has relatives in another village, possibly some distance away, may have a chance of getting something because growing conditions may have been more favorable there, and thus seed might be available. Usually, if any exchange is demanded, the same quantity of grain is returned after harvest to the person who gave the grain for sowing These same conditions apply if seed is given by someone else in the village. Social rules are such that the person who is being asked for seed is obliged to give to the person who requests it. Asking for seed is accompanied by a loss of respect and of the person's image as "a good farmer"

In the case of sorghum in Mali, farmers can easily obtain seed for a specific variety from a family member, usually in exchange for the same quantity of grain after harvest. The person who is asked is obliged to give grain for sowing to anyone who asks - if s/he has anything left to share. If someone is interested in obtaining seed for a specific (new) sorghum variety from someone else in the village, it is customary for the person who wants the seed to express his/her interest ahead of time or at harvest. Persons who help in the harvest have a right to keep a certain number of seed panicles for their own use. Others can ask for small quantities to be reserved for them Usually other grain is given in exchange.

4. **Information exchange:** In the case of pearl millet in Rajasthan, the sole source of information about new modern varieties are the shopkeepers who sell the seed. There is very little to no awareness among farmers about differences among specific varieties, not even an awareness that there are distinctly different varieties on offer. For the farmers, the most important piece of information about a new seed is its region of origin and, if possible, a visual evaluation of the grain being sold.

   In the case of sorghum in Mali, the exchange of information among farmers about new varieties being tested seems rather slow It is not normal to visit other farmers' fields unless one is directly invited to do so or one happens to see the field because it is on a major path or road. Farmers also tend to not "brag" about their own fields and seeds; thus, a third party is often important in spreading news about a new variety. Village-level farmer organizations, for both men and women farmers, are strong in Mali.

This shows that poor pearl millet farmers and women farmers in Rajasthan have few chances to obtain a variety of pearl millet to optimize their yield. The formal sector, and increasingly, the informal sector as well, does not provide preferred varieties. These farmers do not have the resources to address their own seed needs reliably, themselves. However, they contribute directly to diversifying the genetic base of pearl millet in their area by growing modern varieties regularly and thus providing a chance for others to evaluate them.

It can be seen in the sorghum case that farmers actively pursue varietal innovations, but with little contact with the formal sector and with research. Information spreads very slowly, and thus, seed probably spreads slowly as well. Exchange occurs mostly within larger family units, which limits the spread of individual varieties. The challenge in this system seems to be to create more opportunities for contacts between farmers and researchers and with the formal system, as well as facilitating a greater exchange of information among farmers about both their own specific varieties and new options received through contacts with researchers.

Targeting seed-system support in the case studies

In the pearl millet case, the analysis has lead to changes in the orientation of the pearl millet breeding programs in this region, focusing on traits that give yield stability under stress. Farmers in some villages have formed associations to locally organize seed production of a specific variety for themselves. In another area, a local nongovernmental organization has initiated work to identify good sources of local seed for multiplication and distribution to poor farmers.

In the case of sorghum, while research to substantiate the analysis is still going on, the priorities of the variety-selection program have shifted towards quality characteristics and better-adaptation types. Work on institutional arrangements for better involvement of farmers' organizations in research and technology exchange has been initiated.

These analyses benefit from being carried out within the framework of a farming system, with an understanding of its components. The analyses are process focused It is thus necessary to be clear about the actual stakeholders and their institutions in the specific system or subsystem under analysis. Considering the seed needs of specific stakeholders, as in the case of pearl millet in Rajasthan, may be necessary to reveal specific needs and opportunities. For a complete seed-system analysis, it is essential to consider all key stakeholders in the system.

Acknowledgements

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Farmer Seed Systems under Stress

Catherine Longley
Overseas Development Institute

Introduction

The purpose of this paper is to illustrate the complexity of farmer seed systems and the dynamic ways in which such systems adapt to stress. Using data collected between 1994 and 1997 in Sierra Leone, West Africa, the paper shows that many of the assumptions that are made about farmer seed systems in times of stress must be seriously questioned. The resilience and complexity of farmer seed systems during periods of stress underline the importance of making detailed assessments if appropriate forms of support are to be identified and provided.

Understanding farmer seed systems

The components of a seed system include far more than just seeds. Unlike a formal seed system in which seed production is separate from crop production, seed production in a farmer system is an integral part of crop production. Understanding a farmer seed system therefore requires an understanding of both the social and ecological/physical components of agricultural production and the ways in which agriculture relates to wider livelihood strategies. Figure 1 presents the components of a seed system as perceived from a farmers' perspective.

Figure 1 includes six social aspects and eight ecological/physical aspects of a seed system that relate to the successful acquisition and planting of seed. Each of these aspects of a seed system is strongly interlinked with other aspects. Farmers must possess the ability to labor, which relates to good health and having sufficient food to provide energy for work. The ability to labor also requires the appropriate tools for the task at hand, whether clearing new land, plowing, or weeding. Local friends and family not only provide additional labor but may also play a role in helping a farmer access land, seeds, food, or tools. Farming skills and local knowledge are essential for successful agricultural production, including knowledge of how, where, and when to plant local crops and varieties, how to store or where to acquire seed, etc. Trust and mutual cooperation are essential for the sharing of knowledge and agricultural inputs
and for the proper of functioning of both local support mechanisms (e.g., assistance provided by a village chief or through social institutions such as alms-giving) and wider social networks. The latter also depends upon adequate mobility or the ability to travel. Markets are important not only for accessing seed and other agricultural inputs but also for the sale of agricultural produce. Finally, adequate and timely rainfall is essential for seed germination, crop growth, and production.

Box 1 lists a number of key questions that must be answered in order to understand the more specific details of a seed system that relate to what is planted and how seed is acquired. Answers to questions such as who is planting what and why will generally relate to the wider livelihood strategies of men and women of different age groups from respective wealth classes. The role of the market often becomes particularly important in considering why particular crops or crop varieties are grown.

Farmer seed systems under stress

Different types of stress affect farmer seed systems in different ways. Severe drought, for example, is unlikely to affect many of the social aspects highlighted in figure 1, although where drought results in famine, a shortage of food may reduce the farmer's ability to labor. In the case of displacement (whether this is caused by severe famine or by conflict), farmers may be physically distant from their friends and family, and it may be difficult for them to access fertile land. Moreover, refugees or displaced farmers may lack a detailed knowledge of the new agroecology in which they seek refuge. In the case of conflict, relations of trust and mutual cooperation may break down, mobility may be severely restricted and markets transformed. Reduced access to cash or exchange items is likely to occur in all stress situations.

Box 1. Key Questions for Understanding Seed Acquired and Planted

1. Who is planting what?
   - male/female, wealth class, displaced person/resident/returnee
   - crops, crop varieties, amounts

2. When?
   - planting time
   - harvest time

3. Why?
   - crop and varietal uses (for sale, for food for brewing, etc.)

4. How are planting materials obtained?
   - self-saved, purchase, exchange, gift, loan, etc.

5. From whom?
   - self, friends/family, traders, input suppliers, NGOs, etc

6. Where?
   - locally or from far away, from new residence or original home, etc

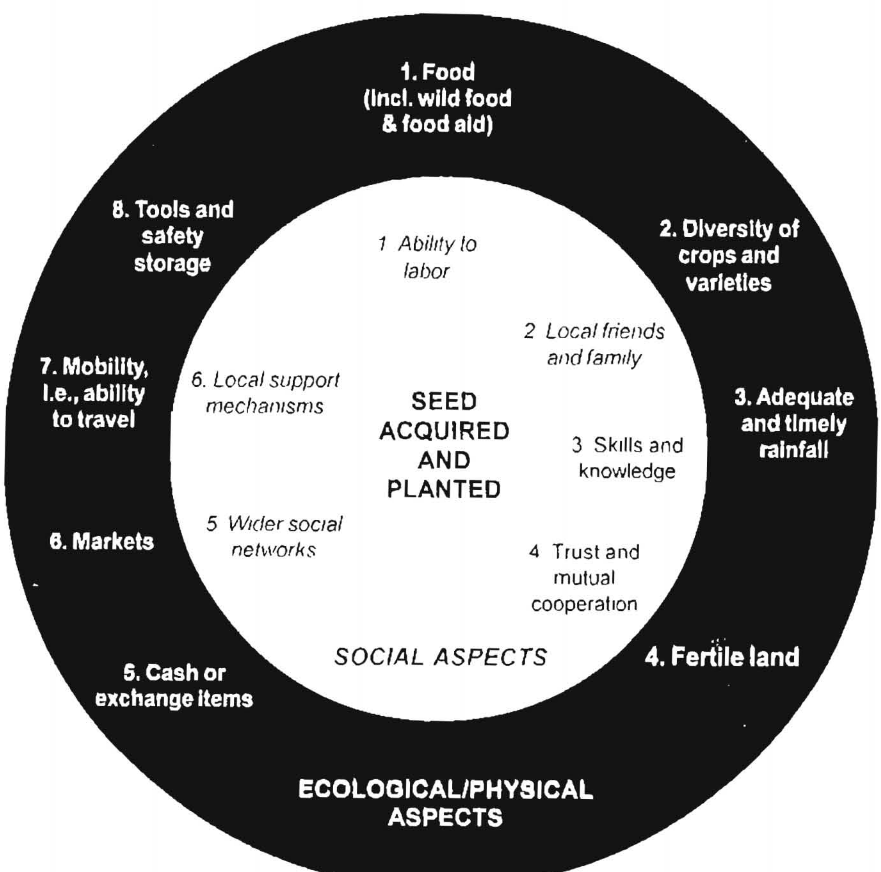

Figure 1. Aspects of a farmer seed system viewed from a farmers' perspective

These changes in the seed system inevitably have an impact on the ways farmers acquire and plant seed. Yet is dangerous to generalize about seed systems under stress; the resilience of seed systems is such that many of the assumptions shown in box 2 are invalid, as illustrated by the Sierra Leone data presented below.

Box 2. Misplaced Assumptions about Seed Systems under Stress

- Loss of self-saved seed stocks
- Less seed saved from one season to the next
- Inability to access seed locally
- Less seed planted, leading to smaller farms
- Fewer farmers planting crops
- Lowered diversity of crops and varieties

Farmer seed systems in Sierra Leone, 1994–1997

The data presented below were collected from a sample of 246 farmers from two different ethnic groups (and Limba) from five villages in the Kambia District, northwestern Sierra Leone. Data for 1994 represent the baseline, when cropping patterns and seed systems were considered "normal." Before the end of the 1994–95 harvest season, in January 1995, rebels of the Revolutionary United Front (RUF) attacked various locations in Kambia District, causing considerable population displacement. Many of the sample farmers fled either into the bush or over the border to seek refuge in the Republic of Guinea. Between 1995 and 1997, Kambia District suffered short periods of instability interspersed by longer periods of relative calm. Further details concerning the nature of the security situation and population displacement can be found in Longley (1997). Large parts of Kambia District remained insecure up to 2001 due to the continued presence of various rebel factions, although agricultural production was still possible. The data for 1996 and 1997 were collected from among the same 246 farmers who were originally interviewed in 1994 Some farmers had chosen to remain in their original homes (seeking refuge in the bush during periods of extreme violence); others had relocated to the refugee camps in Guinea or had sought refuge with family and friends in the region. Most of the sample farmers were able to continue with their farming activities throughout the study period.

Increase in the number of farmers growing specific crops

Data were collected for three crops, rice (planted in both upland and swamp ecologies), groundnut, and a small-seeded grain locally known as fundi (Digitaria exilis). Other crops grown in the area include roots and tubers, various vegetables, maize, sesame, sorghum, pearl millet, and various tree crops. The bar chart in figure 2 shows the percentages of male and female farmers in the sample growing each of the three surveyed crops in 1994 and 1997. While the proportions of both male and female farmers growing groundnuts (a popular cash crop) decreased, the proportions growing food staples increased. The percentage of male farmers growing upland rice doubled, and the percentage of female farmers growing upland rice (traditionally regarded as a man's crop) quadrupled. While the proportion of male farmers growing swamp rice increased only slightly, there was a larger increase in swamp rice cultivation among women. Among women, there was also an increase in the proportion of farmers cultivating *fundi*

Overall increase in area cultivated and reduced farm size

The increase in the number of farmers cultivating grain staples resulted in an increase in the overall area planted to these crops. In 1994, sample farmers planted a total of approximately 77 hectares of upland rice, while in 1997, the area planted was 149 acres, almost double the area planted prior to the effects of war The increase in the area of swamp rice planted was only slight: 69 acres in 1994 compared to 71 acres in 1997. Associated with the increase in the number of farmers cultivating rice and the increase in the area planted was a reduction in the average size of individual farm plots. When the farm size data are disaggregated by sex, however, a slight increase in the size of women's upland rice farms can be seen (figure 3). This was due to a small number of female traders who turned to large-scale rice production in response to the disruption to their normal trading activities caused by lowered mobility.

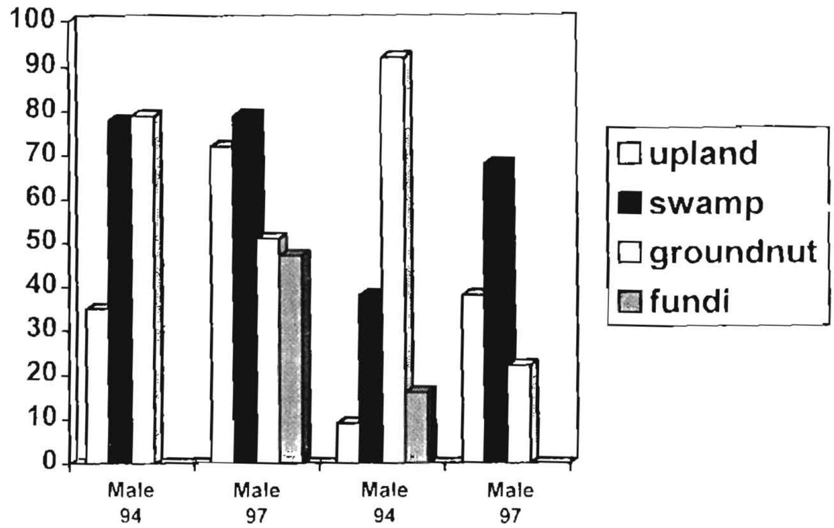

Figure 2. Percentages of farmers growing specific crops, 1994-1997

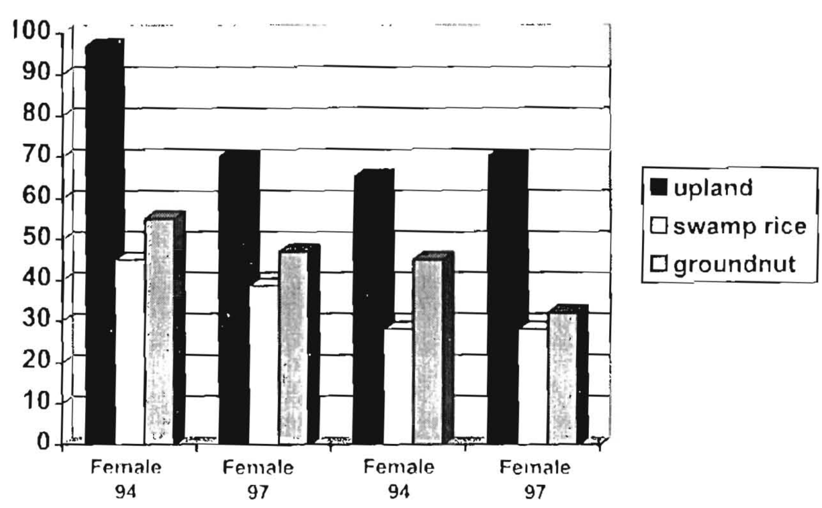

Figure 3. Average size of farms (in acres), 1994-1997

Changes in channels of seed acquisition

Contrary to the assumption that farmers are not able to acquire seed locally in the face of disruptions caused by disaster, the data from Sierra Leone clearly indicate an increase in the proportion of seed acquired from off-farm seed sources. Table 1 shows that for Susu swamp rice farmers—both men and women—the proportion of self-saved seed decreased from 1994 to 1997, while the proportions of seed obtained off-farm through local purchase and loans increased. The decrease in the proportion of self-saved seed is thought to relate partly to the increase in farmers who had not sown crops in the previous season, as opposed to the loss of seed by farmers who had previously sown crops. Thus, rather than farmers being unable to save or acquire seed in times of stress, the channels of seed acquisition changed.

Table 1. Swamp Rice Seed Acquisition by Male and Female Susu Farmers, 1994–1997

Year	Sex of farmer	Purchase	Exchange	Loan	Gift	Self-saved	Total
1994	Male	7%	19%	1%	2%	71%	100%
	Female	29%	10%	3%	19%	39%	100%
1997	Male	26%	12%	6%	9%	47%	100%
	Female	29%	9%	18%	16%	28%	100%

Note Figures shown refer to amounts of seed, expressed as percentages of total seed planted.

Increase in number of varieties planted

For swamp rice, the data show that there was a clear increase in the number of named varieties cultivated: from 23 varieties in 1994 to 41 varieties in 1997. This increase in varieties is explained by the increase in the proportion of farmers cultivating swamp rice and the increase in the proportion of seed acquired from off-farm sources: farmers with no seed of their own (i.e., from the previous harvest) planted whatever variety they were able to acquire. Thus, the increase in varieties was not necessarily a planned response but rather ameans of coping as well as possible in the face of stress. Whether this short-term increase in varieties persists in the long term remains to be seen.

Summary

Relief agencies generally assume that in times of stress, self-saved seed stocks are lost and farmers are unable to access seed locally. If there is an overall shortage of seeds, one might further assume that farms might be smaller than normal, that fewer farmers are able to sow their fields, and that there would be a decline in the diversity of crop varieties (box 2). In contrast, the picture that emerges from the data collected in Sierra Leone is one of increased reliance on the production of grain staples for household consumption, i.e., more farmers sowing more fields. Although the local seed system was able to meet the increased demand for seed, shortages of land and labor were the main causes for the decrease in average farm size.

Resilience of farmer seed systems

The ability of farmer seed systems to continue to function effectively in situations of stress indicates their resilience, which is due to three main factors: (1) their inherent flexibility and ability to cope with change, (2) the variation among different farmers/households/crops/production systems, and (3) the importance of seed to farmers.

The flexibility of farmer seed systems stems from their complexity: there are a variety of different seed acquisition channels that a farmer can use to access seed, both within and outside the village, through various means (self-saving, purchase, exchange, loan, gift) and from various people (family and friends, other farmers, traders). Even though a farmer may not be able to acquire his or her preferred varieties, there is usually some type of seed (or good-quality grain) locally available.

Different farmers and various different household circumstances (i.e., male, female, better-off, poorer, displaced, resident in own home) are such that it is impossible to generalize how farmers in general respond to stress: both livelihood and cropping patterns may change significantly, altering "normal" seed practices.

Whatever the type of stress situation, continued agricultural production depends on the farmers' ability to maintain and acquire seed. Farmers therefore attach great importance to seed and will do all they can to keep or obtain it for planting. In other words, farmers are not careless with their seed. It is only in very extreme situations that seed is not locally available; the farmers' ability to access seed is often more of a problem.

Seed assistance assessment

Much of the emergency seed provisioning that is undertaken is based not merely on a lack of understanding but also on incorrect assumptions about local seed systems (box 2). In the absence of adequate needs assessment by relief agencies, the first step required if farmers are to be provided with more appropriate forms of agricultural assistance is to develop an assessment methodology. Rather than devising new approaches, it is suggested that assessment methods for seed assistance should be built onto existing methods such as the household economy approach (HEA) developed by Save the Children-UK (SCF-UK) and widely used for field monitoring in protracted emergency situations throughout Africa (see box 3). Such a methodology would necessarily involve an understanding of farmer seed systems (as illustrated in figure 1), together with answers to the types of questions listed in box 1. The household economy approach is thought to be highly appropriate for collecting background information relating to seed systems (for both the social and physical/ecological aspects listed in figure 1).

Box 3. SCF-UK's Household Economy Approach (HEA)

HEA describes the household economy, the way in which household economies vary within and between populations, and the context within which households operate (e.g., markets, ecology, etc.). The information gathered by HEA is imprecise but reliable, based on rapid rural appraisal techniques with groups representing different categories of household wealth. HEA data allow insights into the dynamics of rural livelihoods: e.g., how changing markets and agricultural production affect the ability of different types of household to cope.

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Guidelines for Assessing the Impact of Disaster on Smallholder Agricultural Systems

Tom Remington

Catholic Relief Services, East Africa

The first step in assessing the impact of a disaster event on smallholder agricultural systems is to describe the scale and scope of the disaster. Disasters are defined as unusual events that have a serious negative impact on rural communities. This includes social (war or civil conflict) and climatic (drought or flood) events Disasters trigger famine by

- disrupting the agricultural cycle (lost cropping season)
- displacing farm families
- disrupting markets
- destroying food stores
- destroying capital assets

A combination of factors (usually war and drought) results in complex disasters. These situations complicate and prolong both relief and recovery.

Description of the disaster

Answering the following questions for the intended geographic area will assist in describing the disaster:

- Is this a social or a climatic or a complex disaster?
- Is it an acute or a chronic disaster?
- Was the onset of the disaster slow or rapid?
- What is the scale of the disaster in terms of the population affected?
- What is the geographic scope of the disaster?
- Is the affected population concentrated or dispersed?

For more information on disasters see Cuny and Hill (1999).

Description of the on-going relief effort

The United Nations High Commissioner for Refugees (UNHRC) uses a helpful framework to describe the phases of a disaster (UNHCR 1996):

Phase 1: Emergency: This is the acute phase during which conventional relief, consisting of food and non-food assistance, is provided directly to victims. Conventional relief usually consists of the following:

- food and nutritional supplements
- health care services
- shelter, potable water, and sanitation facilities

Phase 2: Care and Maintenance: The shift from the emergency to the care and maintenance phase is highly variable. Conventional relief activities continue during this phase.

All interventions, undertaken during the first two phases require logistical support. Cuny and Hill (1999) define this logistical support as:

The practical art of establishing lines of supply and providing commodities and the transport to move them.

Phase 3: Durable Solution Phase: This is the "return and reintegration" phase of the disaster, during which victims begin the task of recovering their livelihoods. The transition from the Care and Maintenance to the Durable Solution Phase is described by the

- duration of the Care and Maintenance Phase
- rapidity of the transition
- frequency of reversals

The duration of the Care and Maintenance Phase can vary from weeks (as in many communities in Rwanda and Burundi) to years (as in communities in northern Uganda and eastern Equatoria, southern Sudan). The rapidity of the transition is related to the duration of Phase 2 as well as the victims' perception of the risks of returning to their homes. And, finally, the transition is often characterized by setbacks and reversals.

It is important to emphasize that the Durable Solution Phase always follows an Emergency Phase and, therefore, agricultural recovery efforts always follow relief efforts. It is important to recognize this fact in order to understand that recovery activities are often designed from a logistical perspective. Though logistics remain important in the Durable Solution Phase, the emphasis must shift to sustainable development.

Schelhas (1998) divides the Durable Solution Phase into an early stage of *rehabilitation* and a later stage of *reconstruction*. Rehabilitation is propelled by momentum from the relief operations and the commitment of donors and relief organizations. It is during the rehabilitation stage that serious mistakes are often made. The transition from rehabilitation to reconstruction marks the transition to sustainable development. During reconstruction, relief agencies become less operational and civil society assumes greater importance.

In reality, the two stages are as indistinguishable as the terms "rehabilitation" and "reconstruction." However, it is useful to distinguish the two objectives:

- to restore the agricultural system to the status quo ante
- to strengthen the agricultural system

The planning for durable solutions should occur as early as possible and no later than early in the Care and Maintenance Phase.

Description of the ex ante agricultural system

The third step, after having described the disaster and the current relief effort, is to describe the target farming systems, as they were prior to the disaster.

A farming system is a unique mix of enterprises managed by households according to their goals, preferences, and resources and in response to the physical, biological, and socioeconomic environments

This description should result in the identification of distinct farming systems that are characterized by the use of similar methods used in the production of the same mix of crops and livestock for the same purposes. The following information, based on a questionnaire from Collinson (1981), can be used to differentiate farming systems:

- livestock kept (rank the three most important)
- food crops cultivated (rank the three most important)
- cash crops cultivated/main source of income (the most important)

- cropping intensity (years cultivated/years fallow)
- method of land preparation (no tillage, hand hoe, animal traction)
- source of labor (family or hire)
- types of inputs purchased (fertilizer, seed, pesticide, tools)

Description of the impact of the disaster

This section comprises the "problem description & diagnosis" section of a project plan. It is important to avoid the temptation to preselect a specific problem and design a project to address that specific problem Lewis (1995) emphasizes the importance of defining the problem properly because the set of possible solutions is a function of how the problem is defined. This is often the case with "seeds&tools." From a logistical point of view—when the lines of supply are established and commodities are delivered - the transition from food to seeds and tools is straightforward. The tendency is to define the problem as a lack of availability of seed, rather than a lack of access (i.e., seed is not available locally).

Begin the problem description by identifying all assets that have been lost The following checklist can help:

- lives
- houses and other buildings
- land and land improvements (leveled, terraced, bunded, drained, irrigated, etc.)
- equipment (tools)
- production (in storage, in the field, or a lost cropping season)
- seed and planting material
- livestock

An effective way to identify lost assets is to focus participant interviews on what was lost rather than what is needed Following a general discussion of the impact of the disaster on the family, the question "What did you lose because of the disaster?" is asked. This elicits a ranking of lost assets and reduces the temptation to attempt to predict what might possibly be provided and articulate the response accordingly.

For example, following the flooding along the Tana River in Kenya in 1997, "kitchen sets" were requested by several of the families visited. We later learned that this request was not based on what was lost in the floods, but on the knowledge that kitchen sets were being distributed by a different NGO.

In Burundi, both men and women listed housing (roofs, doors, windows) and livestock as the most common assets lost. No one mentioned bean seed or sweet potato cuttings as being lost. Nevertheless, most relief agencies were distributing seed and planting material at the time.

Analysis of alternatives and development of a strategy

In first stage of recovery, with the objective of restoring the agricultural system, the focus should be to assist families in acquiring lost productive assets. This can be done by analyzing the following:

- magnitude of the loss
- ability of the household and community to reacquire the lost asset independently
- feasibility and cost of assisting in restoration of that asset
- role of that asset in the recovery process

If it is a crop-based system, then the focus should be on restoring crop production; if it is a livestock-based system then the focus should be on restoring livestock production.

Articulation of problem statements and recovery objectives

After selecting the preferred strategy, articulate problem statements. Remember that *problem statements* are focused and the stated problems are solvable.

Recall the two broad objectives of agricultural recovery:

- restore the system to the status quo ante
- strengthen and improve the agricultural system

The steps described so far lead logically to the identification of a lost asset as a problem and to an objective to restore that asset. This is the classic project planning model that focuses on problem identification and solving. Although this is a legitimate and often effective way to restore the system to the status quo ante, it is not an appropriate methodology in planning to strengthen and improve the target agricultural system. Strengthening the agricultural system requires a process that focuses on internal strengths and external opportunities, rather than on problems.

Using appreciative inquiry in recovery planning

Most persons working in agricultural recovery would agree with the following statement from Schelhas (1998):

> *Postwar rehabilitation and reconstruction can be regarded and used as a chance to jump to a higher state of technology and to recuperate the years lost.*

Given the fact that farming systems are constantly evolving and that disasters stop or even reverse this evolutionary change, should recovery strategies seek a return to the status quo ante or should they seek to introduce new technologies to improve productivity or sustainability? Shelhas (1998) answers emphatically:

> *In some countries, such as Afghanistan, Angola, Cambodia, Eritrea, Laos, Mozambique and Viet Nam, where wars have lasted 10 to 20 years, there has been no question of rehabilitation on the pre-war level, because technology, markets and populations have changed dramatically in the meantime*

Some recent examples from Uganda and Sudan will help clarify the question:

- The traditional crops in the Acholi farming system in northern Uganda are sorghum, finger millet, groundnuts, and pigeonpeas. After 14 years of conflict and insecurity, should recovery efforts focus on restoring the *status quo ante* or should they introduce improved varieties of maize and beans?
- The traditional planting method of the Dinka in southern Sudan is to direct-seed groundnuts, broadcast millet and sorghum over the top, and then incorporate the millet/sorghum seed with a shallow weeding with the traditional push hoe (*maloda*). Should communities be assisted in accessing *malodas* or should the plowing hoe (*jembe*) or the ox plow be introduced?

Clearly, the decision to return to the status quo ante or to seek to achieve a "higher" level needs to be made on a case-by-case basis. Appreciative inquiry can help ensure that this decision is based on an appreciation of the agricultural system that existed prior to the disaster.

Project planning begins with an identification and analysis of the problem or problems and then proceeds to strategies to overcome those problems. Appreciative inquiry begins with a different set of assumptions: that possibilities, capabilities, and assets exist that can be exploited to both restore and strengthen the agricultural system. The following questions can help in understanding and appreciating the target agricultural system:

- What are the strengths of the traditional cultural practices (land preparation, sowing, intercropping, weeding, storage, etc.) in terms of returns to land and labor?

Emergency Seed Aid in Kenya: A Case Study of Lessons Learned

Louise Sperling
International Center for Tropical Agriculture

Context

This report reviews the effectiveness of seed aid in Kenya, with emphasis on the process and products of aid delivered during the Long Rains 1997 (February to June). While focusing on a single season just after a drought, it draws on a history of almost 10 years of repeated seed aid, with yet another intervention being organized as this report is being written. This report also includes a component on smallholder farmers' own assessments and reflections on the effectiveness of the seed-aid intervention. (Note that the contribution below is the executive summary of a 90-page report.)

Summary: Key points

Seed aid, as distinct from food aid, is a relatively new phenomenon in the Horn of Africa (dating from within the last decade) and both seed aid and seed-system support have yet to be seen as something fundamentally different from food aid and food-assistance support.

Seed aid is different from food aid in at least three key aspects:

- Seed is not intrinsically useful. It has to be adapted to the immediate biophysical environment, and adapted to farmers' potential management levels. It also has a built-in, often narrow, time limit for usefulness.
- Seed interventions affect the heart of a farmer's agricultural system —such as farmers' programming (of land, labor, intercropping patterns)—and tie it into a routine that assumes a certain stability. Further, although seed is often given under the rubric of short-term intervention (the "seed and tools" paradigm), its effects on the agricultural system can be long-term.
- Seed is costlier than food for all key actors (farmers, implementers, donors).

In Kenya, seed aid has been delivered on a fairly large scale—about every other season since 1992—and across a large number of districts. The focus has been heavily on maize over the years and through the region.

The case study draws from research at four sites where seed-aid distribution has taken place (Machakos, Baringo, Makueni, Embu/Mbeere). These sites were chosen so as to compare and contrast aid delivery by a variety of organizations, both government and nongovernment (NGO), with slightly different approaches to seed-system support in similar agroecological contexts.

The study examines both the internal process and effects of seed aid delivered during the Long Rains 1997 (February to June), along with external process and effects:

- Internal process and effects refers to issues such as the appropriateness of the crops and varieties distributed and the targeting of seed-aid recipients.
- External process and effects examines how the intervention affected farmers' broader agricultural management strategies and whether the seed helped farmers get back on their feet and establish a sustainable means of accessing desired seeds.

This paper was prepared with direct support from Catholic Relief Services, Eastern Africa, German Agro-Action, Kenya; The Government of Kenya, Office of the President.

The internal process and effects of seed

Most (77.8%) of the farmers interviewed for this study received seed aid in 1997, with the sites managed by the Government of Kenya (GOK) generally giving maize and beans (plus vegetable seeds in Baringo) and the NGO-managed sites distributing some maize and beans plus a range of more drought-tolerant crops (cowpea, sorghum,millet, pigeonpea). One site also programmed in a component of farmer capacity building (in improved seed production).

Farmers generally assessed the crops and varieties given as appropriate. The more drought-tolerant crops were also deemed "acceptable"—as long as maize was one of the elements in the aid package. Furthermore, farmers commented on the high quality of the seed; most of the farmers sampled did not routinely use certified seed or maize hybrids (except in Baringo). They recognized the "luxury value" of hybrids, but not necessarily just for direct sowing. Farmers can exchange the packaged maize for urgently needed items (for example, food staples such as salt, sugar, and oil). Seed aid in this sense achieves a currency function. Thus, the products delivered received high ratings.

Farmers expressed strong discontent with all three process variables—that is, the timing (generally late), targeting (not transparent), and quantities of seed received (too little). The less rigorous targeting was directly related to lesser quantities received per farmer. Overall, the process variables were rated higher at one site, where a prior assistance/development program had been established.

Each of the four sites had specific built-in biases in targeting, with the possible exception of a government-managed site (Machakos) where there was a blanket distribution for all those who appeared at public meetings. Apparent biases included those who organized themselves into work groups (Makueni), Catholics (Embu/Mbeere), and those with access to irrigated plots (Baringo). There was some evidence that poorer populations were also specifically reached in the Embu/Mbeere sample.

Lack of targeting transparency creates social friction. Farmers cited 27 different (sometimes conflicting) criteria used to select recipients. At GOK-managed sites, all expect seed as part of a "public good" and "their right." The fuzziness in targeting also reflects an ambiguity in the goals set for the seed-aid distribution.

While vouchers were not given, exploration of their potential acceptability showed farmers very divided as to their usefulness and acceptability. Much depends on (a) the availability of local crops/varieties, even if purchasing power is guaranteed, and (b) the willpower of farmers to use the cash/voucher solely for seed stocks.

Different kinds of farmers seem to prefer different options, based to a certain extent on wealth. The very poorest prefer seed aid because of their fear of diverting money *and* because the maize hybrid is beyond their normal reach. Richer farmers—a good number of whom received seed aid—generally feel equally disposed to the two options because hybrids are what they normally use and they have little trouble reaching the seed stocks. The issue of distance to market cross-cuts wealth categories, as does a concern that "quality" seed (local quality seed as well as certified) just isn't available in local markets. In areas where aid organizations are experimenting with non-maize options, farmers sometimes prefer the seed aid just because the crops or varieties they desire (green grams, cowpeas, millet) may not be easily accessed otherwise.

Fundamentally, the internal analysis showed that the goals of giving seed aid were not very transparent in the four cases analyzed. Based on an analysis of practice, there were at least four different goals:

- to fill a temporary seed gap—for the farmer to have something to plant
- to encourage self-help, or for farmers to achieve a self-sustaining seed-production strategy
- to give a gift to a political constituency—political combined with farming goals
- to stimulate "progressive" modern farming practices

None of these goals is inherently negative, although the first two probably more closely parallel goals aspired to in emergency stress situations. However, the multitude of goals, and accompanying approaches, creates confusion about what the seed is for, as well as false expectations and unnecessary dependencies.

Even the small number of cases suggests that seed aid (procurement and delivery) is more effective when decentralized:

- The choice of crops and varieties can be more local and tailored to the environment
- Targeting on a smaller scale is more accurate
- A range of approaches, rather than standardized ones, is possible. In some cases, seed alone may be needed; in others, skill building may prove crucial, and in still others, novel approaches in crops and crop management may be vital.

External logic of seed aid: Has it strengthened farmers' seed and agricultural systems?

Since 1992, on average, each farming family has received seed aid twice, with a high of 10 times. Thus, most farmers, irrespective of wealth, have received seed aid more than once in the last decade. Those in the church sample (Embu/Mbeere), who correlated more with poorer segments, received seed aid about once every two seasons. Farmer comments suggest that many have come to expect "emergency" aid on a continued basis.

Maize seed aid, which was the lion's share of aid given, provided 14% of the total maize sown in the Long Rains 1997, while for beans, aid seed represented 11% of the total sown. The situation for sorghum and cowpea was slightly different because aid agencies most often gave these crops expressly to diversify farmers' crop profiles in more drought-prone areas. Aid seed for these minority crops accounted for 33% and 27% of the total seed sown for sorghum and cowpea, respectively. Thus, during the emergency period, farmers accessed the majority of their seed for all four crops analyzed (maize, beans, sorghum, and cowpeas) by themselves. Across crops, a large portion of seed was sourced from local markets (not stockists), even in ecologically stressed areas.

The research assessed the portion of farmers relying on seed aid for 100% of their seed sown during the Long Rains 1997. Overall figures varied from 14% to 66% of farmers at each site. However, a closer analysis by crop shows that only six farmers (out of 171 total, across sites) relied 100% on seed aid for their key crops—that is, those crops in which they themselves normally invested. For most farmers, seed aid supplied their full seed stocks for a single crop only if the crop were relatively new or of lower priority (as in the case of cowpea, sorghum, pigeon pea, or millet), or in the case of income-generating vegetables such as onion, kale, and tomato.

Across sites, farmers primarily assessed their top two priority crops as maize and beans, with some of the more drought-tolerant crops cited in third place at unirrigated sites and the income-generating vegetables cited where the supply of water wasmore reliable. The matching of farmers' priorities with what they received as aid showed that, overwhelmingly, farmers received at least one of the crops they consider most important.

Farmers can normally use some seven potential channels for accessing seed.[1] For maize, nearly all farmers regularly use home-saved maize seed as their main source and, also, regularly use the local market to top off supplies. Use of stockist seed, that is, use of improved varieties and certified seed, is key only in the Baringo sample, although between one-quarter and a third of farmers in Machakos and Embu/Mbeere claim to use it "occasionally." Certified seed and hybrids are rarely used in Makueni. This overwhelming dependence on local maize seed perseveres in a context of very vigorous and prolonged government efforts to promote hybrid and certified material.

For beans, across sites, farmers use home-saved stocks as their central source of seed. However, local markets appear as an equally used source. Given that bean seed can easily be selected out from the previous harvest (as it is self-pollinated), it is surprising how many farmers get bean seed off-farm every

1 The case study explored farmers' routine crop and seed-procurement strategies to determine how "abnormal" the practices were (or were not) during the designated emergency. To date, seed aid has been given without diagnosing what the constraint may be. There has also been little effort to examine the resiliency of farmer agricultural or seed systems, or to question whether physically giving farmers the seed is the best among several potential strategies

season or every other season (about 30% across the sites), with high amounts being acquired in this way (70% plus of stocks). Thus, most farmers get more than half their bean seed off-farm on a regular basis.

For both maize and beans, the Kenyan data run counter to what is often taken as a truism when describing farmer seed systems: that is, that about 80% of the seed used by "normal" farmers comes from their own stocks and that accessing off-farm seed sources is "abnormal." The Kenyan material shows that small farmers routinely rely on local markets for a significant portion of their seed.

Farmers overwhelmingly expressed dissatisfaction with their maize-procurement strategy, with the notable exception of Baringo where the "progressive" sample accesses seed from stockists. The large majority can't afford certified seed (and find the prices exorbitant) and complain about the local market: the right varieties are not available, the seed is poor quality, merchants cheat on quantity, and the distances are too great. This widespread dissatisfaction seems relatively serious for a crop that forms the core of their agriculture.

For bean-seed acquisition, farmer sentiment is also strong and clear across sites. The large majority find themselves heavily tied to the local market—spending money but not sure of the quality they are receiving. Because beans are self-pollinated, farmers generally regard bean seed as something they shouldn't have to buy, using the money instead for school, medicine, and food. Overall, what does the average farmer want in terms of bean seed? Self-sufficiency. She wants to save seed money, to save transport getting seed, and she wants the seed on time—all implying that home-saved seed is the way to go.

Have seed trends improved for maize and beans over the last decade? Apparently not—just the opposite. Prices have gone up, exchange networks have become weaker, and deteriorating soil fertility and fragmentation have meant smaller harvests. The few positive developments—some new varieties, the emergence of seed aid, the packaging of varieties in smaller packets—do little to counteract very strong negative forces.

There is no concrete evidence that seed aid, per se, is strengthening farmer systems. Those who have received it once are not necessarily less likely to receive it again, and the amounts given were not significant in the context of farmers' overall seed-procurement strategies. Further, the main crop given—hybrid maize— does not ensure that farmers can become less dependent on outside sources: it only performs in better conditions and has a built-in deterioration factor. Considering that it only treats a symptom, and perhaps not in the most effective way, seed aid (seed & tools), as currently delivered, seems to be a rather costly intervention.

Characterizing seed-system constraints and opportunities: The Kenya case

The external analysis of the farmers' seed situation in Kenya raises a number of fundamental questions about the type of problem seed aid is and was supposed to alleviate. Seed & tools programs—that is, the delivering of quantities of seed and basic tools on a one-off basis (the kind of intervention being practiced in Kenya)—are designed to help farmers out of a temporary, well-defined, acute situation. Seed & tools are given in a context where a series of assumptions are made, whether they are consciously articulated or not:

- that farming systems have suffered an acute jolt and farmers have lost vital seed
- that given a discrete injection of seed—a boost—farmers will have the means to plant the seed given: that labor and inputs are adequate to plant and harvest and that the situation is sufficiently secure
- that the seed given, once, will help farmers re-establish an independent means of producing and accessing their own seed

The external perspective on seed aid has documented the general vulnerability of farmers' seed systems and overall agricultural systems. For some Kenyan farmers, the last decade has been one in which they have suffered droughts on a repeated basis. Between distinct, severe dry periods, their farming systems have operated well. However, with sharp drops in rainfall, as in 1991–92 and in 1996, they have required help from the outside to get back to where they were. These farmers have been experiencing *repeated acute stress*

For many Kenyan farmers within the sample, the seed stresses they describe are neither acute nor repeatedly acute. They are there on a continual basis. Small plots (and harvests), unreliable rainfall, lack of adapted varieties, poorly adapted crops (like maize in many areas), distant markets, scarcity of cash to purchase seed—all of these things hinder the farmers' ability to produce and/or access sufficient quantities of seed each season. While seed & tools treat their problems as acute; indeed, their stress situation is a *chronic* one.

A framework is started within this report for examining *acute, repeated acute,* and *chronic* stresses, cross-cutting these seed-system disaster types with root causes: agroecological and political/economic, as well as seed-system issues themselves. In plotting material relating to seed-system functioning from the Kenyan case, economic and political constraints leap forward as a major farmer-articulated constraint. Further, the analysis shows that focusing on seed and variety issues, *per se*, is not effective for dealing with the real bottlenecks in many seed-system situations.

The issue of *right seed crop* is examined in the context of emergency versus nonemergency situations. At a minimum, crops/varieties for emergency interventions need to be

- adapted to farmers' biophysical environment
- adapted to farmers' preferences
- adapted to farmers' management conditions
- promoting risk aversion

Right variety/crop is also examined on the basis of acute, repeated acute, and chronic seed-system stresses.

Hybrid maize proves to be a poor choice in the context of acute, repeated acute, and chronic stress situations. Most farmers do not routinely access hybrid maize seed from the stockist and therefore probably do not have the management expertise with which to nurture the aid varieties. Moreover, most maize hybrids have not traditionally been designed for suboptimal environments and the built-in genetic deterioration of hybrids doesn't necessarily promote self-reliance for those farmers who cannot afford to renew their stocks annually. Simply put, the overriding bias on hybrids—across years and regions—makes the situation something of an extreme or classic case of ignoring the basic emergency principles of promoting risk aversion.

A range of seed-system support interventions in East Africa—which go beyond seed & tools—is reviewed. These interventions have various goals, such as delivering more locally adapted varieties, ensuring that even the poorest farmers can get new materials, improving the quality of farmers' seed, and even helping farmers earn money from seed-production operations. They illustrate that a body of work is emerging to help address some of the more chronic constraints to seed-system health.

A paramount challenge to strengthening the systems by which farmers access seed rests in a more refined diagnosis of where the constraints and opportunities lie. Analysis of seed systems—farmer, formal, and those that aim to integrate the two—is a relatively new field. Prior to a decade ago, development work focused almost exclusively on supporting the institutionalized, formal seed sector. In Africa, seed-system experts estimate that such institutional channels may supply farmers with, at most, 5% of their seed, the obvious exception being maize in areas where hybrids are widely used.

The report ends by sketching the full components of a seed system and their interlinking relationships. Continuing to deliver seed & tools may be analogous to putting a band-aid on a gushing wound. Only a more-targeted diagnosis can lay the foundations for more-targeted interventions—interventions that have longer lasting positive impact.

Emergency Seed Interventions in Somalia: A Reflection on the Current Situation

*Christoph Langenkamp**

Introduction

Somalia is an arid to semi-arid country within the Sahel zone at the Horn of Africa. It is estimated that 6 million people populate an area of 637,540 km². Although Somalis speak one language and share a single religion, Islam, Somalia is sharply divided along clan lines.

Somalia's civil war started in the late 1980s in the northwest of the country and spread to the most productive agricultural areas of the south in the early 1990s. Hundreds of thousands of people were displaced and all government and private services collapsed.

The extensive fighting and a drastic drop in agricultural production caused widespread food insecurity and the great famine of 1991/2. Internally displaced people and the population of the inter-riverine area of Bay were most affected.

The agricultural sector in Somalia

The average annual precipitation varies between less than 100mmand 700 mm. However, as common in these climates, there is great variability between seasons and areas. Southern Somalia has two distinct rainy seasons, the main *Gu* season and the *Deyr* season.

The natural resources of Somalia are limited. Of the total surface area, only 13% is classified as arable, of which 90% is situated in the south where the two permanent rivers are. A further 50% of the total surface area is rangeland. The balance is desert.

In the historic past, nomadic livestock production was the predominant livelihood system in Somalia. However, this changed with the introduction of sedentary crop production and urbanization. The Food Security Assessment Unit (FSAU) funded by the European Community suggests that for 1998/99, the population of the south can be classified as 23% urban, 43% agro-pastoral, 9% riverine, and 25% pastoral.

Approximately 90% of the annual cereal production is produced in southern Somalia. The two most important centers are the Bay Region, primarily growing rainfed sorghum, and the Lower Shabelle Region, producing irrigated and rainfed maize.

The average annual pre-war harvest of more than 500,000 MT has been reduced to an annual post-war level of 300,000 MT. The post-war area planted with cereals varies between 250,000 ha and 300,000 ha.

Before the war, Somalia exported up to 100,000 MT of bananas every year. This industry was severely affected during the war but was revived in 1994/96. However, the banana industry finally collapsed after the El Niño floods of 1997/98 and has never recovered. It is estimated that between 20,000 and 100,000 people who were involved in the banana sector lost their income.

*Christoph Langenkamp has been working in Somalia for the past four years, of which 2.5 were as agronomist for the ICRC. Currently, he is holding the position of Rural Development TA of the European Commission's Somalia Unit in Nairobi

Emergency Seed Interventions

To address the famine of the early 1990s, agencies distributed free food to a starving population. Almost simultaneously, seeds and agricultural tools were distributed to rural and peri-urban populations in order to strengthen and rebuild agriculture-based livelihoods.

Initially seeds and tools came from neighboring countries, chiefly Kenya. Since 1994, most cereal and pulse seeds have been sourced internally from the same agroecological zone, while vegetable seeds continue to be imported from Kenya.

With the change of the conflict to localized inter- and intra-clan fighting, different farming communities were repeatedly affected by war and drought or flood, often being displaced and deprived of principle coping mechanisms like sufficient stocks and the freedom to move

Over time, the combination of varied levels of insecurity, natural disasters, and harsh climatic conditions have led to a situation often described as *protracted emergency*. Neither does the total lack of government structures and an enabling environment improve the situation.

Generally, two scenarios have prompted interventions in the seed sector:

- high levels of insecurity and open conflict linked to destruction, looting, and internal displacement
- failed or very poor crop production

Assessing the first situation is straightforward, and organizations dealing with such emergencies are well prepared. However, the second situation is much more difficult and complex to address. In the early 1990s, most organizations did depend on rapid surveys for assessing situations and deciding on interventions. This approach was found to be useful at the time but had considerable shortcomings.

To improve the general understanding of the food security situation and to be up to date, the FSAU was established, first under the umbrella of the World Food Programme and later the Food and Agriculture Organization of the United Nations and funded by the European Commission. Save the Children Fund (UK) is an implementing partner within the FSAU and introduced the *household food economy approach* as a method for assessing levels of vulnerability to food insecurity at the household level.

Baseline surveys linked with remote sensing information (provided by the Famine Early Warning System) and an extensive network of field staff provides stakeholders with updated monthly information on the food security situation and related aspects such as food production.

This methodology is used to identify farming communities vulnerable to food insecurity. The working assumption has been that communities that are food-insecure are at the same time seed-insecure. Therefore, the FSAU information is used to identify communities at risk. Following this preliminary identification of vulnerable communities, international agencies conduct rapid ground assessments and propose interventions, security permitting. The whole exercise is coordinated through the seed working group of the Somalia Aid Coordination Body (SACB) in Nairobi.

In general, the interventions in the seed sector focus on free distribution of seeds, pursuing very different channels of procurement and distribution. In 1999, more than 3,000 MT of cereal seeds were distributed. Over the past eight to nine years, at least 20,000 MT of seeds have been distributed in Somalia.

Reflections on the current situation and outlook

- What are the institutional aspects of assistance?
- What are the thresholds for intervention?
- Are the agricultural production systems under stress understood well enough?
- Are access to and availability of seeds limiting factors in agricultural production systems?

- Are the basic causes for apparent lack of seed understood and considered?
- Why are interventions in the seed sector being requested, season after season? (Is the assumption correct that farming communities recover after a seed distribution and become self-sufficient in seeds thereafter or are the assessments misleading?)
- Do interventions in the seed sector achieve their objectives of restoring basic agricultural production systems?
- Could interventions be streamlined or better planned and executed?
- Is preventive action possible?

Seed Systems of Small Farmers in Honduras: Their Relevance for Interventions

Jon Magnar Haugen
Agricultural University of Norway

This paper studies the seed systems of small farmers in Honduras—the ways farmers secure their access to appropriate planting material. Since seeds can be obtained not only from domestic production but also from relatives and friends, this paper includes information on both cropping systems and the social systems of small farmers in Honduras.

The capacity of the Honduran farmer's seed systems for supplying seeds in disasters is highlighted, with an emphasis on experiences with mechanisms like seed exchange and seed acquisition in the aftermath of Hurricane Mitch. Such information is relevant for agencies planning interventions to assist farmers in situations of stress and shock.

This paper is based on research in villages that received emergency seed provisions in Honduras following Hurricane Mitch (Haugen 2001). It gives a short analysis of the interventions actually executed after hurricane Mitch and considers the appropriateness of the approaches that were employed in these programs.

The fieldwork was carried out from February to April 2000 in two different regions:

- Yorito, in the interior of the country, between 700 m and 1600 m altitude, with a relatively long rainy season
- Choluteca, situated in the southern region, bordering on Nicaragua and the Pacific, between 300 m and 700 m altitude, with a short rainy season

The information from Yorito is based on a survey that was undertaken with 85 respondents, supplemented by qualitative information obtained in unstructured interviews with individuals and groups. The information from Choluteca is based on 15 unstructured interviews with individuals and groups.

Livelihoods of Honduran farmers

Access to land and other livelihoods

In Yorito, households that are engaged in agricultural production predominantly own and cultivate their own land. In Choluteca, 50% of the households that had their own production units were reported to cultivate land owned by others (Haugen 2001). The access to rental land was perceived as unstable in Yorito, while Choluteca offered examples of households that rented relatively large parcels of land on a stable basis. The practice of sharecropping in Choluteca is in distinct contrast to the absence of sharecropping

in Yorito. These differences can be explained through studying the demand-side and supply- side of the market for land rental. In Yorito, it has traditionally been quite easy to earn money as a day laborer, in harvesting coffee, for instance. In Choluteca, there is less access to such alternative livelihoods, which may make households in Choluteca more willing to pay rent for land. In addition, there are more large landholdings in Choluteca, which may contribute to a higher supply of land for rent. In Yorito, most production units consist of poor households that appropriated communal land in the sixties, seventies, and eighties. The landholdings used for basic grains are small and there is no possibility for landless households to access land.

Cropping systems

In Yorito, beans and maize are the dominant crops. Maize is cultivated once a year, in the primera that starts in

June, after the onset of the rains in May/June. Beans are cultivated in the *primera* and in the *postrera*, which starts in October/early November. In Choluteca, maize is sown across the area but is less common at lower altitudes. Sorghum is also quite widely sown but is most common at lower altitudes. Beans are only sown at higher altitudes, where the climate is cooler, while cowpeas are mainly sown at lower altitudes.

In Yorito, some farmers believe that maize may overshadow beans when they are intercropped; most farmers therefore prefer to monocrop beans. Climbing beans are rare in Yorito because it is believed that they are difficult to harvest and inhibit the growth of maize when they are intercropped. Climbing beans are more common in Choluteca, where they don't climb too much because the drought reduces their growth. The benefits of intercropping in this system outweigh any negative effects. These benefits possibly reflect the fact that for some crops (maize, beans), agroecological conditions in the region are suboptimal. Cowpeas and sorghum are better adapted to the dry climate, but beans and maize are preferred for consumption. Diversification may be an adaptation to optimizing food security and diet in an area with high biotic and abiotic stresses.

Cowpeas are often cultivated in vegetable gardens. Some farmers cultivate minor quantities of special beans and maize varieties in these gardens as well. This results in a rather high level of survival of these seeds (which are often the most interesting from the perspective of agrobiodiversity), even with disasters like Mitch, since it is easier to care for the crop when it is cultivated near the house.

Seed systems

In their discussion of seed systems, Richards and Ruivenkamp (1997) include not only seeds and storage, but also the practices, knowledge, and social relations that farmers use to promote the usefulness of their plant genetic resources (see also Longley and Richards 1999).

Producing, maintaining, and developing seed resources

In both study areas, around 15 different varieties of beans were identified as being presently cultivated. Out of these, most individual farmers only cultivated one or two different varieties (Haugen 2001). The farmers were highly knowledgeable about the different varieties relative to their adaptation to agroecological conditions and their agronomic qualities. The perceptions of varieties relative to use and consumption were also extensive. Most farmers could mention between five and 10 different criteria upon which they judged the varieties they use. Table 1 shows the criteria that were most frequently reported among respondents to the survey in Yorito, and how farmers evaluate the most common bean-varieties in the area relative to these criteria. The table reveals that the performances of different varieties vary strongly, and also that the performance of the bean variety *Tio Canela*, a variety that was widely distributed by in seed relief operations after Mitch, differs strongly between zones.

The visual characteristics of the grains and pods/cobs, as well as the shape of the plants, were important in distinguishing different varieties and are reflected in their names. Common names of bean varieties could be *blanco* (white), *negro* (black), *chingo* (an upright bush-type bean), *vaina blanca, negro* (white pod, black grain). Even though many characteristics are valued by the farmer, the selection process for the seeds is based on visual characteristics, such as form, size, and color of grains and pods/cobs. Varieties are always sown in pure lines to maintain these characteristics.

How farmers secure seeds

In general, small farmers in Honduras can be put into three categories relative to their access to seeds:

1. self-sufficient, generally seed-secure farmers (dominant in Honduras)
2. generally seed-secure farmers importing seeds regularly but from different sources, usually local (quite common among tenant farmers in Honduras)
3. seed-insecure farmers (some farmers are seed-insecure in one crop but seed-secure in other crops)

Table 1. Number of Respondents at Low and High Altitudes with a Positive or Negative Perception of Different Traits of the Bean Varieties Most Common in Their Area

Variety	TC		TC		Ret		Ch		CR		Ped	
Zone	1		3		1		1		3		3	
Perception	Pos	Negs	Pos	Negs	Pos	Negs	Pos	Negs	Pos	Negs	Pos	Negs
Production	27		16	4	7	11	1	11	24	3	13	1
Market acceptance	21		20	1		18	9		23	1		13
Color	6	1	3			3	4		2			1
Taste	8	8	2	14	14	1	7	1	10	8	13	
Adaptation to zone	3		2	10	2				14		7	
Adapt to prod system	8		5	4	2	3	1	1	6	2	5	
Resistance to drought	3			3			1	3	4	1	1	
Resistance to diseases	14	2	1	9	6	5		9	7	4	7	
Resistance to pests	6		2	2	4			5	2	1	3	
Storability	1			6					4	1	5	
Time for maturity		5		6	1	2	6		9		1	
Simultaneous maturation			5	1					4	2	1	
Nutrition				2					1	2	4	
Maintenance of tradition											2	

Note: TC = Tio Canela, Ret = Retinto, Ch = Chingo, CR = Concha Rosada, Ped = Pedreño. Zone 1 refers to the low-altitude communities of Luquigue and Jalapa (n=30). Zone 3 refers to the high-altitude communities of Santa Cruz and Mina Honda (n=29).

Table 2 shows the relationship between level of well-being and the frequency of external bean seed acquisition.[1] The table reveals that poor households are overrepresented among households that acquire bean seeds externally every year. This observation is statistically relevant with $p < .001$ (n=84).

The respondents referred to a number of reasons for saving or not using seeds domestically (table 3).

Table 2. The Relationship between Level of Well-Being and the Frequency of External Acquisition of Bean Seed

	Level of well-being		
Frequency of external seed acquisition	Well-off	Intermediate	Poor
Every year	1	4	9
Less often	32	32	6

1 Households were classified into three classes of well-being according to their score relative to 12 indicators: (1) ownership and standard of housing, (2) ownership of land, (3) amount of land cultivated, (4) engagement in day labor, (5) destination of on-farm agricultural production (domestic use vs. market) and need to purchase food, (6) health conditions and access to health services, (7) access to nonagricultural sources of income, (8) ownership of livestock, (9) ownership of cattle, (10) experience with food shortages, (11) use of day-laborers on own farm, and (12) capacity to lend money to others.

Combining the information in tables 2 and 3, we can infer that most farmers would prefer to use domestic

Table 3. Reasons for Using/Not Using Domestic (Farm-Saved) Bean Seeds

Reasons for preferring domestic seeds	Number of responses	Reasons for not using domestic seeds	Number of responses
Domestically saved seeds are cheaper in terms of money or other obligations	36	Insufficient quantity or poor physiological quality of domestic seed lot*	43
Confidence based on experience with a particular variety	36	Poor genetic quality of domestic seed lot* (degeneration)	6
Confidence in a particular seed lot* based on thorough selection	35	Information that new variety is better	17
		Insecure access to land/no storage facilities	5

Note. N=82 Respondents could give more than one reason for choosing a specific strategy.
*A seed lot is a particular population of seeds (or crops) that is managed separately because it is seen as having qualities that are distinct from those of other populations of seeds/crops (Louette and Smale 1996) In general, this separate management is based on the seed lots being recognized as belonging to different varieties. A variety is composed of all the seed lots used and recognized as distinct units by farmers and sharing the same name

seed if they had the opportunity. Table 2 shows that only poor farmers secure seeds from external sources on a permanent basis. Table 3 shows that for the most part, external sources are only employed whenever the domestic supply fails. Thus, external sources are generally looked upon as an inferior substitute. In-depth interviews revealed that farmers try to retain seeds from their domestic production even when most of the harvest fails (Haugen 2001). Farmers not only believe their seeds are physiologically superior, but also genetically superior. External sources are only preferred for accessing new germplasm. This indicates that acquiring seeds externally every year is a good indicator of seed insecurity.

Aside from employing off-farm sources when the domestic supply fails or when one wants to access new germplasm, off-farm sources are also used in cases of improper access to land or storage facilities. In Yorito, the lack of land security means that tenants may have to cultivate areas with different agroecological conditions every year, and the seed lot of one season may not be any useful the next. Thus, these farmers may not be using off-farm sources because the domestic supply fails, but rather because the land insecurity creates a disincentive for saving seeds. Such farmers probably make up a big portion of the farmers who secure seeds off-farm every year, so the actual number of chronically seed-insecure farmers in Yorito may be very low.

The situation of tenants in Yorito contrasts with that in Choluteca, where it is common for tenants to rent the same land year after year or, at least, to cultivate fields with more or less the same agroecological conditions. This creates an incentive for these producers to behave like land owners and to save seeds every year.

Exchange and distribution of seeds

There are several types of exchange for farmers who want to access seeds off-farm. If they have seeds or grains, but suspect that others have better seeds, it is very common to exchange seeds. Farmers who don't have any seeds to exchange, because of harvest failure or improper storage, can acquire seeds in various ways:

- local purchase (at prices lower than in the market)
- as a loan
- as payment for labor
- as a small gift (only in small amounts)
- received with a sharecropping contract on land

It is important to note that successful local acquisition of seed is usually dependent on good social relations with relatives and friends.

In addition to being acquired locally, seeds can be purchased in the market. This is more common in Choluteca, where the distance to the nearest town is quite short. Many farmers also see distribution through organizations as an important source of seed.

External sources of seeds

Well-off farmers. Members of the community—generally the better-off farmers—can be sources of seed. Even in situations of disaster, these individuals can have seeds that survive, and they can be a key element in the survival of particular varieties. They often save sufficient amounts of grain for their own consumption, and as long as the disaster has not struck just when these stores have been depleted, it is possible to use this grain as seed. (This, however, means that the seed quality will be lower, because the grain has been stored longer and it has not been specifically selected for use as seed.) In some communities, key seed sources purchase some of the harvest of others and sell or exchange seed for labor at the onset of the following season.

Other communities. As mentioned in the section on cropping systems, above, different areas can have advantages in the production of different crops because of differences in agroecological conditions in the region. In Choluteca, where the communities at higher altitudes have more stable production of beans, the export of bean seeds to lower areas can be significant, especially after disasters. Farmers from lower altitudes visit the higher areas to access good-quality seed (see Longley and Richards [1999: p.124] for a similar story from Peru).

The market. In Yorito, the market is not an important source of seed. However, the market can still be an important source of new germplasm to these communities. Some farmers occasionally purchase seed in the market, and by way seed exchange, new germplasm may diffuse into the whole community.

Organizations. Different organizations have been distributing small amounts of seed over the years. The presence of these organizations has led to the introduction of varieties through field trials, where new varieties have been tested and demonstrated. Farmers can take small amounts of seed of the varieties they like.

Changes in the use and distribution of varieties

Changes in the use of different varieties can be accounted for by three sets of factors (suggested by Richards and Ruivenkamp 1997):

- voluntary change, due to altered conditions in the agroecological factors of the production systems or to the degeneration of seeds
- change resulting from successful trials with new material
- involuntary change, where varieties have been accidentally lost or have been consumed out of necessity

Voluntary change. Big changes in the cropping systems of farmers in Yorito have had a strong impact on the varieties that are preferred. The production system in Yorito has traditionally been one of shifting cultivation, a system for maximizing production when labor, not land, is the limiting resource. As population pressure has increased, fallow periods have been reduced or have disappeared. This has led to the depletion of soil fertility, and problemswith pests and diseases are increasing. On the other hand, competition from weeds has been reduced. Thus, the agroecological conditions of farmers' cropping systems have been altered from a situation where varieties compete with weeds to a situation where varieties must tolerate poor soils and a highly hostile environment of pests and diseases.

The shift from labor to land as the limiting resource makes intercropping relevant. Intercropping is labor-intensive but can be advantageous to soil fertility and can increase productivity. The shift might lead to greater use of small-growth varieties that can be sown densely and are appropriate for intercropping. Climbers, which compete well with weeds and therefore are well adapted to shifting cultivation, have disadvantages in the new system: a low productivity per area, maturation at different times, and a labor-intensive harvest.

Change resulting from successful trials. Even before Mitch, the communities were being introduced to new bean varieties, and the demand for old varieties was diminishing. Facing increasing levels of stress from diseases in their fields, farmers have been willing to experiment with new varieties. New broadly adapted varieties of the bush-bean type are being widely accepted, mainly because of their resistance to certain fungal diseases (*Mosaic commun* and *Mancha angular*) (Rosas, Varela, and Castro 1997). The new varieties have diffused rapidly into the farming communities, a trend that started before Mitch but was promoted by the wide-scale distribution of seeds after the disaster. The diffusion has been further promoted by an open-seed system where information and seeds are freely available.

Examples of individual farmers who experienced involuntary change in the use of varieties after Mitch were found, but there were no indications that any variety had become extinct in any of the study areas in recent years. Therefore, farmers who lost a variety because of Mitch should be able to regain it from other farmers.

Impact of Mitch and of post-Mitch seed provision

Mitch struck at the end of October 1998. Landslides, floods, and wind devastated houses and cropland. Because most subsistence farmers depend on their own production or other local sources for their planting material for the next cropping season, it was thought that Mitch had severely affected the seed security of these farmers. In response, various institutions engaged in the distribution of seeds both in Yorito and in Choluteca. Which characteristics of the disaster are of relevance for such interventions?

General effects of natural disasters on cropping systems

A hurricane like Mitch will have a different effect on seed systems and food security than stress of longer duration, such as a war or social conflict. An important difference is the time dimension. Following the categorization of Buchanan-Smith and Maxwell (1994), Mitch was a rapid-onset emergency. Such disasters mainly damage physical/technical/material resources (that is, productive assets). Social and cultural resources, such as traditions for exchange and selection of seeds, might only be disrupted over time, for instance, when a war or a drought leads to long periods of absence from cultivation.

A second characteristic of rapid-onset emergencies like hurricanes is that restoration can be started immediately. This type of disaster can never be forecast, however, so in order to be prepared, it is important to have strategies for rapid interventions in place beforehand. The time that a disaster hits can be crucial for the extent of crop loss. In Choluteca, Mitch hit late in the cropping season. Therefore, farmers' stocks of food were almost empty when the hurricane struck. This made it difficult for these farmers to cope through dietary adjustments. In Yorito, the hurricane hit just before the start of the coffee harvest. Thus, possibilities for coping through seeking off-farm employment were high.

The impact of Mitch

Statistics on crop losses in Yorito show that about one-third of the farmers lost their entire harvest of beans (Haugen 2001). On the other hand, more than one out of three did not experience any bean losses. While crop losses for beans were higher at low altitudes in Yorito, maize was more strongly affected at higher altitudes. This differential impact can be explained by looking at differences in the agroecological conditions between zones.

The *postrera* of beans at lower altitudes was in good growth when Mitch struck at the end of October. Most farmers in this zone cultivate level terrain, which became waterlogged as a result of Mitch, causing heavy losses. Maize, on the other hand, was already mature and the maize that hadn't already been harvested could tolerate waterlogging.

At higher altitudes, the maize was not yet mature, and the winds, which were stronger at higher altitudes, caused the plants to lodge. The *postrera* of beans, on the other hand, had not yet been sown in many cases, while in areas where it had been sown, the germinating plants could survive. The steep fields that dominate in these zones do not become waterlogged so easily.

In Choluteca, Mitch struck late in the *postrera*. Few farmers had much grain left, and it was therefore difficult to put away part of the *primera* for seeds, although some farmers were able to do so. Even though maize, sorghum, and beans are commonly intercropped in Choluteca, Mitch seems to have had a much more severe impact on beans than on sorghum. The explanation was that beans are more susceptible to disease, so even if it was possible to harvest some of all the crops, the quality of the beans was not appropriate for use as seed.

Food security

Hurricane Mitch was not an isolated event, but rather, the most catastrophic event in a increasingly unstable environment. People employ different kinds of strategies to protect their food security against such disasters. In part, they try to reduce the risk for harvest failures by employing precautionary strategies. However, if the harvest still fails, farmers try to reduce the impact through the use of coping strategies. The presence of externally based support is hopefully adding to this resilience and not undermining local institutions.

Farmers' precautionary strategies. The common system of cultivating twomajor crops in two seasons can be analyzed as a strategy for reducing the likelihood of harvest failure, thereby protecting food security. However, the use of varietal mixtures, which is also supposed to reduce the risk of crop failure, is not widespread.

Coping strategies. The main coping strategies encountered in this study include seasonal migration and off-farm employment. Increasing participation in off-farm employment may lead to less resources being spent on-farm.Whenever such strategies are employed every year, they may erode the basis of long-term household food security. However, not many examples of erosive coping were observed in this study.

Other coping strategies that were used in Honduras after Mitch include the following:

- *Changing cropping patterns.* In Choluteca, the first season after Mitch saw greater cultivation of maize and sorghum, while the production of beans was reduced. This may have resulted from reduced availability of bean seeds, or alternatively, in times of stress, farmers may prefer to cultivate greater quantities of maize and sorghum, which have higher and more stable production.
- *Adjusting the diet.* Many farmers reported that they reduced their number of meals and ate fewer beans (which is more of a luxury crop) after Mitch.
- *Selling livestock* Many families have livestock, which may be an important reserve in times of disaster.
- *Obtaining food through social relationships.*

Cropping systems not only have to supply food, but also seeds for the following cropping seasons. In a few cases, it was reported that farmers had to use seeds of poor quality for the first cropping season after Mitch. Such use of poor-quality seeds for coping with a crop failure could be strongly erosive.

Seed provisions

Emergency seed provision was indeed undertaken at a high scale in the two study areas after Mitch. Out of the 75 households that planned to cultivate beans in the first cropping season after Mitch in Yorito, 49 received provisions, corresponding to two-thirds of the total sample. The provisions consisted exclusively of seeds of modern cultivars, mainly the variety *Tio Canela.*

Need for and appropriateness of interventions

As indicated in table 1, *Tio Canela* was generally appreciated by farmers. Does this suggest that the exclusive use of modern cultivars was an efficient strategy for supporting food security after Mitch?

The need for interventions. As the *primera* in Choluteca is sown inMay, the bean seed provisions, undertaken in June, arrived too late to assist farmers in the first cropping season after Mitch. Some of those who had lost all of their harvest were not able to access seeds in other ways and therefore couldn't cultivate beans in this season.

This might suggest that local systems of support were not in place to help affected farmers cope with the crop loss. However, some farmers might have stopped cultivating beans for other reasons. As already mentioned, bean production is vulnerable in Choluteca, and it is maize and sorghum that are the basic crops. After a disaster that strikes harder at beans, it might be rational for farmers to put more emphasis on the cultivation of maize and sorghum. Thus, insufficient access to seeds may not be the only reason for pulling out of bean production. Actually, placing more emphasis on the cultivation of maize and sorghum could be a very efficient coping strategy in this situation. Hence, one should not conclude that interventions should be executed only on the basis of the observation that cropping patterns change.

Seed prices in Yorito seem to have been stable after the hurricane. This was probably in part a result of the influx of donations of seed, but a high proportion of farmers had been able to secure at least a minor harvest. This must have made seeds accessible for farmers whose domestic supply failed even in the absence of provisions. However, the provisions were very much welcomed by many farmers. Were the provisions tailored to the preferences of these farmers?

Which varieties to supply? Sperling (1997) suggests that if germplasm is to be introduced, it should, as far as possible, resemble what farmers were using directly prior to the emergency. But, she adds, this is on the assumption that the agroecological context was a stable, viable one. Many factors suggest that this condition was not present in the production systems of small producers in Honduras prior to Mitch. As already mentioned, voluntary changes in the use of varieties were constantly being made. High stress levels, from both pathogens and a depleted soil nutrient base, suggest that traditional varieties were vulnerable and that farmers needed influxes of new germplasm.

However, at higher altitudes in Yorito, some farmers expressed their disappointment with the germplasm that was distributed in the seed provisions. In the harsher environment at these altitudes, the introduced cultivars proved vulnerable. It may therefore be argued that focusing solely on *Tio Canela* and similar modern cultivars could not be efficient for restoring the food security of all households after Mitch. In these areas, the distribution of local varieties might have been more appropriate.

The objectives of interventions—promoting food security in the long term. The present study suggests that seed shortages were not acute in either Yorito or Choluteca. The fieldwork also revealed that the seed distributions that were undertaken in Yorito after Mitch did not successfully target the most seed-deficient or poorest households. This might suggest that agencies were conscious that the seed crisis was not acute. However, what could then be the motivation behind the efforts to provide seeds?

The lack of targeting, together with the emphasis on modern cultivars, suggests that the principal objective was not to give seed relief per se, but rather to augment the genepool accessible to farmers. As broader access to germplasm may lead to an improvement of long-term food security, there are important reasons for introducing new germplasm to farmers. However, it is important to question whether post-disaster relief ought to be used this way.

Actual impact of interventions—promoting or undermining food security? Formal plant breeding has a high potential for making appropriate germplasm available to farmers. Formal breeding might be especially efficient with characters such as resistance towards pests and diseases that can be difficult for farmers to capture in their selection. The introduction of appropriate germplasm may contribute to the maintenance of traditions for selection and experimentation, and thereby to more efficient farmer plant breeding.

However, a problem with emergency seed distributions is that such interventions may create dependency on external interventions. This is illustrated by the observation that farmers in Yorito and Seed Systems of Small Farmers in Honduras: Their Relevance for Interventions.

Choluteca see organizations as important in facilitating their seed security. This feeling may lead to erosion of the informal seed system, including cultures of sharing seeds and traditions of selection and of gathering knowledge about varieties and crops. Substituting informal seed systemswith formal ones may be harmful in tropical areas. Large-scale use of uniform germplasm can make the cropping sector vulnerable to large-scale harvest failures.

If traditions for experimenting with and selecting seeds are substituted by recommendations from the formal sector, the cropping system may lose its ability to adapt to changing environmental conditions.

Conclusions

External interventions are important for protecting the survival of people in emergencies. They can also strengthen long-term food security by helping farmers overcome bottlenecks in their access to plant genetic resources from the formal sector. However, seed-relief efforts could also undermine long-term food security in two ways: introductions may trigger processes of genetic erosion and increase genetic vulnerability. Furthermore, programs of emergency seed provision may undermine the informal institutions that people employ to cope with food and seed shortages, thus creating dependency on external interventions.

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Decision-Making Processes in Seed-Supply and Seed-Distribution Interventions in Emergency Situations
The Case of Honduras

Sigrid de Barbentane
Noragric, Agricultural University of Norway

Introduction

Hurricane Mitch, which devastated the Central American countries of Nicaragua, Honduras, El Salvador, and Guatemala in the last days of October 1998, led to spectacular mobilization of international and national institutions to rebuild the countries and, in the case of agriculture, to restore the agricultural system through seed-supply and -distribution programs.

The effects of these emergency programs can be seen over the long term, and although their aim has been to rebuild the food security of the countries affected by the hurricane, they can also have a negative impact on the biodiversity and sustainability of local agricultural systems by introducing seeds that are not adapted to particular ecological or socioeconomic conditions, thereby diminishing plant genetic resources (PGR) and food security.

I have chosen to do my Master's thesis on the decision-making processes that led to the distribution of tonnes of seeds to small farmers in Honduras in the year following the hurricane. In fieldwork carried out in Honduras over the past four months, I have collected data on how institutions (international, national, and local) interact during an emergency and towards which aims their decisions are oriented. I have focused on how strategies are chosen in seed-supply and -distribution systems in situations of acute stress.

Preliminary results

I carried out my fieldwork by interviewing, through questionnaires, relief organizations such as international centers (CIAT, CIMMYT, and PROFIJOL), United Nations organizations (WFP, FAO, and UNDP), the European Union, the Ministry of Agriculture of Honduras, various municipalities, and 19 national and international nongovernment organizations (NGOs).

Some of the main points I had in mind when collecting my data are briefly presented below:

- How many NGOs or institutions are working with seed supply? Who are specialized and who are not (in terms of knowledge about seed supply and PGR)? Does a complete list of these institutions exist in a central location? Is there any institution responsible for the coordination and control of activities involving seed supply?
- How can the structures (institutions) already in place in the country be utilized?
- What and where are the needs? How are these needs identified?
- Can the country recover its plant genetic resources for food and agriculture (PGRFA) by itself? If so, how (through informal seed systems, formal seed systems, emergency activities done by NGOs)? If not, where could it acquire the necessary PGR (for example, from countries with similar ecological and socioeconomic conditions)?
- How does the seed-supply system operate in a normal year?
  - interactions between formal and informal seed-supply systems (links with producers and purchasers)
  - ecological aspects (varieties in the country and in each region, type of soil, climate)

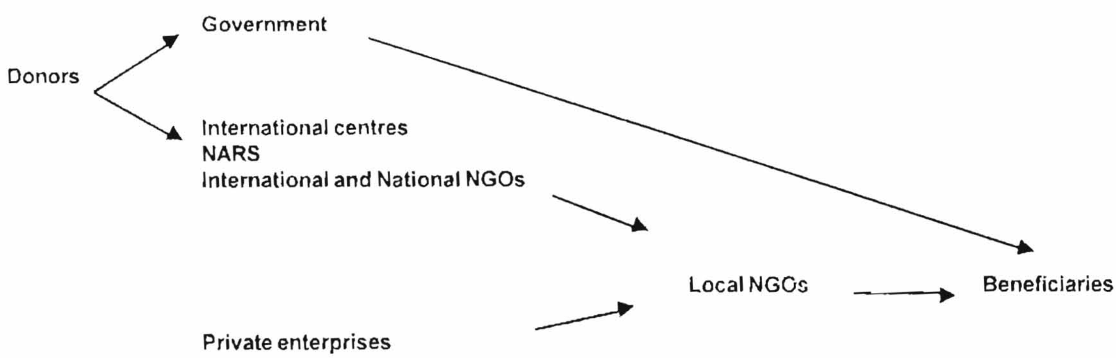
- social and economic aspects (Who are the leaders in the community? How does the information system in the community work? Are there already groups in the community—such as farmers' groups, women's cooperatives, etc.—that can act in times of crisis? Who are the decision makers in the community and in the home?)

- What is the agricultural system in the area? What techniques do the farmers use and why? What are the main varieties sowed and why? How is the exchange system of seeds in the community work? What are the sowing periods for each variety?

I came back from my fieldwork just a few days ago and have not yet had time to analyze the data. However, some quick impressions can be drawn from my results, and these are briefly presented below. It is apparent that there is a great diversity of possible strategies that can be used for seed supply and distribution in emergency situations. It is also apparent that there are many potential problems that should be taken into account before agricultural restoration projects are set in motion.

Strategies of emergency programs

There can be a great deal of confusion about the distribution of responsibilities among institutions, but the following simple scheme can be drawn, showing some of the links between actors in an emergency:



In Honduras, there were five main national producers of improved seeds after Mitch: the International Center for Tropical Agriculture (CIAT) and the Agricultural School of Honduras (Zamorano), FAO, Hondugenet (a private enterprise), and The Ministry of Agriculture. CIAT and Zamorano had an emergency program for producing and distributing two of the main varieties of beans. As well-known institutions in the agricultural system in Honduras, their programs have already had an influence on the varieties available in the country, which have been distributed through NGOs.

Strategies used by institutions at the local level

Distribution of seeds: Distribution is usually designed to intervene in a situation of seed stress (chronic or acute), but it is also a way to avoid price increases in the market. However, it could have the opposite effect in reducing local market prices too much. Local institutions used the following strategies for seed distribution in Honduras.

Donation: According to NGOs and other institutions, there are two main reasons to distribute seeds to small farmers as a donation. The first one is related to amoral principle—it is hard for someNGOs to sell seeds to poor farmers who have lost their stock of seed and grain. The second reason is mainly due to the rush of activity during an emergency. Many NGOs do not have the time or the logistical resources to distribute seeds on credit, which requires in-depth knowledge of the state of the land and of the needs of the population before and after the disaster.

In most of the cases, relief agencies donated seed only once, usually destined for the first sowing after the disaster, which was the month of May for most of Honduras (except for the tropical, humid Mosquitia region in the east of the country).

Distribution of food: This was done in many places by the World Food Program through "Food for Work."

It is important to provide grain or food to farmers in order to avoid the consumption of their seed stocks as food. However, the reasons for continuing such projects months after the disaster seems unclear. According to some municipalities and NGOs, the "Food for Work" program does not stimulate production; rather, it increases the risk of dependency by taking farmers away from their land.

Credit: The credit system was mostly used by institutions that were already well established in the communities, with programs ofmore than three years. The difficulty with this approach is that the institutions have to keep track of repayments and have to have the logistical capacity for monitoring them.

Different forms of distribution based on credits were tried:

- return payment in money (this was used by the government)
- return payment in seed—mostly grain—which was usually aimed at creating a seed or grain bank. In some cases, the seed and/or grain returned was to be distributed to farmers who did not receive any the first time.

In cases of a bad harvest, as in the Mosquitia, it was impossible for some NGOs to ask for repayment. These NGOs have conceded that the previous "credit" was a donation.

In one interesting case, an NGO distributed improved seeds to farmers who had to put their own local seeds in seed banks during the first months of the emergency. The aim was to protect local seeds from any genetic erosion caused by introducing new open-pollinating varieties together. The local seeds were returned to the farmers after the first harvest.

Varieties chosen (local, improved, hybrid): One of the questions was: What kind of seed did the institutions distribute and why? The answers depend on the underlying concepts the institutions have about agricultural restoration programs. They also depend on the level of knowledge of the institutions in relation to the needs and the sociological, economic, and ecological conditions of the region.

Seeds of improved varieties dominated the distribution. The reasons advanced by the institutions can be summarized as follows:

- not enough local seed in the area
- easier to get seed through big institutions, which offer improved and certified seed in large quantity, and which could certify the quality of the seed
- better to replace local seed with improved seed, which can give higher yields and better resistance to disease
- lack of knowledge about the varieties used in the area, the quantity of seed available in the area, or the capacity of the area to produce sowing material locally for the next season

Hybrid seed was mostly promoted by private enterprises, which sold the seed to "well-off" farmers or to NGOs (for distribution to small farmers). The reasons advanced by the institutions that distributed hybrid seed were as follows:

- They gave better yields.
- It was easier to get hybrids in the later stage of the emergency because large quantities of open-pollinated varieties were sold rapidly in the first stage of the emergency, making producers' stocks

low a few months after the disaster. There were large quantities of hybrid seed on the market because they are the major commercial varieties.

Training of farmers: Training of farmers has been promoted by NGOs that have medium- to long-term projects. These were usually the same NGOs that had the credit programs described above.

Through the formation of groups and development of leaders, the training programs have mostly been oriented to specific activities such as the following:

- selection of seeds (local, improved)
- production and multiplication of seeds and creation of micro-enterprises
- protection of the soil (agroforestry, programs against burning)
- cleaning and maintenance of the fields
- creation of silos or communal seed banks
- extension programs to test new seed

Problems encountered during emergency seed-supply programs

Dependency: Dependency can develop for several reasons:

- the habit of receiving donations, which can weaken the incentive of some farmers to rebuild their own production system
- disruption of the social seed-exchange system of the community, by changing the existing system between local producers and local purchasers, thus, destabilizing the local seed market
- distribution of seeds poorly adapted to the ecological and socioeconomic conditions of the zone—there are examples of distributions of seed that was not adapted to the ecological conditions of the area, such as seed from dry tropical climates distributed in a humid tropical region. There was also a poor yield in the Mosquitia. The reason given seems to be the distribution of rice seed from Costa Rica, which was adapted to the ecological conditions of the Mosquitia but not to the cultivation technology used by the people living there. In a case like this, and when farmers' seed stocks are depleted, a bad yield can lead farmers to ask for new distributions.

PGR loss and genetic erosion: A great danger that can result from seed distribution during an emergency is genetic erosion and loss of PGR, which can rapidly destabilize the food security system of a country or a whole region.

Genetic erosion can result from broad distribution of only a few varieties during an emergency, as was the case in Honduras after Mitch. This can lead to a loss of the country's plant genetic resources if there are no programs focused on protection of local varieties. In addition, the disappearance of local varieties may result in the loss of genetic properties necessary to "subsistence agriculture," such as the protein level in the plant, the length of the growing period, or input requirements.

Moreover, in the early stages of the emergency, the Ministry of Agriculture decided to facilitate the importation of seed and grain into the country by weakening border controls. This can have very negative results because of the introduction of seed varieties that were not suited to the ecological conditions of Honduras and which, through cross-pollination, could lead to the degeneration of local varieties.

Lowering the price in the local market: The distribution of large amounts of improved varieties can reduce prices in the local market, which in turn, reduce the incentive of local producers to produce or to sell their own local seed. This also happens when there is to much food distributed. People do not need to buy on the market, so local production is not stimulated.

Selling grain as seed: Sometimes an NGO involuntarily buys grain as seed from producers who take advantage of the lack of seed after the disaster. The problem is that NGOs do not have to guarantee that the planting material is well adapted to the conditions of the area where it is distributed.

Lack of coordination: The lack of coordination among the institutions working with emergency programs and attempting to restore agricultural systems was obvious from my fieldwork. For example, in one small municipality, I met six NGOs, all of which agreed that there was no clear coordination of their activities or beneficiaries during the emergency. All agreed that there could have been duplication of the work because of the very weak coordination. The main reasons given for this include the following:

- *Different or opposing strategies (credit versus donation)*: NGOs that are distributing on credit can hardly develop their own program if other NGOs distribute seed for free in the same communities. With few exceptions, farmers will be more interested n receiving free seed than in paying back the credit.
- *Different political viewpoints:* Some NGOs indicated that political affinities within the municipalities were a problem.
- *Competition for funding from international donors:* Although this reason was not clearly advanced by the NGOs, I feel that the problem of funding leads to problems of interinstitutional coordination.

Lack of monitoring and evaluation: During my fieldwork in Honduras, it was common to see projects that were neither monitored nor evaluated. It seems that only a few NGOs took the time to evaluate the effects of their distribution or were willing to provide reports.

Although this could be explained by a lack of time or capacity, it would seem important to plan for this in an emergency program and to set aside resources for monitoring and evaluating the distribution of seed to beneficiaries. As a student, it was very difficult for me to get reports and evaluations. With such low levels of transparency, it is difficult to see how strategies for supplying and distributing seed during an emergency could be improved.

A monitoring system would also make it possible to control the training of farmers by following each step of the project, from preparing the fields (cleaning, tilling, etc.) to selecting the seed after harvest. It is important to monitor whether farmers sow the distributed seed and that it is not sold or eaten, as happened in some cases. In the case of a bad harvest, a system for monitoring and evaluation are the tools that allow the reasons for the project's failure to be determined, thus allowing another strategy to be defined for future agricultural restoration projects in emergencies.

Lack of knowledge: Many new NGOs came into Honduras after the hurricane and started emergency programs in affected areas without having a precise idea about the real needs of the people and the capacity of the area to recover. When there was a lack of knowledge, the institutions usually distributed improved seed purchased directly from specialized institutes (which had the legal right to sell certified seed). According to the NGOs interviewed, purchasing seeds from the big, well -known national institutions was security against distributing poor-quality or poorly adapted seed.

Lack of flexibility of the institutional administration: The EU was involved in the distribution of seeds to Honduras through the NGO EURONAID. EURONAID's distribution has been strongly criticized by farmers and NGOs that had contracts with them because of the heavy bureaucracy involved, which does not function well in an emergency.

Moreover, in many cases, the seed was not available until after the sowing period, so it could not be distributed.

Lack of Information: The lack of information given to farmers was often linked to the lack of time or the lack of logistical capacity in some NGOs. In some cases, it can also be correlated to the local staff's poor understanding of the agricultural system.

One example involves hybrids that were distributed in a municipality in the south of Honduras. Farmers who were working with hybrids for the first time did not receive any information about how to work with them or what their specific characteristics were—such as lower yield for following harvests, the need for higher inputs, etc. Many farmers were badly surprised when they saw the low yields of the second harvest after a season of effort.

Preliminary conclusions and recommendations

The emergency situation created by Hurricane Mitch in Honduras was characterized by the arrival of an enormous number of institutions, such as NGOs and international centers. Through them, the population—especially farmers, saw the development of many different programs attempting to restore the agricultural system and seed supply and distribution in a situation of acute stress.

In this early stage of my analysis, it appears clear that strategies were not always related to a clear understanding of the country's agricultural systems before and after the disaster—nor were they related to people's specific needs. Moreover, it does not seem that institutions perceived the difference between acute and chronic stress in relation to the seed situation. Through my fieldwork, I learned that seed problems existed long before the hurricane, and that the situation was worsened by the disaster. The main strategy chosen by NGOs to cope with the loss of seed was direct distribution to farmers. However, the NGOs that had been working in Honduras before the disaster appeared to have longer-term programs, including training of farmers and extension of credit.

The significant loss that the country suffered in the agriculture sector has led some institutions to develop emergency programs by producing large quantities of basic grains (although it has not been possible to obtain information on how much seed or grain was provided). The idea behind these efforts was to make seed available for the first sowing after the hurricane, which is May for most regions in Honduras). Although a significant quantity of seed was made available in time, the stocks of open-pollinating varieties were insufficient in the latter stages of the emergency. Although the need for seed distribution was not clear, many NGOs introduced seed-supply projects as the second phase of their emergency program, that is, four to five months after the disaster. This delay is one of the reasons for the problems between the demand for seed in March-April and the supply. It was too late for the big producers to adjust their stock in relation to the demand from NGOs. In addition, the lack of information and coordination between institutions during the emergency actually worsened the seed-exchange system in the country and led not only to delays in distribution, but also, in some cases, to the distribution of seed that was poorly adapted to the ecological and socioeconomic conditions of the country.

I would also like to mention that NGOs do not have to report their projects to the government (or to any other coordinating institution) and that no one knows what people are doing and where. This compounded the problems of transparency between projects and institutions.

Through my own experience in Honduras, it seems that the different responsibilities of the institutions working with seed supply and seed distribution should be clarified before a disaster occurs, and that one organization should have the responsibility to coordinate agricultural projects at the national level when there is an emergency. It also appears necessary for some sort of coordinating mechanism to be established among institutions before a disaster, because it is extremely difficult to coordinate projects when a disaster has occurred.

The approach of participatory programs has taken a position of greater importance in development projects in the past few years. Including farmers in decision making could be an important step toward improving the sustainability of agricultural restoration projects.

International and national gene-banks should have a clear strategy in place for emergency situations and should be able to produce large quantities of seed when necessary—not only commercial seed but also important local varieties if there is a clear indication that no seeds are available at the local level.

It is also indispensable to have better knowledge of plant genetic resources. Many local varieties have been neglected because of a lack of knowledge on what is cultivated, why, and where. It is important to undertake studies that link ecological conditions with social and economic aspects of the country in order to define more precisely the strategies for agricultural restoration projects to follow in relation to the specific needs of the people.

110008

Seed-System Interventions in Eastern Africa for Chronically Stressed Situations (with emphasis on bean-related activities)

Soniia David
International Center for Tropical Agriculture

Introduction

Small-scale farmers typically obtain much of their seed from their own stock. For some crops, such as pigeon pea, other farmers are the second most important source of seed (Tripp, personal communication). In a situation of chronic seed deficiency or stress, a significant proportion of farmers are regularly seed insecure in a non-emergency situation. This paper reports on situations of chronic seed shortage, drawing largely on experiences with the common bean (Phaseolus vulgaris L.), a self-pollinating crop widely grown in Eastern Africa.

The nature of seed demand

The following characteristics of a chronic seed shortage are derived from research on seed systems in Eastern and Central Africa:

- The major causes of chronic seed shortages are poverty related: farmers seek seed from off-farm sources out of necessity to restock or top-up after crop loss, domestic crisis or after consuming or selling existing stock.
- In addition to factors related to poverty, unfavorable weather (drought, excessive rain, etc.), and poor storage/seed conservation are major causes of periodic seed loss. Farmers also seek seed off-farm to expand crop area, to obtain new varieties, and more rarely, to obtain better quality seed.
- Farmers are most dependent on on-farm seed sources for crops that are important for both food and cash and which are difficult to store and conserve.
- Commercial outlets are an important source of seed.
- There may be a historic decline in dependence on seed from other farmers (gifts, exchange, or purchases) for some crops;.
- Important differences exist between wealth groups in seed-sourcing behavior. The poorest farmers are usually the most dependent on off-farm seed sources.

Seed demand

For the majority of farmers throughout Eastern Africa, their own seed is their most important source in most seasons. In the Hararghe Highlands of Eastern Ethiopia, the majority of bean farmers obtained seed from their own stock in 1996: 58% for white pea beans (a commercial crop) and 54% for colored varieties[1] (Mekbib and David 1999). In two areas of Uganda, 59%–80% of farmers relied exclusively on farm-saved seed in the main season of 1993 (David, forthcoming). In a few exceptional cases, dependence on off-farm sources is regular and deliberate (e.g., farmers who produce fresh beans for sale, farmers who follow a deliberate strategy of selling most of their harvest each season) (David and Sperling 1999). Chronic seed deficiency can be defined by several criteria, such as frequency of off-farm

1 The report does not indicate whether farmers obtained seed from multiple sources or a single sources.

sourcing, the percent of households dependent on off-farm seed sources, and the reasons for seeking seed off-farm. Based on frequency of off-farm seed sourcing, farming households can be broadly classified as follows:

- **Seed secure:** households that depend primarily on farm-saved seed and rarely face seed shortages
- **Regularly seed insecure:** households that run short of seed once a year or once every two seasons
- **Chronically seed insecure:** households that depend on off-farm sources every season

Tables 1 and 2 show significant differences in dependence on off-farm sources of seed between bean farmers in several countries. One important factor accounting for these regional differences is the amount of seed sown. In Uganda, the farmers in Mbale District, who sow amean of 46 kg and depend on beans as a major cash crop, are more dependent on off-farm sources than farmers in Mubende District, who grow beans for subsistence.

Table 1. Bean Seed Obtained Off-Farm

Location/year	Percent of farmers
DR Congo, 1991—92a	59
Rwanda, 1991–92a	47
Mbale, Uganda, 1993b	41
Mubende, Uganda, 1993b	20
Hararge Highlands, Ethiopia, 1996c	47 (white pea beans) 42 (other varieties)

Source: a Sperling, Scheidegger, and Buruchara (1996), b David (forthcoming), c. Mekbib and David (1999)
Note: In all cases, some seed may also be obtained on-farm.

Table 2. Estimated Frequency of Seed Purchases by Bean Farmers in Uganda and the Great Lakes Region (Percent)

	Uganda*	Great Lakes Region**
1 out of 3+ seasons	50–60	10–30
1 out of 2 seasons or once/year	30	30–60
Every season	10–15	20–40

* Uganda (*N*=235)
**Rwanda (*N*=152), Burundi (*N*=295), DRC (*N*=227)

Lessons learned regarding seed interventions

Because of moderate to low demand for local and modern varieties, regional variations in off-farm demand, and location-specific preferences, seed production should be decentralized for certain crops, such as beans, potatoes, sweet potatoes; repeated seed distributions over several seasons may be necessary before a new variety is fully established within local seed networks and markets.

Issues:

- how to define chronic seed stress
- methods for accurate "quick and dirty" assessments of seed needs and monitoring seed needs
- how to ensure that diagnostic information on seed systems is used for planning interventions
- determining how long it takes for new varieties to become fully established in local seed networks
- developing strategies for improving farmers' knowledge about seed health and storage
- research and development to promote seed saving (e.g., seed-banking schemes)

Farmer-to-farmer diffusion

Farmers everywhere rank seed from other farmers second in preference to their own seed in terms of quality, access to adapted materials, and convenience. However, for commercial crops such as beans, the historical decline of farmer seed networks has been noted in several countries (David and Sperling 1999) and is partly attributed to commercialization. As one Ugandan bean farmer noted, "Nowadays seed is like money." In Uganda, only 7% of farmers obtained bean seed as gifts in 1993 and 1% received seed in exchange for other commodities. Only 3% of farmers purchased bean seed from other farmers (David and Sperling 1999). Gifts, loans, and exchanges were more important among bean farmers in the Hararge region of Ethiopia, especially for colored bean varieties which are mainly used for home consumption. In 1996, 28% of farmers in that area obtained colored bean varieties from this source, compared to 11% who received seed for white pea beans (a cash crop) as a gift, loan, or exchange item (Mekbib and David 1999). A major problem reported by bean farmers everywhere is that other farmers often do not have enough seed to spare.

Lessons learned regarding seed interventions

Farmer-to-farmer diffusion may not operate swiftly, efficiently, or equitably. Farmers require at least two to three seasons of experimentation before diffusing new varieties. Poor farmers are often left out of seed-diffusion networks.

Issues:

- Is it possible (or desirable) to strengthen farmers' seed networks?
- If so, how?

Demand from commercial sources

For some crops, such as beans, seed obtained from commercial sources is next in importance to farmers' own seed, although this source ranks lowest in terms of quality. Farmers in several countries report on the mixed quality of purchased bean seed and note that the closer the source is to the farm, the better the quality. Farmers in Uganda, Rwanda, Burundi, and the Democratic Republic of the Congo (DRC) rank seed purchased from shops or markets lower in quality than their own and that of other farmers, and consider it potentially riskier to sow (David and Sperling 1999). The poor quality of seed obtained from grain markets in Uganda was confirmed by a study that showed low germination rates (a mean of 72%–74%) and a high proportion of damaged seed (36% on average) (Buruchara and David 1995).

The amount of seed purchased is usually higher in the main season (5–7 kg for beans in Hararge, Ethiopia, and 7-21 kg in Uganda) and farmers often purchase no more than one or two varieties at a time (1.2 varieties in Uganda) (Mekbib and David 1999; David, forthcoming). In some countries, farmers show a distinct preference for specific purchasing locations, related to their perception of quality in some cases. Bean farmers in the Great Lakes Region prefer to purchase from farmer-sellers or local merchants whom they regard as more conscientious about adaptive qualities and physical sorting than merchants in large towns (David and Sperling 1999). Purchasing bean seed from shops is more common in some parts of Uganda (e.g., Mubende District), while buying from open markets is more common in other areas (e.g., Mbale District).

Farmers' behavior in acquiring bean seed, their perceptions of this behavior, and the proportion of seed obtained from specific sources were associated with wealth status in several studies. For example, wealthy Ugandan bean farmers purchase relatively larger quantities of seed but poor farmers purchase seed more frequently, and the proportion of buyers is higher relative to other wealth groups (David, forthcoming). Among poor farmers in the Great Lakes Region, 70% in Burundi, 52% in Zaire, and 33% in Rwanda usually purchase all of their bean seed during at least one season a year (David and Sperling 1999). These findings suggest that for the most part, poorer farmers buy seed to replenish seed stocks that have declined or been depleted by consumption, sale, or unfavorable agro-environmental conditions. Better-off farmers tend to purchase seed to improve their genetic stock or to restock after periodic crises resulting in loss of seed.

Lessons learned regarding seed intervention

Small-scale farmers of all wealth categories are willing to buy seed of both local and modern varieties if the varieties are acceptable (even if they are unknown), the quality is "good," and certain marketing principles are observed (David, Kasozi, and Wortmann 1997). These principles include small quantities (50 g to several kilos), labeling in local languages, distribution through multiple market and non-market channels (e.g., clinics, women's groups), and a pricing system that recognizes that farmers are only willing to pay a small premium for clean seed.

Issues:

- modalities for making commercially oriented, decentralized seed-system interventions (DSSI) sustainable
- how to create demand
- what quality standards to use
- selecting production areas for DSSI: ecologically optimum vs low-potential areas where seed availability might be a greater problem
- determining the types of institutions best suited to lead/catalyze DSSI: NGOs, researchers?

Seed-system interventions

Most seed-system interventions in Eastern Africa focus on the delivery of modern varieties because of the assumption that farmers in this region do not face problems with seed shortages and because of researchers' bias against landraces.Yet, a seed-supply system aimed at alleviating chronic seed stress must meet certain requirements: it must supply seed of both local and modern varieties regularly and sustainably; it must meet local demand in terms of varieties and quantities required; and it can not depend largely or exclusively on exchange or informal networks to ensure that the needs of the poorest farmers are met.

Current seed-distribution interventions in Eastern Africa are based on key assumptions regarding farmers' seed-sourcing behavior, namely, (1) small-scale farmers cannot afford to buy seed of newly introduced varieties or will not risk it, (2) farmers' seed networks function efficiently in varietal diffusion, and (3) a good variety will sell itself. Below, interventions in seed conservation and distribution are classified into five groups and evaluated in the context of chronic seed stress.

Seed-conservation interventions

1. **Improving farmers' seed management:** Programs, usually initiated by NGOs, train farmers in techniques of seed management to reduce post-harvest/storage loss. Researchers tend to focus on introducing storage technologies (for example, to control bruchids in beans).

   Pros: High potential impact, creates awareness of the importance of seed quality

   Cons: Does not address other poverty-related constraints, which cause seed stress; coverage is typically limited

Seed-distribution interventions

1. **Seed delivery through NGOs:** Agricultural research institutions multiply seed and sell/give it to NGOs or directly to farmers. This system is used in Ethiopia, Uganda, and Rwanda. In some countries such as Rwanda and Madagascar, NGOs contract farmers to produce seed.

   Pros: Quick impact

Cons: Expensive, not sustainable, does not address the problem of chronic seed shortages

2. **Seed delivery through the national extension system:** In this approach, which is widely used throughout Eastern Africa, extension agents give (rarely sell) seed directly to farmers.

   Pros: Quick impact

   Cons: Expensive; not sustainable; since seed delivery is only done once, it does not address the chronic nature of seed shortages; seed is mainly given to better-off farmers

3. **Seed-exchange schemes:** Seed is given to farmers through the extension system with the understanding that they will return a certain amount or share it with other farmers. This system is widely used in Tanzania and Ethiopia.

   Pros: Quick impact

   Cons: Time consuming; reaches relatively few farmers; not sustainable; since seed delivery is only done once, it does not address the chronic nature of seed shortages

4. **Small packet sales:** Small seed packets prepared by research institutions are sold through commercial (small shops, markets) and noncommercial outlets (clinics, women's groups). This approach has been used on a pilot basis for beans and pigeon pea in several countries (Uganda, Tanzania, Kenya) and on a nationwide scale in Rwanda and Malawi.

   Pros: Wide coverage, accessible to farmers, partial cost recovery

   Cons: Needs good organization and contacts with a diversity of outlets, difficult to make sustainable

5. **Local-level seed enterprises:** Farmers, entrepreneurs, or local institutions (schools, churches) are trained in methods of seed production and assisted in setting up small-scale seed enterprises. This approach is well established for potatoes (Kenya, Uganda) but is more recent for other crops. Madagascar is the only country in the region that has institutionalized local-level seed enterprises.

   Pros: Potentially sustainable, seed is produced at relatively low cost, provides farmers with a new income-generating activity, may be easily linked to varietal development efforts

   Cons: Requires high initial investment to establish and organize if it is to be sustainable, requires involvement of several agencies (e.g., formal seed sector, research, NGOs, etc.), some producers may monopolize seed production and charge high prices, business success depends on a regular supply of new varieties for some crops

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Appendix

The following summary provides some examples of on-going small-scale seed enterprise activities in Eastern Africa.

Lead institution: CIAT
Location. Eastern and central Uganda
Year started: 1994
Number of seed producers: 3 groups
Crop: Beans
Status: Project support ended in 1997; two groups continue to produce seed

Lead institution: Arid and Semi Arid Land (ASAL) Program
Location Laikipia District, Eastern Kenya
Year started 1996
Number of producers Unknown
Crop. Potatoes, beans, chickpea, trees, safflower
Status: Project support ended in 1999

Lead institution: National Potato Program of Uganda
Location Kabale District, Uganda
Year started. 1995
Number of producers 19
Crop: Potatoes
Status: Potato producers organized and registered as a company (Uganda National Seed Potato Producers' Association); in 1999 the association received a grant of $30,000, which is being used in a revolving fund

Lead institution: World Vision, Rwanda
Location 4 locations countrywide in Rwanda
Year started: 1995 (on a commercial basis)
Number of producers: Unknown
Crops: Potatoes, beans, cassava, wheat, sweet potatoes, soybeans, groundnuts
Status: Project ended in early 1999

Linking Emergency Aid with Rehabilitation and Support in Chronic Stress Situations

Diress Mengistu
Norwegian People's Aid, South Sudan Program

The past and present experiences of aid agencies and governments have clearly shown that communities or societies alone are unable to cope with the negative effects of a crisis, especially when the crisis exists in the same area for several years. Sooner or later, the need for external support or aid, therefore, becomes important to bring the situation back to normal. For people or societies that are already vulnerable, even a small shift in their situation may give rise to a crisis that outstrips their capacity to cope, resulting, in other words, in a disaster or emergency (Eade and Williams 1995).

This paper tries to present issues related to agricultural production (where farmers' seed systems are a constituent) and support from aid agencies to periodic crop failure and food crises in southern Sudan, which is often described as "one of Africa's most terrifying conflicts" (NPA leaflet, undated).

Hunger and its impact on food production and seed availability

A common word one may hear in most areas of southern Sudan would probably be *hunger* It is very common to hear this word during meetings, assessments, interviews, etc. But, really, what is hunger? What do people mean by hunger? The core meaning of hunger is the experience of having an empty stomach (Maxwell 1991). Hunger is a form of suffering, like feeling cold or tired. As such, it is an intrinsically bad thing. People should be given the chance to avoid it whenever they can, and this may be done by providing access to food.

Especially in the areas where I have been working (Yirol and Rumbek), hunger is a general term that includes all sorts of suffering resulting from insecurity and displacement, drought, floods, etc. Similarly, "[h]unger is also a powerful and emotionally laden term which is symbolic of many forms of suffering and deprivation. For instance, it may be used as a synonym for famine"(de Waal in Maxwell 1991).

It is important, at least briefly, to look at how frequently hunger has affected agricultural production and seed availability in Yirol and Rumbek.

From my extensive visits to elderly men and women and during several interviews (from 1994 to date), I came to learn about the following events related to hunger:

- **Between 1906 and 1955** (the colonial era), there were about **five hunger episodes**: in 1906, the mid-1920s, 1937/38, 1944/45, and 1954 (exact years are difficult to ascertain)
- **Between 1995** (independence) **and 1972** (the Addis Ababa Agreement), there was one hunger episode around1958/59.
- **Between 1986 and 1999**, (during the current war between the government of Sudan and the Sudan People's Liberation Army/Movement (SPLA/M), there have been three hunger periods: 1986–1988, 1992–93, and 1998.

Causes of hunger (food insecurity)

- During the colonial era: except for the hunger episode in the mid-1920s, whose cause was marked by colonial destruction and fighting, the cause of the hunger was mainly drought and insect pests.
- 1958/59: this hunger was caused by drought.

- **The latest three hunger episodes were caused by**
  - drought
  - the severe armed struggle between the SPLA/M and the government of Sudan, which resulted in
  - the displacement of thousands of people
  - tribal fighting between the Nuer and Dinka

Coping with hunger (suffering)

- Before 1986, people used to manage the crisis or the hunger through various coping mechanisms: grain purchase from traders in towns and trading centers, either for cash or through exchange of livestock (cows, goats, sheep, chickens); direct exchange of livestock for food grain; fishing and gathering wild foods if people had no cattle; kinship support, etc.
- Since 1986, traditional coping mechanisms have been severely reduced by the intense and continuing political and armed struggle, loss of livestock and other assets (during displacement and cattle raids), little or no exchange due to recurrent crop failures, hostilities between neighboring tribes that restricts exchange, limited kinship support, and traditional supply routes being cut off.

Emergency response (food/aid)

Emergency relief/aid to the victims of prolonged war and recurrent drought has been in the form of relief items, mainly food aid with some seed aid, throughout southern Sudan. However, many case studies have shown that while emergency relief can help save lives, it does not contribute to long-term objectives that could increase the capacity of vulnerable communities to cope with future crises. Oxfam suggests that if emergency or humanitarian work remains strictly defined in terms ofmaterial inputs, such as food aid and medical relief, it runs the risk of weakening and undermining people's existing capacities, such as local production systems, local organizations, and local self-esteem (Eade and Williams 1995).

Emergency food and seed aid in Yirol started in May 1992, when about 4000 households displaced by insecurity were resettled around the Aguraan area. Food and seed aid continued to 1995. It was resumed again in 1998, after three years, and continued up to early 1999, when northern Bahr-El-Ghazal was hit by a serious food crisis (which some said was a famine). This put intense pressure on the communities in Yirol and Rumbek, who normally did not have food reserves.

The impact of food and seed aid

It is true that the food aid, even when delayed, saved people from dying. In some cases, it also—directly or indirectly— assisted people in resuming their food-production activities. However, because the food or seed aid was not accompanied by appropriate rehabilitation measures, a similar crisis appeared in northern Bahr-El-Ghazal in1998. This was so extensive that it also affected the communities in Rumbek and Yirol who were in the process of recovering from the 1992/93 crisis. The socioeconomic dislocation that occurred in 1998/99 in Bahr-El-Ghazal was exacerbated by the delay in relief response, in spite of an appeal by officials of the Sudan Relief and Rehabilitation Association (SRRA) (see Biong 1998).

The impact of seed aid has been controversial in southern Sudan. Lack of timely delivery, poor and often dubious quality of materials, and the wrong kinds of crops and or varieties have characterized the distribution of seed, especially in Yirol and Rumbek. These problems have been attributed to lack of understanding of farmers' production situation and the function of local seed systems. Consequently, considerable quantities of maize and serena/seredo seeds were eaten—not because farmers were hungry but because they could not trust external seeds before testing them under their own conditions, or because the varieties were unfamiliar in their area). If it were a matter of being hungry, they would have eaten their own seeds first, which have always been available; they wouldn't have waited for external seeds or food to rescue their hunger.

It is now understood that farmers usually reserve their traditional seed, which has been selected over decades and centuries, even during bad years of crop failures. Therefore, most farmers have saved and planted their traditional crop varieties in the absence of external aid, but in small quantities. The introduction of seed through external aid is accepted by farmers in the following two important situations:

- for displaced and returnee households, who might have run away empty-handed
- for diversifying crops or varieties of crops (like groundnuts) through on-farm trails

If emergency aid (food or seed) is not accompanied by some sort of rehabilitation measures, then not only will the recurrent cost of emergency aid be exorbitant, but there is also the possibility of people becoming victims of a vicious spiral of events.

Linking emergency aid with rehabilitation and development

When emergency aid is accompanied by rehabilitation and development activities, not is only the immediate target (saving lives and livelihoods) achieved, but also the root causes of the crisis can be understood and interventions can be designed to deal effectively with predictable crises.

However, most donors—and the majority of aid agencies—still follow the linear assumption of relief-rehabilitation-development. Again and again, case studies have shown that such an assumption or policy cannot achieve its objectives in situations where people are exposed to inter-linked problems. According to Oxfam, "The conceptual framework for their [most aid agencies] interventions was that of a continuum of relief-rehabilitation-development, in which crises were viewed as setbacks to be weathered before continuing the journey along a defined path. It is now widely recognized that such linear assumptions about progress and development are unhelpful" (Eade and Williams 1995). There have been some positive changes in the past few years, with some donors linking emergency aid with rehabilitation, although the type of rehabilitation depends also on donor policy and not community priorities.

What rehabilitation measures or interventions should then be implemented in these areas?

The objective of this paper is not to provide a blueprint for the type of intervention that can be undertaken. It is rather to highlight some achievements of a group of farmers in Yirol, West Payam, regarding food production (seeds being taken care of as part of the overall production system) when the situation is still considered a chronic emergency.

In 1995, in Yirol and Rumbek, the Norwegian People's Aid (NPA) agricultural project developed an analytical framework for agricultural production (see appendix 1) with full and active participation of the community . The framework clearly indicates the three main causes of their suffering: insecurity and its attendant displacement, recurrent drought, and inadequate technical and material support.

Based on this analytical framework, NPAwas able to prepare amodel intervention framework (appendix2) to tackle the problem of hunger and food insecurity through agricultural rehabilitation measures. The main intervention selected by the community and NPA (in addition to food and seed aid during cultivation—food aid in 1995 and seed aid in 1995 and 1996) was farmer training in key agricultural production activities, since NPA cannot do anything about lack of security or recurrent drought. The selected intervention was clearly indicative the fact that, with relative stability and reduced displacement, if the rainfall situation did not go significantly below that of the previous 10 years, people would be able to produce sufficient food grain in three to five years. Some activities in support of the intervention, such as the establishment of farmer training centers, demonstration plots, and basic extension services, were also introduced.

Since 1997, NPA has developed its relatively simple strategy, which is now a more comprehensive, three-tier approach that can respond with high degree of flexibility to the changing needs of farmers. It is believed that when farmers are trained in crop husbandry and ox plow technology, there will be a substantial increase in agricultural production, which has been the major source of their livelihood.

With funding from OFDA (USAID), the intervention framework has been jointly implemented with the SRRA within the context of emergency aid since 1997. After three years of implementation, even though very few farmers used ox plow technology in the beginning, farmer-to-farmer extension (part of NPA's extension approach) has led to more farmers being trained in the year 2000—more than 100 in Yirol, West Payam, alone.

What is impressive is not only the number of farmers who have adopted the technology, but the incredible commitment of farmers to agricultural production and the result they achieved from their 1999 harvest — an average surplus of 1–2 mt (sorghum and groundnuts combined). It is important to note that this increase in grain production can be

attributed to two production factors:

- More land was cultivated using ox plows—an average of 7 fedans per household, compared to the average farm size of 2– 2.5 fedans.
- Yield/unit area increased from an average of 220 kg/fedan for groundnuts to about 340 kg/fedan. The long-term average yield of groundnuts had been 180 kg/fedan, while that of sorghum had been 270 kg/fedan (Breen 1995)

This increase in grain production has also been achieved in a year where the annual average rainfall was lower than in the last five years (see appendix 3).

Farmers' observation on crop growth and development in 1998 and 1999 was that they could clearly see significant differences in morphology and tolerance to short dry spells between crops planted in a seed bed prepared with the ox plow and seed beds prepared with the traditional *maloda* in the same field. (see *maloda* in appendix 4).

The challenge to these farmers, at this stage, is not how to produce more food for consumption. It is rather how and where to sell their surplus grains (Mengistu 2001), since internal markets for their produce are extremely limited. It can be concluded that at least they have no immediate fear of hunger this year.

A lesson we can learn from this experience is that it is appropriate to support farmers (before the onset of a crisis) to be self-sufficient in terms of food production through careful selection of appropriate interventions. This is only possible if—and only if—the communities themselves select the intervention.

Implementation of some rehabilitation measures in an emergency can improve agricultural production, which is the source of a community's livelihood. That means increased capacity to absorb a short-term food crisis or reduced vulnerability to an immediate food crisis. Some important components of rehabilitation measures should also include the following: effective support to and coordination with local organizations at the grass-roots level and technical material and financial support for the same organizations.
In southern Sudan, that is SRRA.

Support for chronic stress systems

In chronic stress, the support that may be required for food-production or seed systems depends highly on coping strategies, farming systems, nature of the crisis, etc. It is suggested that the following points be considered by aid agencies prior to intervening in any stress situation:

1. Analysis of past and contemporary agricultural production and its constraints:
   - farming systems
   - seasonal calendars
   - farmers' seed systems
   - agroecological aspects
   - major markets/trading centers for agricultural inputs and for sale of agricultural produce

2. Community or household coping strategies, capacities, and vulnerabilities regarding the following:
   - good, average, and bad years
   - possession of agricultural inputs and access to same—past and present—with special emphasis on bad, average, and good years
   - relationship with neighboring communities and access to same
   - degree of kinship support
   - presence/absence of farmers' organizations, community groups, indigenous NGOs, and their functions/objectives.
   - wealth ranking within a community (better-off, average, poor)

3. Taste and preference of the community (farmers) for external inputs
   - agricultural implements (tools)
   - crop types and varieties

4. Physical and environmental characteristics of the area:
   - long-term data on rainfall (if available)
   - landscape
   - seasonal and permanent rivers, bodies of water
   - soil conditions

5. Infrastructure:
   - access to the area during dry and wet seasons, means of transport
   - communal or public storage facilities

6. Support provided by external agencies:
   - short-term and long-term objectives
   - sources of funding (donor agency)
   - type of support
   - duration of support
   - target population

Suggested approaches

It should be noted that there is no single methodological approach or technique to collect the information required. Therefore, a range of tools and methods should be employed to gather both qualitative and quantitative information and data. For example, Tripp (1991) reminds us that static survey:

> *presents the opportunity to quantify the most common practices in an area and to form a more precise idea of what constitutes 'typical' or 'average' farmer practice, provides a better understanding of variations in farming practices, helps to estimate farmers' perception of production problems, evaluate their causes, and identify solutions. As long as time, financial resources and skilled personnel are not limiting factors, a combination of methods (such as static survey and dynamic survey) and various tools of PRA/PLA, RRA, etc., therefore is essential to understanding a wide range of issues of an area or a community to be supported during and after emergencies.*

If aid agencies consider these points cautiously and choose a suitable approach to understand a situation where support is likely to be extended, the chances of having a positive impact are high. Furthermore, duplication of efforts (by several NGOs) can be minimized, as has been seen in some areas in southern Sudan.

Conclusion

It has become increasingly clear that, especially in chronic, complex emergency situations, conventional emergency responses such as food aid or seed aid alone are not effective measures in reducing people's vulnerability to external shocks or stress.

This means that aid agencies and donors need to undertake rehabilitation and small-scale development initiatives to increase the capacity of rural communities to absorb stress or shocks, especially short-term situations. During emergencies, an effective link between emergency responses, rehabilitation, and small-scale development measures should be considered right from the outset, so that emergency responses are timely and do not undermine future activities that aim at increasing the capacities of affected communities.

This article has briefly demonstrated how an intervention can be started and what can be achieved when communities are fully involved in all aspects and at all levels, under situations of chronic stress, where communities' livelihoods have been threatened with adverse environmental factors and on-going civil war for nearly two decades.

An important lesson that can be drawn from the experience of Norwegian People's Aid in south Sudan is the active and full participation of affected communities at various stages of a project. Such stages of involvement include needs assessment (identifying root causes of stress and contributing factors), to selection of appropriate interventions based on the capacities of communities, to joint monitoring of the impact through agreed-upon indicators.

Such community participation, when accompanied with appropriate methodological approaches, can reveal the communities' capacities (which have often not been given sufficient attention by aid agencies) and vulnerabilities to a crisis.

In addition, many authors have clearly indicated the causes of crises, along with effective measures, suitable approaches, etc. There are plenty of guidelines developed by scholars and scientists from around the world regarding poverty, famine, drought, coping strategies, vulnerabilities, etc. We therefore need to look at previous work and experience relevant to the situation we want to tackle.

Acknowledgements

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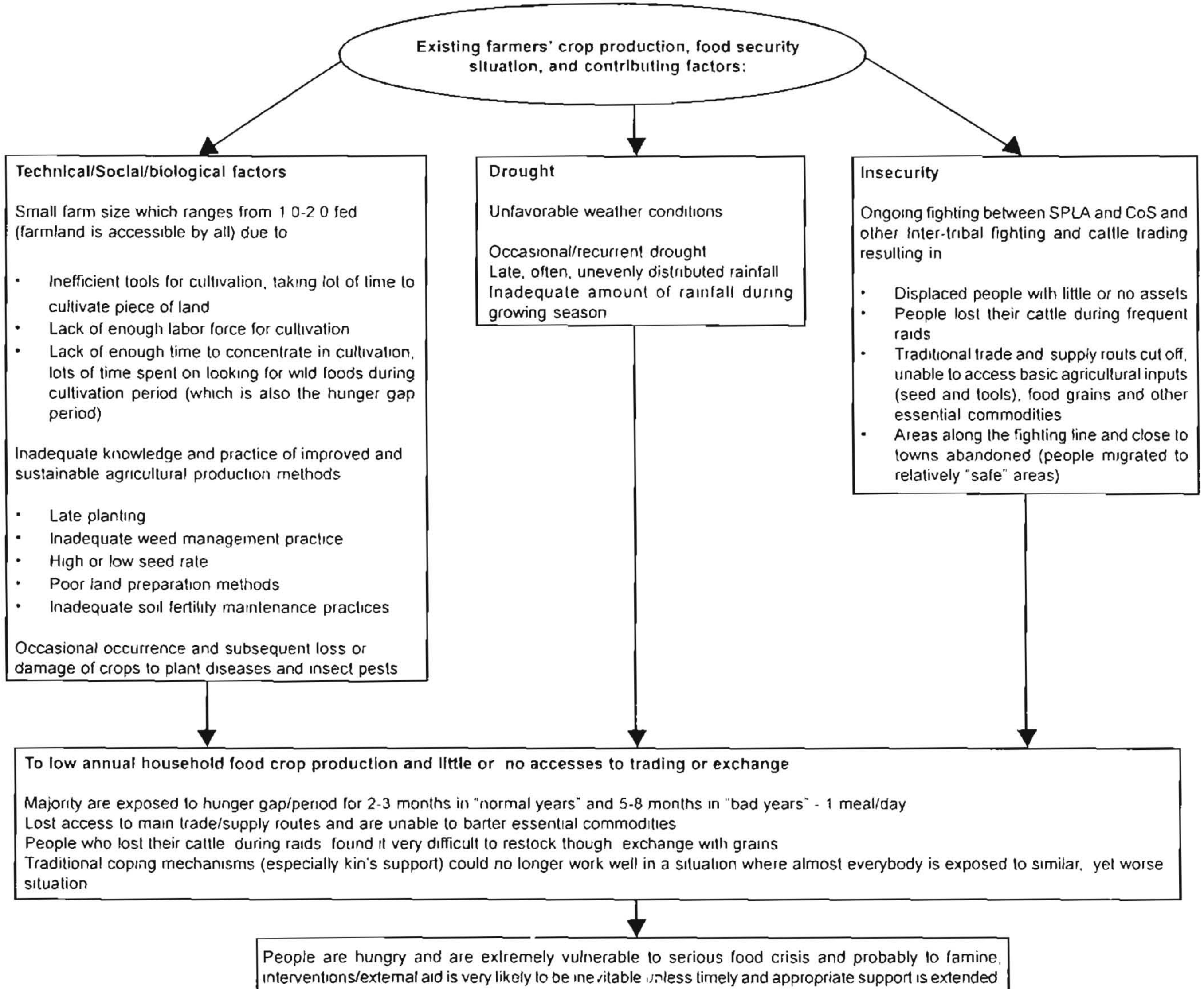
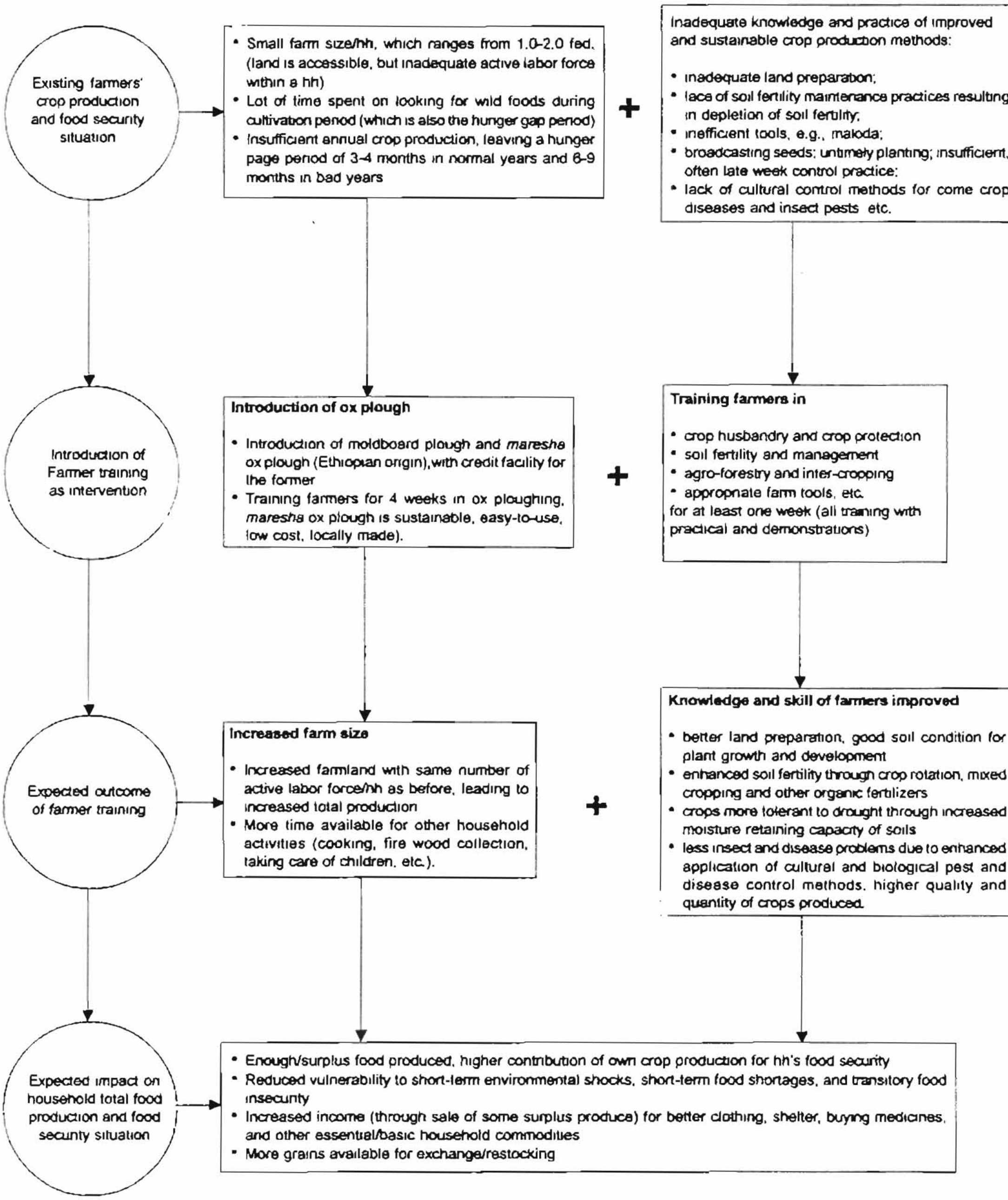
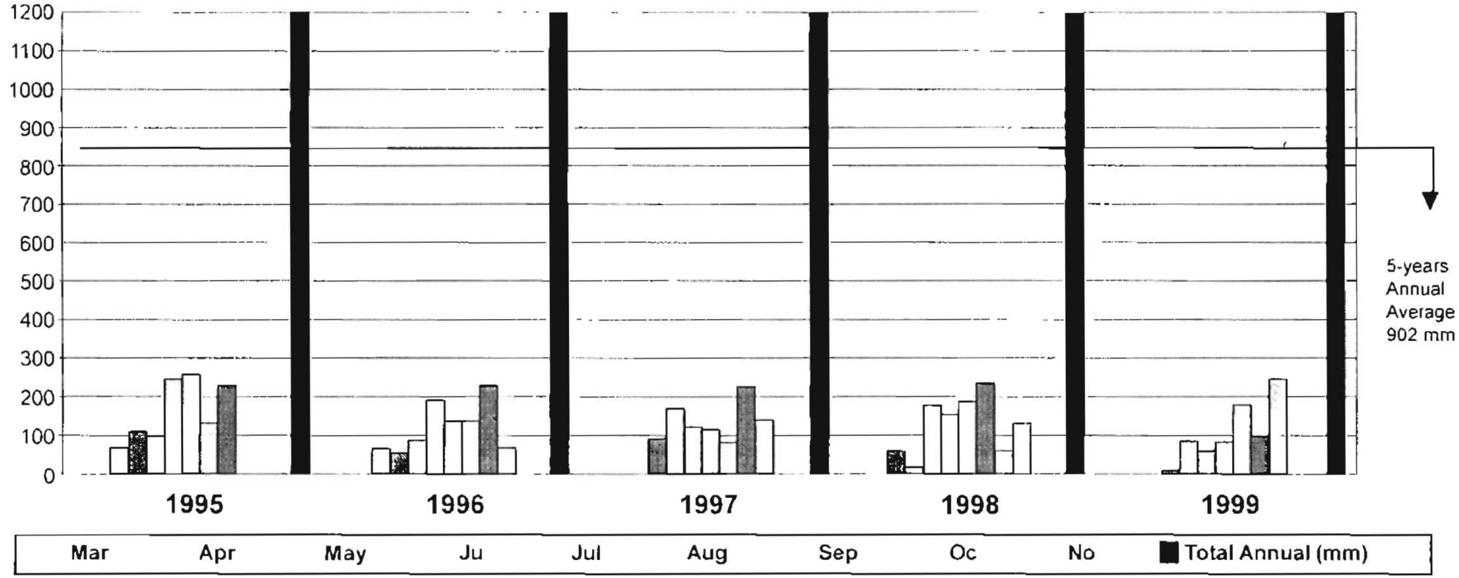


Appendix 1. Agricultural rehabilitation analytical framework based on existing situation, 1995



Appendix 2. Model framework for NPA's agricultural rehabilitation intervention: The impact of farmer training on total crop production and household food security, 1986

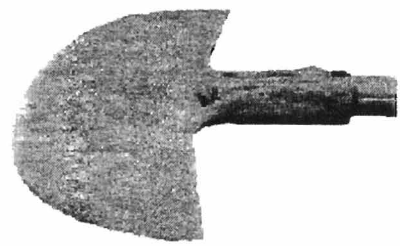


Location NPA Mabui Farmer Training Centre, Yirol County, Bahr-el-Ghazal Region.
Source Agricultural Department, Food Security Project, Noregian People's Aid (NPA), Sudan Program

Appendix 3. 1995–1999 monthly and annual rainfall data for Mabui area

Appendix 4. Maloda, the traditional hoe of the agro-pastoral Dinka people of South Sudan

The photograph below shows a small, crescent-shaped metal hoe, which is used by local farmers in the Bahr-El-Ghazal region, south Sudan, to dig the soil for planting of crops. It is known as a *maloda* (the local name). It is attached to a long, straight stick. Because it does not dig below 1 inch in terms of soil depth, land preparation using this simple hoe has been unsatisfactory and inadequate for most crops.



Increasing the Resilience of the Farmers' Seed System through Linkage with the Formal Sector

C.J.M. Almekinders
Technology and Agrarian Development, Wageningen University

Introduction

Small-scale farmers in developing countries rely largely on seed from their own farm or from other sources in the community. In some countries, commercial enterprises play a significant role in supplying seed for cross-pollinating crops and vegetables. The role of the public sector in supplying seed is of little significance for most small-scale farmers and crops. While the farmer's seed supply is far from ideal, the public seed sector faces financial and institutional constraints that limit its performance.

Understanding farmers' seed systems, the formal seed sector, and the relationship between these systems is necessary if opportunities to improve small-scale farmers' seed supply are to be identified, with funding for the public seed sector unlikely to increase. The recognition of the strengths of farmers' seed systems and their complementarity should be taken as a starting point for exploring such opportunities. Support to local seed systems should also consider the resilience of local systems, i.e., the capacity of farmers to cope with periods of seed shortages and lack of availability. Resilience of farmers' seed systems and the seed sector as a whole can be increased through improved integration between the various actors in the systems.

Farmers' seed systems

Farmers' seed production systems are integrated and variable

Seed production is integrated in crop production, and inseparably linked to crop development and *in situ* conservation. Farmers' seed systems vary from place to place, between communities and between households within a community, between crops and crop varieties. Farmers' systems are also called "local systems"; the informal system can be seen as the total of farmers' systems.

On-farm seed production is usually part of crop production

While the bulk of crop production is used for home consumption and marketing, part is separated to be used as seed for the next planting (figure 1). Seed is usually separated from the bulk production after harvest and before storage, or after storage before planting. There is a large variation in seed selection, handling, and storage practices, depending on the crop, farmer, and environmental and socioeconomic conditions. Practices such as selection of heads or ears from the field before harvest, separate storage of seed, etc., reflect more specialized seed production practices.

Seed sources

There are different sources for off-farm seed (i.e., seed other than the farmer's own, produced and saved on farm). Each of these sources varies in such things as cost, availability in time, travel distances involved, social relationships, etc.), and which source is most attractive depends on the reason the farmer uses off-farm seed. Friends and relatives within or outside the community are important sources of seed, particularly for small amounts of new varieties. Seed to refresh or replace degenerated seed is often procured outside the community, for example, from communities at higher altitudes (as in the case of potatoes) or communities with other rainfall patterns and cropping seasons, allowing access to a supply of fresh seed for planting. Better-off farmers in the community who produce a surplus can be important sources of seed as well. They may have a surplus left in store at planting time when others who produce below the subsistence level have long depleted their reserves of

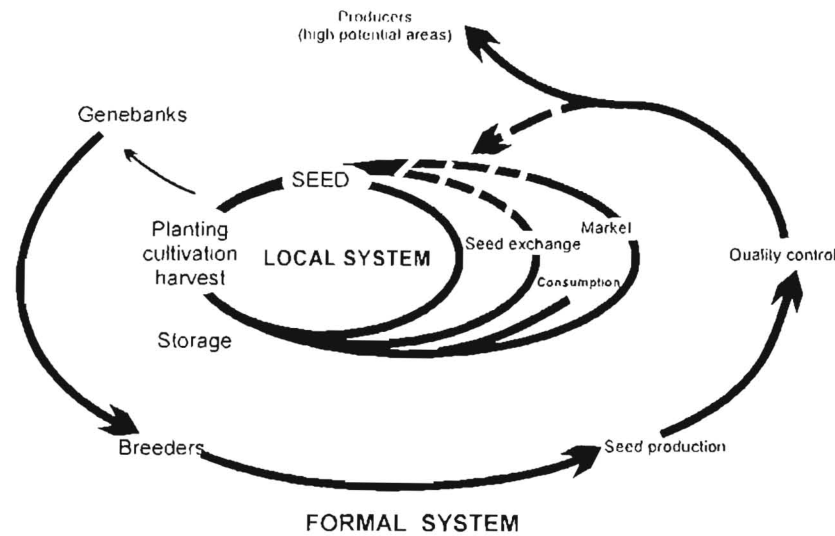


Figure 1. The local system of farmers' seed supply and the formal system: two parallel systems with relatively little interaction

grain, roots, and tubers. Middlemen and the local market are optional seed sources (figure 1), although they usually sell grain that is then used for seed. Exchange of seed among farmers in a community and introduction of seed from elsewhere adds to the dynamics of farmers' seed systems.

Integration with crop development and in situ conservation

The combination of farmers' practices and the use of different seed sources and varieties represents a system of local management of plant genetic resources, in which seed production is fully integrated with local crop development. In local seed reproduction, there is a strong interaction between the genetic makeup of the planted varieties, the farmers' practices (use of inputs in production, seed selection and storage), and external factors, such as droughts, low soil fertility, diseases, etc. In addition, mutations, introgression, and hybridization are also significant elements of local crop development, depending on the crop and the presence of wild relatives. The system as a whole represents a system of farmers' use and maintenance of crop genetic diversity; in situ conservation can be seen as an outcome of this system.

Formal seed system

The organization of the formal seed system looks much more like a chain than the farmers' system (figure 1). The formal seed sector was set up and organized with the principal goal of diffusing quality seed of improved varieties developed by formal breeding programs. The principal sources of materials for formal breeding programs are the *ex situ* collections of genebanks. Genebanks contain materials that were originally collected from farmers' systems, that is—in the case of cultivated plants—materials that were developed and maintained by farmers.

The formal system has been relatively successful for well-endowed, high-potential areas, but much less successful in more variable, marginal areas. This is partly explained by the fact that improved varieties tend to be poorly adapted to farmers' preferences and production environments. In general, plant breeders have lacked understanding about what farmers in these areas need, developing only few, genetically uniform products for on-farm testing. Evaluation and selection of new materials was on-station, where conditions are different from those in the target environment.

In the conventional organization of the formal seed sector, there is relatively little interaction between local farmers' systems and the formal system. Only two points of intentional relationship exist: the collection of germplasm in farmers' systems for ex situ maintenance and the supply of seeds of improved varieties (the second is, in many situations, not of much importance to small-scale farmers).

Complementarity of formal and informal seed systems

An analysis of the strengths and weaknesses of small-scale farmers' seed systems and the formal sector shows important areas of complementarity and opportunities for strengthening the informal as well as the formal sector.

Weaknesses in small-scale farmers' systems can be identified in the areas of seed technology, introduction of new materials and exotic genes, and seed diffusion (over larger distances and across social barriers). These weaknesses are also opportunities to improve the informal seed sector, particularly since they are the points at which the formal sector tends to have a comparative advantage. On the other hand, farmers' systems tend to have a comparative advantage on the weaker points of the formal sector. Farmers' systems tend to be strong in knowledge about local situations, capacity to adapt genetic materials and technologies, intercommunity diffusion of new materials, and using and maintaining genetic diversity. The weaknesses and opportunities do not, however, occur in all situations, nor do they occur in the same forms or combinations: again, weaknesses and opportunities vary with crops, conditions, and communities.

The recognition of complementarity opens up possibilities to define and structure a formal seed sector that effectively meets the seed needs of local farmers. Building on the strengths of farmers' seed systems and considering farmers as important suppliers of seed offers the formal sector opportunities to focus on the key activities of the national seed supply, for which they have expertise and are well equipped.

Interventions supporting small-scale farmers' seed systems

Different subsystems and system levels

Local seed systems are shaped by a wide range of interacting human and environmental factors. Since the environment in which farmers in developing countries operate is variable, heterogeneous, and complex, local seed systems also show important location- and crop-specific characteristics. The local seed systems together form the informal seed system—a mosaic of farmers' systems that vary between communities and between households in a community. Using a crop perspective, a farmer household can be considered to be engaged in different seed systems. The seed system of self-pollinating and vegetatively propagated crops, like rice and potatoes, shows other characteristics than, for example, the seed system for maize, which is a cross-pollinating crop. Household members may play varying roles in these systems, with gender being an important role-defining factor. The seed system may even vary between varieties grown by a single household, for example, when modern and local maize varieties are planted on
the same farm. In Rio Tinto, Honduras, farmers use seed from the local maize varieties from their own farms or from others in the community, while the commercial sector is the principal source of hybrid varieties.

Seed systems can be analyzed at different levels of organization, and interventions can target different subsystem levels. The household seed system can be seen as the lowest level subsystem. Community seed systems are a relevant level of analysis as well, considering that most seed sourcing and exchange takes place between community members. Community seed systemsmake up the seed system in a valley or region. The national seed system is the level at which seed and variety regulation, agricultural policy, etc., are implemented. At each of these levels, seed security is defined by a particular set of factors and relationships. In theory, a particular development or intervention may positively affect seed security at one level, or of one subsystem, while having a negative effect on another level or subsystem. For example, seed importation may improve seed security at the national level, but may not necessarily improve household seed security. The time component is important as well, as is demonstrated with seed aid Seed aid may improve seed security over the short term (for the coming planting season) but may have negative effects over the longer term. The understanding of factors or interventions that show such trade-offs between different system levels and subsystems is important for seed policies and interventions that aim to support farmers' seed security.

Activities at the community level

A range of activities that target farmers' systems are currently being implemented and explored. They address the availability of and access to quality seed and genetic diversity.

Improving on-farm seed production. Collaboration with key farmers or target groups (women, the landless, or the poorest) to improve local seed production practices can address field practices like roguing and rotation, fertilization, crop protection, seed harvesting, selection, and storage. These practices contribute to improved "maintenance breeding" of local varieties. Improving the seed quality of local or improved varieties is relevant to *in situ* conservation as well: local varieties are more competitive with improved varieties when quality and availability of seed increase.

Specialization of seed production. Organizing farmers into cooperatives, small enterprises, or growers' associations can be stimulated when local seed production is successful. Commercial specialization is difficult, however, when special expertise or resources do not produce significantly better-performing seed for which a better price can be obtained. This is the case for many self-pollinating crops that are relatively easy to store, with no important disease or storage problems. Successes so far are mostly based on maize, potatoes, or situations in which farmers have direct and exclusive access to a continuous flow of new improved varieties (beans in Colombia, flow of CIAT varieties).

Demonstration trials for introduction of new varieties. Seed of new varieties, quality seed, and practices that improve seed quality are effectively introduced to farmer communities through demonstration and evaluation trials. The trials may be on-station, with field days on which farmers are invited to see, comment on, and take seed from the materials planted. The demonstration plots may also be planted at strategic places in the community, for example, on a farmer's land along the public road or in the school garden. Individual on-farm trials, with farmers visiting each other, is another way to raise farmers' interest and to stimulate their keenness to experiment and to exchange information. The incorporation of lost local varieties in such trials can be important, along with treatments showing the effect of improved seed quality. For introducing improved adapted materials, participatory plant breeding (PPB) may be considered, but it requires the commitment of partners and expertise in plant breeding.

Seed kits. The distribution of large numbers of relatively small samples of seed from improved varieties, sometimes with information on the seeds and with fertilizer, are used as a way to insert new varieties and quality seed into local seed systems, assuming further diffusion via farmer-to-farmer exchanges.

Community seed banks. Seed banks can support the storage of seed reserves, at the same time, contributing to improved production and selection practices, and communal storage. Community seed banks could potentially improve access to seeds for the poorest farmers and be an entry point for the development of farmers' organizations and capacity building. Seed banks can also be organized to serve as local germplasm collections to improve farmers' access to genetic diversity. Organization of community seed banks may, however, be complicated.

Seed fairs and diversity competitions. Local seed fairs have become important activities to stimulate local exchange of seeds and raise awareness among farmers of the relevance of crop genetic diversity. They are important occasions for farmers to find seed of varieties that have been lost or need replacement.

Activities that directly support farmers usually have a strong local focus and make use of participatory methodologies. These activities all contribute to the strengthening of the local system of plant genetic resource management. Distinguishing between activities that support the local seed system, local crop development, or *in situ* conservation is almost impossible. Genebanks, plant breeding or seed programs, extension services, and development-oriented NGOs are potentially engaged in these activities, albeit with different underlying perspectives (i.e., conservation, crop development, seed supply, or general community development).

Increasing the resilience of the small-scale farmers' seed supply through integration with the formal sector

Improving the interaction between farmers' seed systems and the formal seed sector should be based on complementarity and a recognition of farmers as seed-sector participants, i.e., as clients and as seed producers. Figure 2 illustrates the actors and linkages between actors in amore integrated seed system,making the distinction between formal and informal actors and seeds irrelevant. Better integration of the systems will contribute to the resilience of the entire seed sector. At this moment, both the formal and farmers' seed systems are vulnerable and break down easily under stress. The formal seed sector is still seriously hampered by a reduction of budgets and the political and socioeconomic instability that characterizes many developing countries. Farmers' seed systems are vulnerable because they involve many households that have little or no buffering capacity in the form of capital and assets or access to natural resources. They find themselves in a vicious cycle of poverty and are usually the most affected when a disaster hits the system.

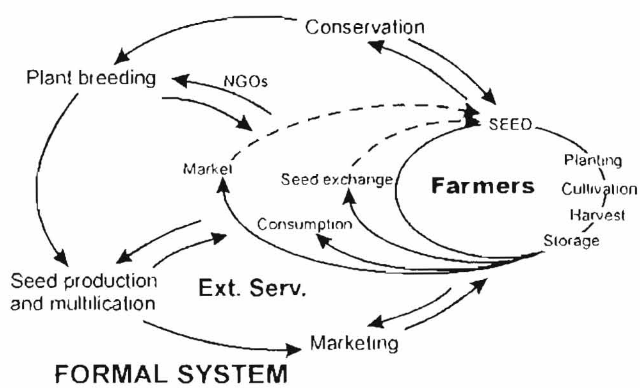


Figure 2. The local system of farmers' seed supply and the formal system or institutional system integrated through multiple linkages

Integrating formal and farmers' seed sectors by increasing the linkages between the various actors could improve the resilience of the entire system and its subsystems. A negative impact on one of the actors or subsystems could be overcome by modifying linkages and accessing seed or new materials from other sources or mechanisms. The parallel with increasing ecosystem resilience through increased integration is easily seen (for example, increased coherence in food webs). It is also clear that stronger subsystems contribute to the strength of the total system. For the seed systems of small-scale farmers, this implies that support to overcome weaknesses would contribute to resilience in times of unforeseen distress.

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Annexes

Group discussions

These annexes summarize group discussions on focused aspects of seed aid and seed system reports. Work was conducted either in plenary or smaller sub-groups on the following themes:

- Hidden versus explicit goals of seed aid
- Seed-system models and analytical frameworks
- Seed-system health indicators: A note
- Seed-system stress: Initial thoughts on types and indicators
- Seed assessments
- Possible seed-system support interventions
- Linking emergency to recovery and development in seed-aid interventions

Annotated bibliography on small farmer seed systems and relief

Workshop program

List of participants

Hidden Versus Explicit Goals of Seed Aid

Working together in the plenary sessions (June 22, 2001), the full participant group realized that there may be reasons that seed aid is given – beyond simply wishing to fill farmers' 'seed shortages' during aperiod of stress. The group reflected on the full range of possible motives for physically delivering seed, which frequently affect the specific type of development relief implemented. The list below (generated by brainstorming in a matter of minutes), suggests that there may be secondary motives in delivering seed aid that may or may not support smallholders' best interests during a crisis period.

- Promote purity of a variety
  - for commercial purposes
  - (note: can lead to lack of sustainability in production)
- Support commercial sector
- Promote new technology, e.g , new cultivar
- "Helper syndrome" (the need to "give something")
- Return seed system to status quo "ANTE"
- Help farmers establish self-help mode
- Fill temporary seed gap
- Support progressive farmers in generating income
- Build political good will

Seed-System Models and Analytical Frameworks

Working Group Report, June 23, 2000 (with introduction by C. Almekinders)

Introduction

Models of and analytical frameworks for seed systems are tools to be used for gaining a better understanding of the functioning of these systems. Models focus on components and interactions and often serve as checklists to help us determine which elements are more important in a given system (for instance, markets may be important in one seed system, farmer-to-farmer seed exchange in another). In this way, models help in the diagnosis of a seed system (in terms of the functioning, strength, and weakness of the seed system, for example) or help design surveys to provide information on these system parameters. Models may work within an analytical framework from a particular perspective, such as livelihoods, equity, or the 'health' of the system. A useful diagnosis should help identify constraints and serve as a basis for intervention.

Models are always simplifications of reality, and this is particularly so in the case of seed systems, which combine both biological and socioeconomic processes. Weltzien's presentation underlined this point by showing the complexity and the dynamics of seed systems she studied in Rajasthan. The models presented and discussed in the meeting were very different in emphasis, which points to the fact that models are usually designed to be tools for specific objectives or situations, and reflect particular perspectives (i.e., those of the designer or the users of the model). For these reasons, we felt that synthesizing the different models presented into a single model that could be usefully applied in all situations was neither possible nor desirable.

A seed system diagnosis/analysis can occur on a number of levels, such as household, community, or region. The models presented here usually do not explicitly specify a level of analysis in farmers' seed systems. However, different components may be more prominent at different levels. The models presented focus on different components, reflecting the various perspectives and goals of their authors. The system health model of McGuire (annex) focuses on parameters that could reflect the sustainability of a seed system in its widest sense. Weltzien's framework presents some parameters for characterizing the supply of seed and varieties, as well as the exchange of seed in an area, including specific information from farmers on seeds and varieties. It can be considered as a framework for interventions in the field in seed technology and variety introduction. Both McGuire's and Weltzien's frameworks start from the management of germplasm, a physical activity that is familiar to users with a more technical background. The model by Almekinders looks especially at seed flow between the various actors in the seed sector, and conceptualizes seed flow within and between the informal and formal seed systems. Longley's model starts from a farmer's perspective, focusing on household seed security and relating this to socioeconomic factors.

A working group convened on June 21, 2000, and offered the following additional notes on the rationale and use of seed-system models.

Why use a model?

Models for seed-system analysis should be a guide to considering all the components of a seed system, offering a checklist of components and considerations for practitioners to consult. This should help guide the diagnosis of problems (if any) and the identification of their causes, leading to more appropriate interventions:

Components ➔ Diagnosis ➔ Identification ➔ Intervention

Scales of analysis

Throughout the discussions, the group returned to the issue of scale of space and time in analyzing seed systems. This was along three general lines.

1. **Physical scale** for farming and seed systems
- Household
- Community
- Subnational
- National
- Regional

Many agreed that analysis should usually start at the **household** level, and continue upward, as appropriate (e.g., when considering policy or international movement of refugees).

2. **Scale of livelihood systems** was discussed. One needs to know how the seed system fits in with other components, such as livestock. This could be thought of as follows:

- Livelihood system
- Agricultural system (crops and livestock)
- Farming system
- Seed system

While most of the analysis may focus on seed system, the analytical perspective has to be broad enough to consider possible important interactions, or tradeoffs, with other parts of larger system.

3. **Scale of time**

Sequence of analysis

There was some group discussion of how one could focus in on a particular crop for seed systems analysis. One proposal was to start with a

- Focus on livelihood and, with stakeholders, do a
  - Needs Assessment—perhaps best in **chronic** situations (the only time where **type of disaster** was mentioned)
  - Loss assessment—perhaps best for **acute** situations, where seed may not be needed
- Explicitly justify crop focus, based on above (rather than implicitly, according to other agendas)
- Proceed with a full system analysis

'Output values' or the ultimate considerations for a model

To ensure that one knows where models should end up, the group discussed what the ultimate values for a seed system are, from the farmer's perspective.

- Access to seed
- Timing of supply
- Genetic quality of seed
- Quality in general
- Adequacy of output for larger farming and livelihood system

Different possible models

The group also spent considerable time trying to synthesize the various frameworks and models presented during the day. Some felt that synthesis was perhaps not desirable, since different models speak to different audiences, as mentioned above. However, some felt that the differences among models was more than just the type and level of jargon used, but that the different models focused on different aspects. These models included the following:

- **Seed system from a farmer's perspective.** Longley presented a model of concentric circles, offering a list of considerations from social and ecological dimensions (figure 1). The considerations were wide-ranging and provocative, and some felt the model worked best as a heuristic tool, to help think of probing questions from the farmer's perspective.

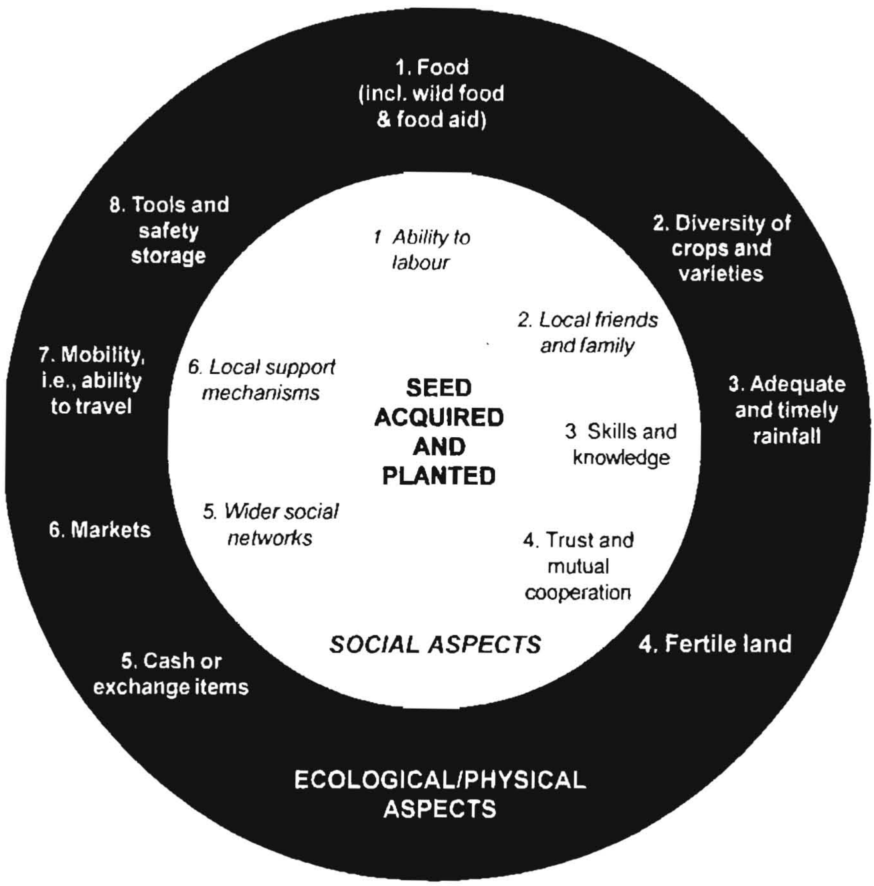

Figure 1: Aspects of a farmer seed system viewed from a farmer's perspective

- **External perspectives on flows of material and information:**

  - Sperling had synthesized Weltzien's and McGuire's presentations, drawing out a simple model of the different stages of the flow and management of planting material. To this schema different analytical frames, or lenses, might be applied by **crop and variety, then overlaying** the following (see figure 2):

    * Technical analysis of **each component**
    * Social analysis **overall and of each component**
    * Communication and infonnation **overall and of each component**
    * Institutional issues **overall and of each component**
    * (any further technical aspects not covered in the model of flow)
    * And to think about **scale, as mentioned above**

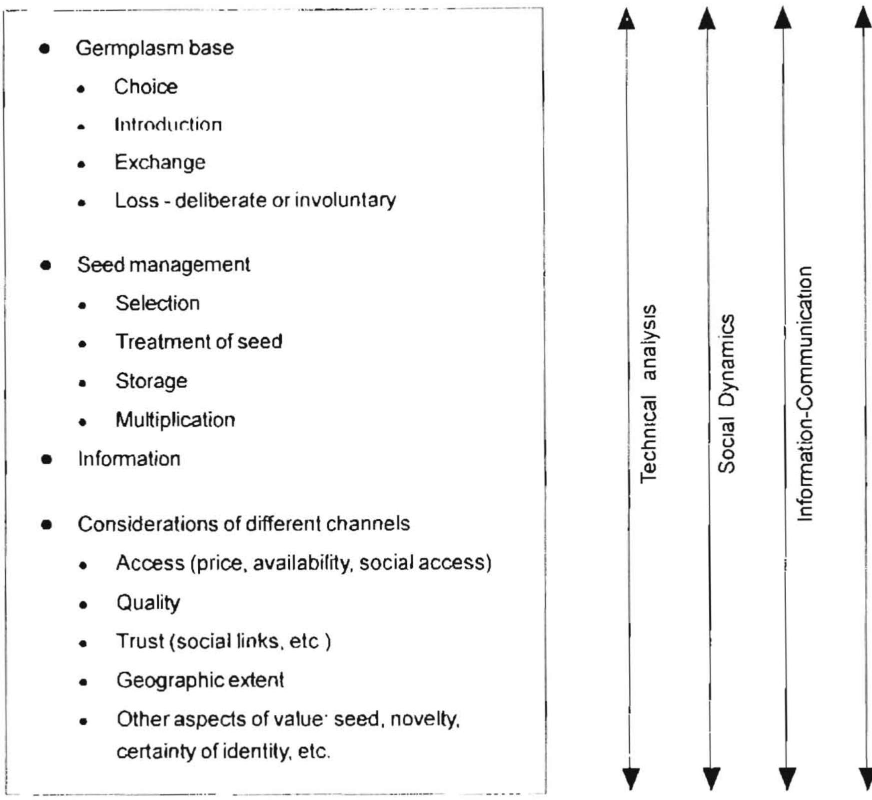

Figure 2. Components of seed system

This approach starts out on one aspect the management of germplasm—which is physical and more easily understood by technically minded practitioners, and then probes it with other analytical frames. It appeared again when the group discussed the components of farmers' seed systems.

- Almekinder proffered a visual model of the flow and management of material—which contained additional dynamism. This model (figure 3) , shows both farmer and formal seed systems and suggests possible links between them, focusing on germplasm. Other links to other institutions (for information, etc.) could be applied to the latter model.

- **SWOT—Strengths, Weaknesses, Opportunities, Threats.** The group thought a SWOT procedure was also potentially useful for understanding seed systems **'SWOT' is a strategic planning tool that can look both internally** at existing systems (strengths, weaknesses) **and externally** (opportunities, threats). SWOT can also be used explicitly to consider past, present, and future time-frames.

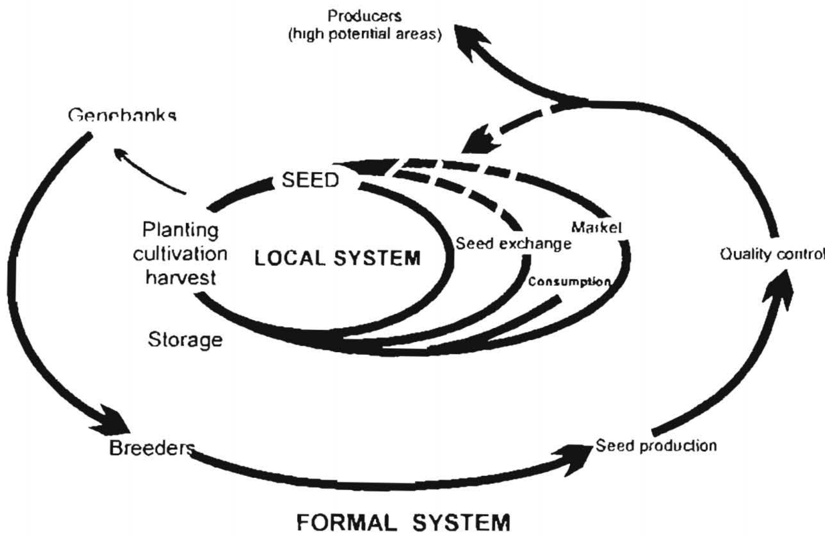

Figure 3. The local system of farmers' seed supply and the formal system—two parallel functioning systems with relatively little interaction

Seed-System Health Indicators: A Note

Notes developed and elaborated by Shawn McGuire, based on initial group discussion

What could be meant by examining the "health" of a seed system? Itmay help to consider where the concept of health has been applied elsewhere to the understanding of systems, such as in recent research on "ecosystem health" (Rapport et al. 1998). Within that field, some argue that "health" is best used as a metaphor for a system's status, to encourage broader thinking about interactions in it, to identify problems and possible treatments, and to provide a language to link to human health (e.g., Gallopín 1994). However, others feel it is possible to discuss health in more precise terms and to develop indicators for more practical, applied uses, such as explaining and predicting phenomena (e.g., Costanza and Mageau 1999). The latter argue that systems have emergent properties (Okey 1996) and their health can be described and analyzed using such properties as the following:

- ***Stability***—How well do system components (such as production) resist change? Stability over longer time frames is one definition of sustainability.
- ***Resilience***—How quickly does a system return to its former state after a disturbance, such as a disaster?
- ***Diversity/complexity***—How many components are there in a system, and what is the number and nature of the connections between them?
- ***Efficiency***—What is the level of production in relation to the level of inputs?
- ***Equity***—How evenly distributed are outputs or access to inputs, such as seed?

For seed systems, equity should be a key concern. Stability and resilience are important properties when looking at stress and recovery.

Indicators, including some of the indicators mentioned in this workshop, can be small parts of the system that are relatively easy to measure, and to measure accurately. As with human health, a single measurement cannot tell us all there is to know about system health. Health is a value that integrates many factors; while its meaning is very comprehensive and relevant for us to know, it is not something that can be easily or precisely measured and established. To move from indicators to the properties described above, and from these properties to an even broader value such as health, some type of model is needed to choose indicators and integrate their meanings, a model developed through an interactive process (Figure 1). This is not always a simple process, but with the right indicators and models, a few indicators can give a picture of the state of a system, and predict the path of change. With farmers' seed systems, this process is in its infancy: we know far less about what makes for a healthy seed system than we do for an environmental system (let alone for the human body!).It may not be possible, or even desirable, to develop elaborate models to predict health or sustainability in farmers' seed systems in the same way that somemodels work in environmental systems. However, at the very least, exploring some of the links between indicators and relevant properties, such as resilience, can help us to understand these systems better and to support their roles in maintaining farmers' livelihoods.

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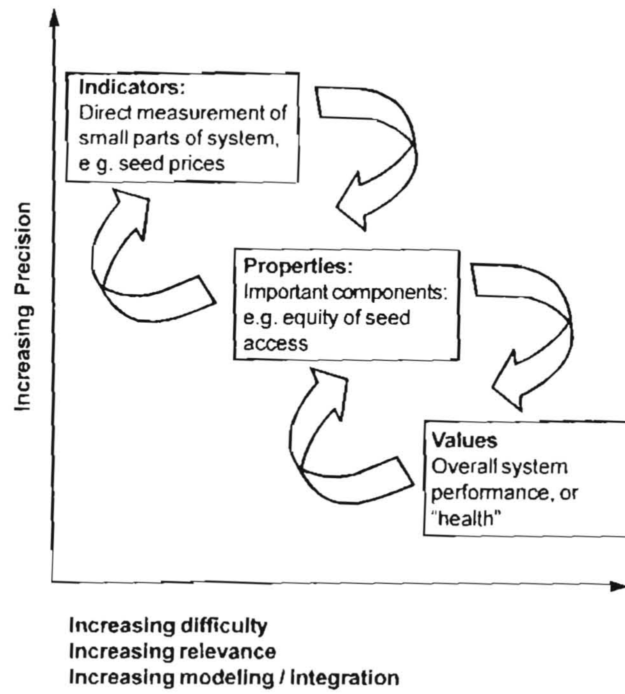

Source: Adapted from Costanza, 1992.

Figure 1. Schematic representation showing how models can relate indicators to system properties and values

Seed System Stress: Initial Thoughts on Types and Indicators

In reflecting on the range of case studies presented, the group realized that many of the "acute" cases (that is, emergency scenarios where problems with seed security were purportedly triggered by a sharp, discrete event, like a flood) seemed, under closer analysis, to indeed exhibit symptoms of more chronic stress. This led the group to start to distinguish analytically between acutely and chronically stressed seed systems.

Acute versus chronic

Acute seed insecurity is brought on by distinct events of short duration and often affects a broad range of the population. It may be caused by failure to plant a single season, loss of a harvest, or one-time loss of seed stocks in storage.

While in "normal times," we may find households that are seed secure, semi-secure, and "always seed short (i.e., chronically seed insecure), all may be affected during an acute event such as a flood, drought, or short civil disturbance—sometimes to an equal degree.

Those communities and farmers who recover quickly, with or without one-off assistance with seeds and tools, suffered from acute stress.

Chronic seed insecurity is independent of an acute stress or disaster (although it may be exacerbated by it). Chronic seed insecurity may be found among populations that have been marginalized in different ways:

- economically/socially marginal (poor, little land, little labor)
- ecologically marginal (e.g., repeated drought, degraded land)
- politically marginal (insecure areas or on land with uncertain tenure)

Chronically seed-stressed populations may be characterized by (1) continually having less seed to plant than needed, (2) running a very high risk of crop and seed loss, or (3) using low-quality seed and unwanted varieties on a routine basis. The result is built-in vulnerability to seed-system calamities.

Acute and chronic insecurity are closely linked. More and more, we are seeing a transition from acute to chronic stress rather than recovery. And in areas of chronic seed insecurity, there is a much greater vulnerability to acute disasters due to a lack of resilience. The result is that more and more farming systems and small farm communities are becoming chronically seed insecure. Relief interventions must look both for ways of increasing seed security in chronically vulnerable areas and for ways to assist communities in recovering from acute disasters and preventing a slide into chronic seed insecurity.

Indicators of seed-system stress

Several of the participants took a few moments to think about indicators of seed-system stress applicable in their own site-specific contexts. Such efforts to develop targeted indicators are novel—and should best be encouraged on a much broader scale if we are to start to understand differences among seed systems. It is only with targeted assessments that we can refine our diagnosis of what is healthy, what is not, what kind of seed-system intervention might take place—and for whom.

Contribution from E. Weltzien

Seed-system indicators are not always so easy to assess. It seems important from our experience to assess these issues with the farmers who are most affected: poor farmers, women who manage farms. It is also important to know who is actually responsible for seed management in a household—to address the appropriate persons.

Observations based on experiences with severe chronic stress (pearl millet in Western Rajasthan) and mild chronic stress (sorghum in Mali):

- There is no marketing of locally adapted varieties (landraces), either grain or seed.
- Farmers sow seed of varieties they do not know, with large percentages of their area planted to these varieties.
- Farmers sow seed of varieties/crops that they know are suboptimal for the conditions in their own fields.
- Farmers sow seed that they know is of inferior quality (germination, health status).
- Farmers are not familiar with institutions involved in seed-system development.

In systems where the commercial or government supply of seed is poorly developed, i.e., where farmers normally rely on self-produced seed, the following is found:

- Farmers do not have their own seeds stored.
- Seed experts and wealthy farmers do not have excess stocks of seed.
- Grain price is higher than normal at sowing time.
- There is an out-migration of male labor, even at sowing time.

Contribution from T. Remington

As with indicators of food insecurity, an indication of stress does not necessarily point to the cause of the problem as being either availability or access, for example:

- Fields may not be planted even when labor is available, rains are normal, and insecurity is absent. This was quite dramatic in Bahr el Ghazal after the 1998 famine, where we saw that all fields had been planted with farmers' seed of the traditional varieties of sorghum, millet, and sesame. There was no lack of availability!
- Extensive areas may be planted with poor-quality seed (i.e., food grain) or with unadapted/underperforming varieties. Again, it was quite dramatic that farmers elected to plant small plots of the relief seed. They were not stressed but they were curious, and they did not want to take a big risk so they only planted test plots (which was a good thing, too, because the seed was conditioned grain from Uganda and it was lousy).

Contribution from L. Sperling

Indicators of seed stress may differ markedly by context. For instance, after the Rwandan genocide and war escalation in mid-1994, aid agencies were shocked that farmers were getting a good deal of their bean seed from the market. This "market purchase," they thought, was a real indicator of stress—that farmers had lost their home stocks. However, even in "normal" times, Rwandan farmers regularly purchase seed from the market—for a range of reasons. The wealthier may purchase small amounts to get new varieties. Average-sized land holders purchase regularly in order to top off their own home-saved seed stocks. And the poor, who purchase on a routine basis, may obtain nearly all of their seed from local market stalls, where they know the merchants, recognize the varieties, and have some sense of the quality of the seed. (Simply put, they have little choice but to eat their stocks, and normally, they know they can get acceptable quality from local vendors or purchase from neighbors.)

Stress indicators in this situation were the following:

- dramatic changes in the proportion of seed purchased by the wealthier class
- lack of availability of local, farmer-recognizable varieties at the nearby markets

- seed priced significantly higher (e.g., 50% more) than the "normal" mark-up at the beginning of the season
- seed mixes with a high proportion of "bad" elements—broken seed, pest-damaged seed, pebbles and small twigs—being sold, with the implication that even inferior seed would fetch a price

Contribution from S. de Barbentane

The following indicators can show seed-system stress (some of them were particularly associated with the aftermath of Hurricane Mitch):

- sale or consumption of seeds (of all farmers' harvest and stocks)
- farmers more involved in off-farm employment
- migration out of the community—fewer farmers in the community at sowing time
- dietary adjustment (In Honduras after Mitch, beans seeds were more affected by Mitch than maize in some areas. In response, farmers started eating only maize.)
- seeds sold at the market not consistent (in color, size, etc.)
- fields not available (because of erosion, etc.)
- biotic problems in local varieties (pests, etc.)
- lack of capacity in informal relief systems to support farmers who lost their seeds

Seed Assessments

Working Group Report, June 23, 2000

Working Group members

Conny Almekinders

Soniia David

Kate Longley

Shawn McGuire

Lestus Serunjogi

Ray Studer

Eva Weltzien Rattunde

The group began by defining the different approaches to assessment used by relief and development agencies and then determined the specific components of a seed assessment. Each of the components was then examined in more detail, highlighting questions to be asked. Subsequent discussions then briefly focused on the indicators that could be used to shed light on the questions raised.

Types of assessment/assessment approaches

There is a wide range of assessment approaches and procedures, each suited to different types and stages of an emergency situation and the requirements demanded by the assessment. Three main types of assessment are as follows:

1. initial rapid assessment in an acute emergency
2. detailed 'one-off' assessment followed by subsequent reviews and/or re-assessments in more stable conditions (suitable for protracted emergencies)
3. long-term institutionalized monitoring (suitable for repeated acute or chronic stress situations) to gather information about changing seed systems and changing needs.

Similar types of information about seed systems would be collected in each of these different types of seed assessments, although the level of detail and the methodologies vary. The group decided to begin by identifying the types of questions that might be asked within each component of a detailed 'one-off' assessment since this would offer a good foundation from which both a more rapid assessment and longer-term monitoring could then be developed.

Policy and institutional context

As a background to any type of assessment, it is necessary to gather information on the policy and institutional context relating to both agricultural production and potential interventions. The policy context not only helps to determine the opportunities available to farmers but also shapes the scope and nature of agency interventions. In order to understand the policy and institutional context, it is necessary to look into the following:

- government policies and development goals relating to agriculture, such as crop/sector focus, seed regulatory framework, input-supply mechanisms (e.g., private, parastatal, credit and/or subsidies for fertilizer/improved seed, input packages in relation to adoption, nature of extension provision, etc.)

- the links between extension research and NGOs/relief agencies
- the organization and coordination of emergency aid, agricultural rehabilitation, and rural development (by government organizations, NGOs, and international bodies)

It is essential to identify the stakeholders to be consulted in designing and implementing any form of seed intervention.

Assessment components

Regardless of which type of assessment is undertaken, there are three components relating to seed systems that must be considered:

1. Availability (seed supply): this refers to where, what type, and how much seed is available at a defined level, whether household, community, district, national, or regional.
2. Accessibility: this refers to the terms of access through which different types of farmers can acquire the seed that is available.
3. Demand: this examines the type and quantities of seed that are required by farmers and whether or not this matches that which is available and accessible at a particular level.

It is important to note that these components represent an analytical approach, not consecutive stages in undertaking an assessment. It is quite possible that all components can be carried out simultaneously, and many of the questions to be asked as part of each component may overlap with those of another component. Issues to be addressed within each assessment component are outlined in the following sections.

Seed availability/seed supply: What type of planting material is available and where?

In assessing what type of planting material is available, it is necessary to take account of the crop species, varieties, quality, and quantity available. Also when it is available. It is essential to disaggregate different crop types (and in some cases, varieties), especially in relation to their end use (e.g., for food, for sale in markets, etc.) and adaptation (e.g., cycle length, photoperiod sensitivity, resistance to key insects or diseases). What is the ratio of consumption to propagation, and is the overall output sufficient to cover consumption needs? Possible sources of available seed might include household seed stocks, market supplies, formal-sector sources, etc. Depending on the various sources, a range of factors relating to seed production must then be considered, including the quality of seed (germination, physical purity, and genetic quality); the breeding system of the crop; how, when, and by whom seed is produced; seed processing and storage (who, where, what treatments are used); seed use and seed losses (e.g., from pests, diseases, theft, or consumption); seed selection (if it takes place)– by whom, when, where, how (goals, direction, heritability, intensity); and the annual seed rate.

Seed accessibility: How is seed accessed and who has access to what?

How is seed available (i.e., in terms of access) to different groups of farmers? The definition of relevant farmer categories depends on the local situation. Possible categories might be defined by residence (displaced/returnee), wealth, ethnicity, gender, marriage status, livelihood system, landholding status, ecology,etc. What are the limiting factors to accessing available seed? Do they include cash, transport, security, social norms, poor crop production/ storage? What are the means through which seed is accessible (i.e., strengths or opportunities that can be built on)? Is it accessed through kinship, exchange resources, social norms, etc.? How do farmers find about about good sources of seed, new varieties, specific seed qualities? What are common sources of information? Who uses which ones? What type of information about seeds or varieties are farmers searching for?

Seed demand: How much seed, of what type (spp, variety, quality), and when is it required?

Some understanding of the nature of seed demand is useful in highlighting the purpose for which seed is required, e.g., whether to provide small quantities of novel material for farmers to test, to replace material that may be poor quality or which may have been accidentally lost, or to supply poor farmers with seed that they are unable to keep for themselves, etc. Is there a demand for "traditional" planting materials or for novel materials in response to a changed ecological and/or social situations (e.g., different or declining markets, lack of labor, etc.). Has there been a change of seed needs in term of crop uses? Are there distinct needs for different types of farmers? What are the cropping areas and seeding rates for the crops required? What is the germination rate and the likelihood of successful establishment (in terms of rainfall instability and/or damage by insects, sandstorm, soil erosion, flooding, etc.)? What are the contingencies available to farmers in such situations? What are the associated inputs required (e.g., capacity to sow, oxen, tools, labor, fertilizer)?

Methodologies for data collection

The methodologies used for data collection depend very much on the assessment approach, the time available, the level of detail required, and the geographical scale to be covered. Data can be both qualitative and/or quantitative. The timing of data collection is particularly important in a rapid assessment, where results are expected to inform interventions for the forthcoming planting season. In a rapid assessment, it is necessary to know *a priori* what the relevant farmer categories might be and to sample accordingly (wealth, residence status, and livelihood system are likely to be the most significant); whereas, in situations where more detailed, quantitative assessments are possible, the relevant categories can be defined ex post, according to the data collected. In the latter case, it is important to gather information regarding *actual* seed sources (e.g., what was planted, how much, on what terms, from where/whom, why, when, etc.) rather than asking vague or hypothetical questions. In addition to asking about what was planted, it is necessary to ask what seed was given/exchanged/sold to others, also to enquire about seed loss (e.g., when was the last time, or how often is on-farm seed lost, and for what reason). What are farmers' preferred seed sources in a good season and in a bad season? To whom would you *not* give seed, and from whom have you not been able to get seed/variety?

Proxy indicators

The use of proxy indicators is often necessary in rapid assessments or to highlight topics for further investigation as part of a more detailed assessment. Where rudimentary assessments of seed needs are carried out at present, these generally rely on local production data as an indicator of local seed availability. However, the assumption that low production necessarily leads to seed shortages is often incorrect. Given this, together with the difficulties of accurately measuring crop production, the usefulness of crop production information as an indicator for seed needs is highly dubious. Not only is it important to select proxy indicators that can produce reliable measurements, it is essential that information gathered through the use of proxy indicators be interpreted in the light of triangulation methods of verification to avoid arriving at incorrect conclusions. For example, large areas of unplanted land may be due to a shortage of labor, not seed; the absence of particular seed types in local markets may not be due to scarcity but to the fact that these seed types are acquired through other means; etc.

The following list provides some suggested indicators that could be useful in seed assessments, mostly for assessing seed access, but further work is required in this area.

- market prices of seed and grain
- source of food grains in local market (i.e., local or from elsewhere)
- availability of local grain in market that could be used as seed
- the size of stocks held by local stockists
- the use of food aid as seed (also use of seed aid as food)
- land left unplanted, sowing delayed
- proportion of population resident (as opposed to displaced)
- number of varieties of a crop available
- l of insect infestation in grains to be used as seed