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# Examining the Role of Collective Action in an Informal Seed System: A Case Study from the Central Valleys of Oaxaca, Mexico

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*This paper explores social arrangements associated with seed transactions among small-scale maize farmers in the Central Valleys of Oaxaca, Mexico, where no formal seed supply system exists. We test the hypothesis that individual farmers have strong incentives to participate in some form of collective action to ensure their access to seed. Six communities were studied, three of them in detail, using in-depth, semistructured interviews with key informants; focus group discussions; and a tracer study that followed seed flows among farmers. Farmers mostly saved seed and only occasionally acquired seed from outside sources. We found no evidence of a specialized social organization based on collective action to mediate seed flows. Seed transactions are infrequent, bilateral, and ad hoc, although trust is an important component, as it ensures reliable information about the seed is provided. Implications of these findings are discussed, especially for genetic diversity if the current supply system breaks down.*

**KEY WORDS:** maize; small-scale farmers; informal seed supply; collective action; Mexico.

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## INTRODUCTION

Maize is the most important staple crop for Mexicans, particularly the rural poor. Eighty percent of the maize area in Mexico is thought to be planted to farmer-saved seed (Morris & Lopez-Pereira, 1999). Although there is a large body of knowledge about how farm households choose maize varieties and select seed (e.g., Bellon & Taylor, 1993; Bellon & Brush, 1994; Louette *et al.*, 1997; Louette & Smale, 2000; Van Dusen, 2000; Perales-Rivera *et al.*, 2003), relatively little is known about the local systems that mediate the supply of seed among farmers and households. Local seed supply systems are important not only for rural livelihoods but also for the conservation and evolution of crop diversity on farm[5] (Louette *et al.*, 1997; Bellon, 2004). The relatively limited knowledge of local seed supply systems is particularly serious in the case of maize in Mexico. Mexico is a center of diversity and domestication for maize (Piperno & Flannery, 2001; Matsuoka *et al.*, 2002), and small-scale farmers continue to play a key role in maintaining that diversity (Hernandez, 1985; Perales-Rivera *et al.*, 2003; Bellon, 2004). The structure and evolution of maize genetic diversity depend on farmers' access to a diverse array of farmer varieties, which in turn depends on the informal flow of varieties and seed among households and communities (Bellon *et al.*, 1997; Louette *et al.*, 1997). A better understanding of the workings of local seed supply systems is integral to meeting two not necessarily incompatible goals: 1) ensuring that the farmers who depend on these systems can gain access to new germplasm—improved or local—that can enhance the benefits they derive from growing maize; and 2) supporting farmers' efforts to maintain crop diversity in their fields (Smale & Bellon, 1999; Maxted *et al.*, 2002).

The study of how Mexico's local seed supply systems function has implications beyond Mexico itself: the methods and findings can be useful for understanding how these systems work in other regions and with other crops. Maize is an important staple crop for the poor in many parts of Latin America and sub-Saharan Africa, where a large number of farmers still rely on themselves or on local farmers to acquire seed. It is estimated that about 60% of the maize area in Latin America and 64% of the area in sub-Saharan Africa is planted to farmer-saved seed (Morris, 2002). More generally, local or informal seed systems remain the prevailing sources of seed for many crops in developing countries. Even though relatively little is known about how these systems function, many studies have stressed their importance

[5]It should be noted that on-farm conservation of crop genetic resources, particularly of open-pollinated crops, is a dynamic process in which the germplasm continues to evolve over time, influenced by management practices as well as by naturally occurring pollen flow (Louette *et al.*, 1997; Berthaud *et al.*, 2001).

(Cromwell, 1990; Almekinders *et al.*, 1994; Wierema *et al.*, 1994; Sperling *et al.*, 1995; Friis-Hansen, 1999; Thiele, 1999; Almekinders & Louwaars, 2000; Seboka & Deressa, 2000; Tripp, 2001), and there is an urgent need to understand them in greater detail (Seboka & Deressa, 2000).

This paper presents a case study of the local seed supply system used by small-scale maize farmers in the Central Valleys of Oaxaca, Mexico. It discusses the relationship between two important components of the system: (1) the social arrangements and (2) the seed transactions that ensure the supply of a diverse array of farmer varieties[6] of maize to small-scale farmers in this region. The hypothesis examined here is that individual farmers participate in some form of collective action to ensure their access to a larger base of maize genetic diversity than they would be able to manage or maintain individually.

This hypothesis is based on the findings of previous research (1997–2002) in the study area by the International Maize and Wheat Improvement Center (CIMMYT) and the Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP) (Smale *et al.*, 1999; Bellon *et al.*, 2003). The aim of that research was to determine the possibility of improving maize productivity while maintaining genetic diversity. This paper increases the scope of that study by examining the social arrangements that shape the seed and information flows on which farmers depend.

## COLLECTIVE ACTION AND CROP GENETIC RESOURCES

The term "collective action" is used to mean many things. Several authors have stressed the need for a clearer and more consistent conceptualization and operationalization of this concept as well as a more consistent terminology (Nordvig Rasmussen & Meinzen-Dick, 1995; Meinzen-Dick *et al.*, 2004; Poteete & Ostrom, 2004). Collective action has been variously defined as "voluntary action taken by a group to achieve common interests" (Meinzen-Dick & Di Gregorio, 2004), as "the coordinated behaviour of groups toward a common interest or purpose" (Vermillion, 2001), or as what takes place "when more than one individual is required to contribute to an effort in order to achieve an outcome" (Ostrom, 2004). Common to most of the definitions is the notion that collective action involves several actors and is directed towards a certain interest or purpose shared by them. However, there are different points of view as to what constitutes the

[6] *Farmer varieties* (referred to here as "varieties") are the crop populations that a group of farmers recognize as distinct units. They may not have specific names beyond the color of the kernel; i.e., a farmer may plant two varieties of white maize. A farmer variety is not a variety in the sense of commercial agriculture, where a variety should be distinct, uniform, and stable.

collective, and to what extent the action reflects a common purpose. The collective may take several forms, ranging from a formal organization to the mere observation of a set of rights and responsibilities related to the use of a common resource (Meinzen-Dick & Di Gregorio, 2004). Furthermore, some who study collective action regard institutions of collective action as social entities acting as a homogeneous unit, whereas others hold the view that collective action is an aggregate or a coalition of actors. The latter view should not be mistaken for a notion of social actors as detached, atomized individuals, however; the point is to avoid regarding an abstraction as a material thing and not to assume "that organizations or collectivities such as social movements act in unison or with one voice" (Long, 2001).

Though good reasons exist for undertaking collective action, it has been argued that the objectives of the individual may not always coincide with the common good. Based on the notion of economic rationality in relation to collective action, Olson (1971) proposed that voluntary group action is unlikely to achieve or maintain a common good because it is rational for individuals to be "free riders" (Steins, 1999). This view was further stressed in Hardin's seminal article "The tragedy of the commons" (1968), where the author projected the overutilization of open-access natural resources because of individual users' unsustainable exploitation of resources at the expense of others. Kimber (1981) later criticized this view for assuming that only "free riders" are rational, and argued that a considerable number of individuals would still be willing to make the expected contributions to the common good, as long as the benefits they would receive in return would continue to exceed their costs. Various dimensions of cost-benefit considerations play a role in shaping involvement in collective action, such as the time required for benefits to accrue, where and to whom they accrue, as well as how evident or tangible they are. Nevertheless, individual, material self-interest is not the only motivation for purposive action. In a widely cited article, Granovetter (1985) interprets human action as "embedded in concrete, ongoing systems of social relations," which means that individuals are not "islands" but share values and visions—such as reciprocity or a sense of fairness—that are rooted in their social context and hence help frame their individual decisions. Granovetter's position has been supported by researchers throughout the social sciences (see Portes & Sensenbrenner, 1993; Bourdieu, 2001; Long, 2001; Polanyi, 2001 [1957]; Swedberg & Granovetter, 2001).

The concept of collective action has been used to describe and analyze the provision of public goods through the collaboration of multiple actors; the development of social movements; and issues of development and natural resources, in particular the management of forests, fisheries, rangelands, irrigation systems, and even pest control (Ostrom, 1990; Knox

*et al.*, 1998; Steins, 1999; Vermillion, 2001; Ravnborg *et al.*, 2002). To our knowledge, the concept has not been used to understand how crop genetic resources are managed locally and particularly how local seed systems operate.

Seed is a unique commodity because it has both private and public good characteristics (Morris *et al.*, 1998). A particular bag of seed cannot be consumed by two farmers at the same time (rivalry), and in that sense the specific benefits derived from planting it accrues to the farmer who plants it and not to anybody else. Furthermore, it is relatively easy for the owner of the seed to supply it only to authorized users (excludability); hence seed can be seen as a private good. Seed can also be considered a public good, however, because in many circumstances neither rivalry nor excludability occurs. Seed is a crop genetic resource that contains the genetic code for certain traits of actual or potential value and contributes to the stock of genetic diversity. Anybody who has access to seed with the same genetic information cannot be excluded from benefiting from the coded traits. The use of this seed by one person does not diminish its availability to another person who has the same type of seed.

As a public good, crop genetic resources differ markedly from other natural resources that are public goods, such as water or land. The main problem for the maintenance of these sorts of resources is overuse. Crop genetic resources, however, are renewable, and the more they are used the better (Friis-Hansen, 1999). In fact, the continued conservation of many landraces and wild relatives is often entirely dependent on their use. This makes the issue of free riders very different in crop genetic resources compared to other natural resources, where overuse is a problem. However, it does not eliminate the problem that society may underinvest in maintaining crop genetic resources. There still may be a considerable gap between the public and private benefits derived from genetic resources, and hence there is a need for some form of public or collective action. This characteristic of genetic resources has been well recognized, and public investments have been made in conserving genetic resources over the years, mainly in gene banks but lately also on the farm. What has not been explored is the potential role of collective action in genetic resource conservation at the local level, even though some interventions to support on-farm conservation are based, at least partly, on the idea of collective action (for example, the establishment of community seed banks or of farmers' seed networks; see Lewis & Mulvany, 1997; Feyissa, 2000; Jarvis *et al.*, 2000; Mazhar, 2000).

The limited literature available on informal seed systems agrees that they are mostly based on traditional social alliances and family relations, are cast in the context of mutual interdependence and trust, and often constitute dynamic and highly complex networks (Almekinders *et al.*, 1994;

Seboka & Deressa, 2000). These characteristics suggest that collective action could play a role in local seed supply. In the next section, we discuss why it is hypothesized that collective action may play a role in seed supply among small-scale maize farmers in the Central Valleys of Oaxaca, Mexico.

## PREVIOUS FINDINGS AND THE ARGUMENT FOR THE HYPOTHESIS

As mentioned, previous research on genetic diversity was conducted in six communities in the Central Valleys of Oaxaca (Smale *et al.*, 1999, 2003; Bellon *et al.*, 2003; Bellon, 2004). It concluded that maize agriculture continues to play a significant role in farmers' livelihoods, food security, and the conservation of genetic diversity. A formal seed sector has yet to develop in this region, where almost all of the maize planted consists of landraces. (The use of modern varieties is negligible, because farmers regard their long production cycle as incompatible with local rainfall patterns or their culinary qualities as unsuitable for traditional food preparations.) Most farmers depend on themselves to acquire seed, either by saving it from their harvest or getting it from other farmers. For example, for 87.5% of the maize types planted, farmers saved seed frequently. However, for 47.3% of the maize types, farmers sometimes acquired seed from outside sources. This was particularly the case for specific types of maize. For example, for maize that did not have white grain, 64.9% of farmers resorted to outside seed sources, and for a rare, red-grained type, 80% of farmers resorted to outside seed sources.

Research in the Central Valleys also showed that farmers were interested in diverse maize landraces. On average, farmers planted 1.6 varieties per household; the greatest diversity reached 2.13 varieties per household in one of the communities. Farmers valued different characteristics in maize cultivars; for example, out of 25 characteristics elicited (e.g., yield by weight, tolerance to drought, consumption characteristics), seven were rated as very important by more than 50% of the male farmers interviewed, and 15 by more than 50% of the female farmers interviewed. Farmers were invited to assess a set of 170 varieties collected in the region by "voting" for as many as they liked. On average, male and female farmers voted for 10.8 and 13.7 varieties, respectively. Farmers showed interest in many different varieties, not just a few, and even the most popular types accounted for only 36% and 54% of the votes of male and female farmers, respectively. During subsequent field days, where farmers could purchase seed of a representative subset of these maize varieties, they bought 2,726 kg of seed,

evidence of their willingness to pay for seed of a diverse set of the landraces present in the region (Bellon, 2004). Furthermore, by continuing to value and plant these landraces, farmers contributed to the conservation of maize biodiversity. Additional evidence suggests that through their seed selection and management practices farmers play an important role in generating the biological diversity observed in the study area (Pressoir & Berthaud, 2004).

Research in the Central Valleys also indicated that farmers who needed to acquire seed from other farmers experienced some difficulty in finding seed that met their requirements. First, a farmer has to learn who grows which maize variety and investigate the characteristics and performance of the maize of interest. Then he or she must make sure that the information offered is trustworthy and the seed is reliable. Finally, the conditions of acquiring the seed must be negotiated. It therefore appears that acquiring seed of diverse maize varieties under these conditions can entail risks and high transaction costs to individual farmers. If one assumes that there is a high probability of seed loss due to climatic conditions and poor storage,[7] then it is reasonable to hypothesize that a group of farmers could maintain more diversity than any individual, and at a lower cost and reduced probability of loss. There should be clear incentives for individual farmers to cooperate in providing seed and information for a diverse set of maize varieties—in other words, for engaging in collective action to support their seed supply. The basic ingredients for collective action are present: a group of farmers with a common interest and a benefit that accrues from a voluntary group action. Furthermore, in this region several traditional collective action institutions exist, such as the *téquio*[8] and the *guelaguetza.*[9]

To test this hypothesis, we developed the following operational definition of collective action, based on the notions of collective action reviewed earlier: *the actions of a well-defined group of farmers linked by a set of rights and responsibilities regarding the mutual supply of seed of a diverse set of farmer varieties.* Building on this definition, we developed the following predictions to examine the hypothesis:

[7] This is reasonable because this is rainfed agriculture, with common occurrences of severe drought. For example, during the period of the study, 1997–2002, there were two years with major droughts (1997 and 2001). Furthermore, drought and storage losses were identified as very important concerns by these farmers (Smale *et al.*, 1999).

[8] *Téquio* refers to a form of communal work in which one has to provide a service to the community. It can refer to communal work in the interest of a certain group (for example, the local school), or it can be in the interest of the community in general (for example, construction and maintenance of roads, drinking water, infrastructure, or sewerage).

[9] *Guelaguetza* is a Zapotec institution of mutual aid between households. It can take place in many different situations and between different people and includes agricultural tasks, the roofing of houses, weddings, funerals, and religious festivals (Montes Vasquez, 1985).

- The existence of a number of people that identify themselves as part of a group that recurrently shares seed in some form (e.g., sale, exchange, or barter).
- Apart from the existence of a group, collective action could be inferred from adherence to a certain set of rights and responsibilities regarding the mutual supply of seed. This behavior should be reflected in how seed transactions are conducted (e.g., specific practices or patterns associated with seed flows).
- The existence of collective action should depend on providing certain advantages or benefits to farmers compared to working individually. These could include lower transaction costs for acquiring seed or reduced risk of seed shortages.

## STUDY SITES AND METHODOLOGY

The study was carried out in six communities in the Central Valleys of Oaxaca: San Pablo Huitzo, Santo Tomás Mazaltepec, San Lorenzo Albarradas, San Agustín Amatengo, Santa Ana Zegache, and Valdeflores (Fig. 1). Yearly mean temperature in the region is 18–22 °C, with an average annual precipitation of 600–1,000 mm (INEGI, 2001a). The rainy season runs from May to October. Descriptive statistics of key agricultural and economic variables for the six communities are presented in Table I.

Farming systems in all six communities are characterized by low productivity (Smale *et al.*, 1999). Landholdings are relatively small and maize is the major crop, being sown on average on more than 90% of the landholdings, but beans and squash are also commonly planted. Maize landraces dominate local agriculture; only in San Pablo Huitzo is the area planted to improved maize seed slightly significant. Not surprisingly, this community had the highest average percentage of irrigated maize.

Land tenure arrangements differ notably among communities. All farmland is privately owned in Zegache, whereas almost none is privately owned in Valdeflores, Mazaltepec, or Albarradas. In Huitzo, privately owned land represents on average about half of the land farmed by households, and in Amatengo it represents about one quarter.

Agriculture is the major source of income for nearly all households, whether located in better or poorer maize production zones. Nonfarm employment is an important source of income for about 25% of the farmers. A similar overall percentage of households depend on remittances, although there are differences, particularly in Huitzo and Mazaltepec.

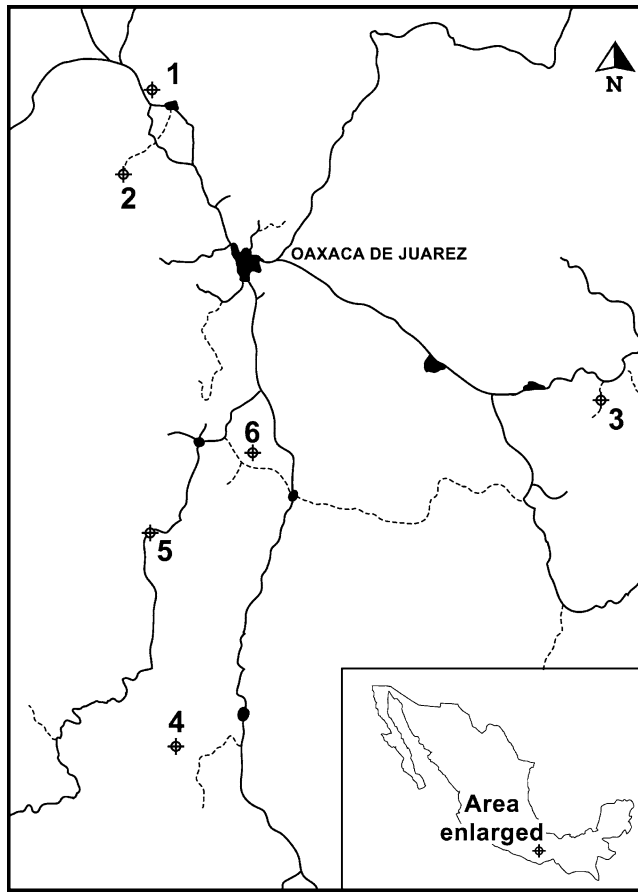


**Fig. 1.** Location of the study communities in the Central Valleys of Oaxaca, Mexico. 1. San Pablo Huitzo; 2. Santo Tomás Mazaltepec; 3. San Lorenzo Albarradas; 4. San Agustín Amatengo; 5. Valdeflores; 6. Santa Ana Zegache.

The population in the study area is predominantly Spanish-speaking, but in Zegache and Mazaltepec much of the population (>30%) belongs to the Zapotec ethnic group and speaks Zapotec as a first language, although in both communities almost all Zapotec speakers also speak Spanish (only 1.3% and 0.9% respectively do not; see INEGI, 2001b). All six communities have electricity and potable water, some medical services, and a primary school. Huitzo, Valdeflores, Amatengo, and Mazaltepec have secondary schools, and Zegache and Albarradas each have a national secondary school program via television.

**Table I.** Key characteristics of the six study communities.

| Community characteristics | San Pablo Huitzo* | Santo Tomas Mazaltepec | San Lorenzo Albarradas* | San Agustin Amatengo | Valdeflores | Santa Ana Zegache* |
|---|---|---|---|---|---|---|
| Maize yield potential | Good | Poor | Poor | Poor | Good | Good |
| Farm size 1996 (ha) | 2.44 | 3.91 | 4.01 | 2.84 | 3.87 | 3.46 |
| Maize area (ha) | 1.99 | 3.65 | 3.02 | 2.76 | 3.55 | 3.22 |
| Maize area in improved seed (%) | 0.14 | 0.00 | 0.04 | 0.00 | 0.00 | 0.01 |
| Maize area irrigated (%) | 54.2 | 15.7 | 8.10 | 11.90 | 3.78 | 0.17 |
| Land privately owned (%) | 49.60 | 0.00 | 1.00 | 27.42 | 0.00 | 100 |
| Households dependent on local agricultural production (%) | 70 | 100 | 95 | 98 | 85 | 100 |
| Households dependent on local non-farm income (%) | 40 | 28 | 30 | 25 | 25 | 15 |
| Households dependent on remittances (%) | 3 | 13 | 23 | 38 | 25 | 25 |

Source: Smale *et al.* (1999).
*Communities where the seed flow tracer study took place.

Because the CIMMYT/INFAP research project was conducted in the same area, background information on all six communities was available. The locations were selected for the contrasts they reflected in maize yield potential and dependency on non-farm income (Smale *et al.*, 1999). Informants were selected based on the information from the previous study, which included a random sample of 240 households. For the activities of this study, informants were selected according to gender, age, ethnicity, economic status, and level of formal education to ensure that the diversity of social groups was reflected. The research employed qualitative and quantitative methodologies, including:

- In-depth, semistructured ethnographic interviews with key informants were used to identify relevant issues and questions. This procedure was fundamental, because many issues are embedded in people's minds, practices, and institutions. These issues are not

easily articulated by farmers unless researchers obtain some prior knowledge that allows the identification and proper framing of effective questions.

- Through a series of focus group discussions, the questions identified through the interviews were posed to groups of farmers, resulting in an inventory of responses on issues such as ways to acquire seed, reasons for doing so, social relations in seed transactions, and sources of information on the seed, among others.
- Based on information from the interviews and focus groups, a quantitative tracer study was done for seed flows between farm households.

The patterns that were identified by the key informants were confirmed by the focus groups and the tracer study. The three methods complemented each other and allowed key issues to be addressed from several angles.

The ethnographic interviews were conducted with 22 key informants from the three most contrasting communities: Zegache, Albarradas, and Huitzo. This activity was restricted to only three communities because of the labor-intensive and time-consuming methodology and because we preferred to focus on communities with the most contrasting conditions. This process yielded high-quality information that sampled the range of situations present in the study area. The key informants were selected based on prior knowledge, using the above-mentioned criteria, to reflect contrasting socioeconomic and ethnic conditions.

There were 12 focus groups, one each for men and women in each of the six communities, involving 46 women and 58 men in all. The discussions covered the relative importance of seed loss among vulnerability factors faced by farmers and the mechanisms that guide seed transactions. Participants also acted out seed exchanges. Focus group results were remarkably similar across communities and gender. The focus group discussions were carried out in all communities because they were easy and inexpensive, and they provided a great amount of valuable information.

The survey-based seed flow tracer study involved males and females from 153 farm households in the three communities where the ethnographic interviews were conducted. We focused again on these communities for two reasons: the tracer study was labor intensive, and results of the focus group discussions had suggested that the conditions of these three communities reflected those of all six. In the tracer study, we followed the flows of seed among selected farm households, paying special attention to farmers' explanations about the transactions: why they had engaged in a transaction,

with whom, and what was the significance of the transaction, among other factors. As a starting point, 10 households in each community were selected using criteria similar to those described for the selection of informants (this was not a random sample)[10]. After the first round of interviews, households that gave or received seed from each of the original 30 households were located and queried in a second round of interviews, and so on, until each of the original households had led to an average of four additional households being visited. A total of 531 transactions of both incoming and outgoing flows were recorded, including the type of transaction and the social relations involved.

## RESULTS

Saving seed from one's own harvest is the predominant practice in the study area. Previous research showed that 89.7% of all seed lots were saved by farmers from their own previous harvest, and the rest were acquired from other farmers (Smale *et al.*, 1999). Only 24.2% and 20.9% of the farmers in the tracer study acquired or distributed seed, respectively, in 2001. Farmers in the tracer study said that their main reasons for acquiring seed were for experimentation and, to a much lesser extent, to overcome the lack of seed of their own. The main reason for giving seed to others was a sense of social responsibility. Farmers felt that they were morally obliged to give seed to a farmer who asked for it. Most transactions involved the exchange of money or seed, and some farmers said explicitly that they engaged in seed transactions to obtain seed or money, but often the reason to engage in the transaction was not the payment *per se*. Many types of seed transactions were identified.

### Types of Seed Transactions

Informants described different types of seed transactions in detail during the ethnographic interviews and focus group discussions. Quantitative data on seed transactions were later gathered in the seed flow tracer study. Transactions were classified into seven categories, including "other," which referred to infrequent, ad hoc transactions (Table II).

The quantitative data clearly show the heterogeneity of transactions, although purchases account for half of all transactions. Focus group

[10]For this reason, and because the subsequent rounds of interviews were not independent, we did not carry out any statistical analyses on the data, and we used them only in a descriptive fashion.

**Table II.** Types and number of seed transactions.

| Type of transaction | Description | Transactions | | Acquisition | | Distribution | |
|---|---|---|---|---|---|---|---|
| | | # | % | # | % | # | % |
| Purchase | Seed that has been bought and paid for in cash | 280 | 52.7 | 143 | 42.7 | 137 | 69.9 |
| Inheritance | When parents or foster parents pass on maize seed to their children or foster children. This can be when the parents die, or when the children become independent of their parents and start to farm on their own | 89 | 16.8 | 84 | 25.1 | 5 | 2.5 |
| Exchange | Seed of one kind of maize is exchanged for the same quantity of seed of another kind of maize. Sometimes seed is acquired in exchange for grain, but then quantities normally vary, as seed has higher value than grain | 52 | 9.8 | 37 | 11.0 | 15 | 7.7 |
| Gift | In this transaction seed is provided without payment, whether monetary or in kind | 49 | 9.2 | 32 | 9.6 | 17 | 8.7 |
| Barter | This is an exchange in kind, i.e., maize seed is given for some other good of use to the seed provider (e.g., beans or coffee) | 7 | 1.3 | 4 | 1.2 | 3 | 1.5 |
| Borrowed | The seed provider hands over the seed to the person requesting it, while the latter in turn promises to give back the same quantity of seed of the same kind of maize once it has been harvested | 3 | 0.6 | — | — | 3 | 1.5 |
| Other | This category contains various other ways of obtaining seed: sharecropping,[a] pepena (gleaning),[b] seed won in a lottery, payment realized in kind with maize, and seed acquired without the knowledge of the seed provider | 51 | 9.6 | 35 | 10.4 | 16 | 8.2 |
| Total | | 531 | 100% | 335 | 100% | 196 | 100% |

[a]In this arrangement the owner of the land contributes the plot of land and the seed while the other contributes the labor. When the harvest is over, they split the harvest (in most cases equally) between the two of them.
[b]The practice of collecting one by one grains that are left over on the ground in the field after the harvest.

discussions and informant interviews provided detail on the many types of transactions and their individual variations. We had expected a relatively uniform and clearly defined mode of transaction, reflecting adherence to a set of rights and responsibilities and a system of collective action. This was not what we found. In addition, although most informants remembered from whom they had obtained seed in the recent past, many had difficulty recalling to whom they had given seed, which may explain the noticeable discrepancy between the number of acquisitions and distributions.

Most seed transactions carry no obligation beyond the immediate transaction, except for borrowed seed or seed given as a gift. The borrower must repay the seed, and gifts usually carry an implicit obligation to return the favor. Transactions involved different types of social relations between the seed provider and the recipient.

## Social Relations

The in-depth interviews and focus group discussions revealed the categories of social relations frequently involved in seed transactions (Table III). These were later quantified in the tracer study. The seed provider categories mentioned here do not constitute an exhaustive list, and each category could be divided into subcategories with overlaps and variations among them. For example, neighbors can sometimes also be relatives or *compadres*[11] This grouping reflects the informants' own classifications; that is, if an informant referred to a seed provider as an uncle, the provider was classified as family member, though the person might also be a neighbor.

Family members and acquaintances are the most common sources or recipients of seed. Most seed transactions took place between people who already knew each other and shared a feeling of mutual obligation. Informants in focus group discussions and ethnographic interviews were not able to identify specific persons as particular seed-relations (except for researchers involved in the CIMMYT/INIFAP project, which included a seed distribution activity). The data regarding social relations do not provide

[11] From the word c*ompadrazgo,* referring to a ritual kinship, somewhat similar to the relation known elsewhere as godparents, through which close relations of loyalty, mutual help, reciprocity, and confidence are established and formalized. Often there is a certain degree of prestige associated with being asked to become someone's compadre or comadre, and in some ways compadrazgo can signify social capital (Cordero Avendaño de Durand, 1997).

**Table III.** Transactions by type of seed provider.

| Social relation of seed provider | Description | Transactions | | Acquisition | | Distribution | |
|---|---|---|---|---|---|---|---|
| | | # | % | # | % | # | % |
| Family members | This group includes blood relatives as well as affiliated relatives | 247 | 46.5 | 177 | 52.8 | 70 | 35.7 |
| Compadres | Very close relations, considered almost like family. When asked for help they cannot easily refuse (Beals 1970) | 25 | 4.7 | 13 | 3.9 | 12 | 6.1 |
| Neighbors | Neighbors. It should be noted that neighbors often also are relatives or compadres | 7 | 1.3 | 5 | 1.5 | 2 | 1.0 |
| Friends | Includes workmates and people who belong to the same social organizations, church group, or communal work group. Their role is significant both as a source of information and in terms of exchange or mutual help | 38 | 7.2 | 22 | 6.6 | 16 | 8.2 |
| Acquaintances | This group includes sharecropper relations and owners of neighboring fields, plus other persons people know, but with whom they do not have close social ties | 157 | 29.6 | 70 | 20.9 | 87 | 44.4 |
| Strangers | Persons of whom nothing or very little is known. With strangers seed is usually sold for cash, as no relation of trust or familiarity exists | 19 | 3.6 | 18 | 5.4 | 1 | 0.5 |
| Others | Includes commercial seed vendors, shopkeepers, government or NGO programs etc | 38 | 7.2 | 30 | 8.9 | 8 | 4.1 |
| Total | | 531 | 100% | 335 | 100% | 196 | 100% |

evidence of farmers' involvement in specialized institutions or groups for the mutual supply of seed.

## Relationships among Social Relations and Seed Transactions

Trust is important for these farmers. Trust in the seed may often derive from a relationship of trust between the recipient and the

**Table IV.** Type of transaction by type of seed provider.

| Seed provider's social relation to seed receiver | Purchase | Exchange | Other (Barter, borrowed, share-cropping etc.) | Gift/ inheritance | Total no. of transactions |
|---|---|---|---|---|---|
| Kin[a] | 90 (33 %) | 27 (10 %) | 25 (9 %) | 130 (48 %) | 272 (100%) |
| Friends/ Neighbors | 34 (61 %) | 12 (21 %) | 7 (13 %) | 3 (5 %) | 56 (100%) |
| People the seed receiver knows | 126 (75 %) | 10 (6 %) | 26 (16 %) | 5 (3 %) | 167 (100%) |
| Strangers | 30 (86 %) | 3 (9 %) | 3 (6 %) | 0 (—) | 36 (100%) |
| Total | 280 | 52 | 61 | 138 | 531 (100%) |

[a]Here both consanguineous and affiliate kinship as well as *compadrazgo*.

provider. The data suggest a systematic relationship between transaction type and supplier–recipient relationship (Table IV). Inheritance and gifts are the most common transactions among kin. While purchase is common among all social relationships, it is clearly the most common among strangers and acquaintances. It seems that as social distance between supplier and recipient increases, the frequency of purchases increases and the frequency of gifts and inheritance decreases. In barter and exchange among acquaintances and strangers, informants also said that quantities were calculated based on market prices, but rates in transactions with kin or a close relationship might be more favorable. Clearly no particular type of transaction is restricted to a single category of seed supplier. Closeness of social relationship improves chances of preferential treatment—a finding that is consistent with Sahlins' (1972) findings on primitive exchange—but it does not determine the type of transaction. Most transactions involve a feeling of trust between provider and recipient, either through consanguineous or affiliate kinship, compadrazgo, or friendship.

In interviews as well as focus group discussions, informants emphasized that seed must be of good quality and appropriate for target production conditions and preferences. Some seed seekers also take into consideration the way the seed has been cultivated and what they know about the general quality of a supplier's work. These complex requirements make it difficult for those seeking seed to obtain appropriate information. The problem is exacerbated by the lack of a generally accepted and clearly defined nomenclature for local maize varieties, beyond broad categories such as grain color, grain size, and growing cycle, as described in previous

research in the area (Smale *et al.*, 1999) and confirmed by both Zapotec- and Spanish-speaking farmers in the present study.

The easiest source of knowledge and trustworthy information, not surprisingly, is the people with whom the farmer already has close social relations. Farmers may already know the characteristics of varieties used by kin or close friends, and they can easily obtain more information. Conversations with family members, compadres, and neighbors, as well as observations of what other farmers were growing, were among the most frequently reported ways of obtaining information about seed used elsewhere in the community. Acquiring seed from trusted sources reduces the risk of obtaining inappropriate seed. Similarly, seed transactions can occur through many types of social relationships, so farmers are not dependent on a single supplier.

## Frequencies of Seed Transactions

It is difficult to assess the frequency of seed transactions. Farmers do not keep records of such transactions, and estimates must rely on the memories of those interviewed. In the tracer study, seed transactions involving current cultivars were carefully registered, noting the year they took place and allowing farmers to go as far back in time as desired. Recent transactions are more likely to be remembered than those from a long time ago. Notwithstanding these limitations, an estimate of the frequency of seed transactions was calculated. Table V shows the average number of transactions (acquisitions and distributions) per farmer for the three most recent years. The distribution between acquisitions and instances of providing seed is approximately the same, meaning that on average acquisitions occur 0.31 times every year and provisions 0.39 times a year (in both cases, approximately once every three years). In 2001, only 24.2% and 20.9% of farmers in the tracer study engaged in seed acquisitions and distributions, respectively. Seed transactions are apparently infrequent and do not involve a large number of farmers every year.

**Table V.** Frequencies of acquisitions and distributions per year per farmer across most recent years.

| Year | Average number of acquisitions/farmer/year | Average number of distributions/farmer/year |
|---|---|---|
| 2001 | 0.31 | 0.39 |
| 2000 | 0.25 | 0.30 |
| 1999 | 0.23 | 0.24 |

## DISCUSSION

Three parameters were identified to analyze the presence of collective action among farmers to access seed of a diverse set of maize landraces: (1) a group of farmers, (2) rules or practices, and (3) derived benefits. Within these three parameters, we did not find the expected collective action. First, if a farmer is a member of a group related to seed supply, one would have expected informants to be able to name particular people whom they rely upon to obtain seed regularly. This was not so. In many cases, farmers had trouble remembering the people with whom they had had transactions. While many seed transactions take place within prior existing social relations, most seed transactions do not involve any direct long-term obligations between suppliers and recipients, as would have been expected in a specialized organization or group. In other words, while individual farmers participate in groups, networks, or other organizations, none of these networks appear to revolve specifically around issues related to seed supply. In fact, to the contrary, when farmers experience problems related to seed, they draw on existing networks and social relations and use these to identify possible solutions.

Second, there were many types of seed transactions. The diversity of transactions, even under similar circumstances, as well as their bilateral nature, suggests that there is no fixed procedure or otherwise clearly defined framework for seed transactions, whereas a collective action scenario would involve a set of relatively well-defined practices. Seed needs, and hence transactions, do not seem to have a special status. They appear to be just another resource that farmers occasionally share with each other as part of the arrangements that make life possible in rural areas. The transactions are not governed by specific seed-related rules but are negotiated in the wider context of the social relation between the involved parties, so the particular details of the transaction may depend on many issues that may not be related specifically to seed. For example, the seed provider may give favorable treatment to those he considers very close relations, regardless of whether the issue is seed, a request for labor, or the loan of farm implements.

Third, no clear benefit seems to be associated with collective action. Part of the rationale for the original hypothesis was that seed loss was the principal driving force behind seed transactions and that collective action would reduce the problem of seed loss. The results showed that this is not the case—seed loss does not seem to be a major problem for these farmers—and a more important driver for acquiring seed is farmers' experimentation (Badstue *et al.*, 2003). Clearly experimentation is a form of

managing risk to acquire information, but it is related to curiosity and the search for new maize types that fit farmers' needs.

When farmers occasionally do obtain seed from other farmers, it is mainly from close social relations. There are good reasons for this. The cost of obtaining information on different varieties and availability of seed should be relatively low, given that it can be obtained as part of normal, frequent social interactions. The social ties give rise to trust and confidence that the seed has the desired characteristics and quality. At the same time, farmers often have first-hand knowledge of the varieties grown by relatives or friends. If the variety is grown in the same community under conditions similar to those in the farmer's own fields, uncertainty related to environmental adaptation is reduced. Finally, obtaining seed from a close social relation can often secure preferential treatment in the transaction. Close social relations are an important but not exclusive source of seed for farmers, however. Farmers do get seed from people outside their family circle, particularly through purchase. This variation in seed sources emphasizes the flexible and sometimes ad hoc nature of seed transactions among farmers.

Given the low frequency of seed loss, the current system, in which each farmer maintains and reproduces one or more landraces and only infrequently engages in a seed exchange, appears relatively resilient in terms of maintaining local crop genetic resource diversity. The system is nevertheless dependent on sufficient opportunities for obtaining seed from others when the need arises. At the moment this does not appear to be a major limitation, but future changes to the production system may alter this. For example, a sharp drop in the number of maize farmers, due to migration or shifting to other crops, could limit the efficacy of the current system, particularly if individual farmers assume that others are maintaining certain seed types but nobody actually does so.

Farmers generally save seed from one crop cycle to the next. The need to acquire new seed is therefore occasional rather than constant or recurrent. The incentives for collective action may be low because the fixed costs may exceed the benefits, given the relatively low frequency of acquiring seed off the farm. Rather than maintaining collective action for seed supply, farmers mobilize social resources on an ad hoc basis to solve a problem of seed shortage or to take advantage of an interesting opportunity for accessing new seed. Farmers' seed management in the study communities entails very low transaction costs, and the seed available through existing social relations is sufficiently reliable to prevent seed loss from being a major problem. Collective action would have to bring very considerable benefits to improve on this system.

Within the three parameters identified for examining collective action, we did not find that collective action was an important element of the seed system. We did find that the mobilization of social relations is a crucial part of seed transactions, and likewise we accept that the types of seed transactions are not random but the outcome of a negotiation which in turn may reflect certain rules within a social group.

The way collective action was operationalized here could be considered quite restrictive: it is confined to formal organizations with very strict group membership with the sole purpose of supporting seed flows. Its advantage, however, is that it provides very specific predictions to test. Even if these are rejected, it provides a rigorous opportunity to learn and reassess the hypothesis and associated assumptions. One could alternatively consider the existence of more informal institutions with rules that are not predetermined and that adjust to contingencies. These "fuzzy" rules are more difficult to identify, but they are also more flexible and better suited to deal with risk and uncertainty (for example, crop failure or storage problems). Add to this the desire to experiment. Under these circumstances, it would be reasonable to conclude that elements of collective action in other spheres play an indirect role in seed exchange. One has to be careful, however, not to interpret any outcome of a negotiation in a social group as evidence of collective action, since this could dilute the concept to a degree where almost any activity that is not undertaken in a social vacuum would become a form of collective action.

From a methodological perspective, the findings presented here provide suggestions for other studies regarding collective action. It is important to identify certain minimum criteria to use as indicators for the presence of collective action in a particular context. Furthermore, the specific issue or problem in relation to which collective action is being considered, and the affected population, should be clarified at an early point in the research.

In the initial discussion of the concept of collective action, we identified one approach based on the view of collectivities as social entities and another which starts from the perspective of the individual social actor. This study suggests that the point of departure of further studies of informal seed systems should be the ways and processes through which individual farmers deal with issues and concerns related to seed and the incentives they face to act individually or collectively. One can hypothesize that collective action in seed supply may be quite important in circumstances where seed loss is frequent and widespread and where farmers acting as a group may increase their individual chance of accessing seed when needed (e.g., areas that suffer frequent, but patchy droughts so that not everybody is affected at the same time), or where there is an interest or need for seed of

diverse crop types but information about this diversity may be very difficult to gather, as in environmentally heterogeneous areas with very low population density.

Several other issues also merit further study. For example, if collective action does not play a primary role in the organization of seed systems in these communities, what, then, does? How does informal seed supply actually work? What are the organizing principles that underlie local seed supply and help shape farmers' practices? Likewise, it would be interesting to understand the extent to which issues regarding the availability of and access to seed of a diverse set of maize varieties are perceived as a limiting factor and whether or not they influence farmers' transaction costs in relation to seed acquisition. We will address several of these issues in other papers.

An important implication of the findings presented here is the challenge that certain issues would present to the development of a commercial seed sector in this area of Mexico. The demand for seed from external sources, whether seed of improved or farmer varieties, is small. Furthermore, these farmers have different needs and preferences and therefore require different maize types. One size does not fit all (or at least "a few sizes do not fit all"). Interventions such as those practiced in the CIMMYT/INIFAP research project demonstrated farmers' interest in acquiring seed of other maize varieties. As part of that project, farmers purchased seed of many diverse maize varieties, but only in small quantities and for experimentation. As mentioned earlier, 2,726 kg of seed were sold to 371 farmers, but the average amount purchased was around 4.3 kg. To sell one ton of seed, almost 250 transactions are required. This may not be such a problem if the demand is only for one or two varieties, but if the demand is for many different varieties, the costs of selling seed may be too high for a commercial provider. Supplying seed under such circumstances may not be a self-sustaining enterprise, since commercial seed enterprises most likely have to supply larger quantities of fewer varieties to be financially viable.

Finally, interventions based on collective action to support farmers' efforts of maintaining maize diversity in this region, such as establishing community seed banks, may not be successful. Interventions directed more towards individual farmers, such as the CIMMYT/INIFAP research project, or which build on local institutions that serve other purposes, may be more effective. This remains an area for further research.

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