# Relief or Agricultural Development ?

## Emergency seed projects, farmer seed systems and the dissemination of modern varieties in Mali and Niger

Working Paper

International Crops Research Institute for the Semi-Arid Tropics

**Citations:**

Longley C, Kanfidéni B and Diakité L. 2004. Relief or agricultural development? Emergency seed projects, farmer seed systems and the dissemination of modern varieties in Mali and Niger. Working Paper. ICRISAT, PO Box 39063, Nairobi 00623, Kenya. 120 pp.

Longley C. 2004. Relief or agricultural development? Emergency seed projects and the dissemination of modern varieties. Part I of Longley C, Kanfidéni B and Diakité, L. 2004. Relief or agricultural development? Emergency seed projects, farmer seed systems and the dissemination of modern varieties in Mali and Niger. Working Paper. ICRISAT, PO Box 39063, Nairobi 00623, Kenya. 19 pp.

Diakité L, Diakité S and Longley C. 2004. Farmer seed systems and the dissemination of modern varieties in Mali. Part II of Longley C, Kanfidéni B, and Diakité L. 2004. Relief or agricultural development? Emergency seed projects, farmer seed systems and the dissemination of modern varieties in Mali and Niger. Working Paper. ICRISAT, PO Box 39063, Nairobi 00623, Kenya. 23 pp.

Kanfidéni B, Dary H and Longley C. 2004. Informal mechanisms for the dissemination of crop varieties in Niger. Part III of Longley C, Kanfidéni B and Diakité L. 2004. Relief or agricultural development? Emergency seed projects, farmer seed systems and the dissemination of modern varieties in Mali and Niger. Working Paper. ICRISAT, PO Box 39063, Nairobi 00623, Kenya. 18 pp.

# RELIEF OR AGRICULTURAL DEVELOPMENT?

## EMERGENCY SEED PROJECTS, FARMER SEED SYSTEMS AND THE DISSEMINATION OF MODERN VARIETIES IN MALI AND NIGER

Edited by Catherine Longley

**ICRISAT**

**International Crops Research Institute for the Semi-Arid Tropics**
Patancheru 502 324, Andhra Pradesh, India

**2004**

## Authors

**Kanfidéni Boureïma**, Agricultural Engineer, INRAN, Niamey, Niger.

**Lamissa Diakité**, Agro-economist, IER/ECOFIL, Bamako, Mali.

**Soriba Diakité**, Agronomist, Point Sud, Bamako, Mali**.**

**Halidou Dary,** Technical Engineer for Agricultural Statistics, Directorate of Agriculture, Ministry of Agricultural Development, Niamey, Niger.

**Catherine Longley**, Special Project Scientist, ICRISAT, Nairobi, Kenya and Research Fellow, Humanitarian Policy Group, Overseas Development Institute, London, UK.

# Preface

This publication reports on findings from a study undertaken in Mali and Niger to examine whether emergency seed relief interventions are an effective means of disseminating modern varieties (MVs) to farmers. Following the Sahelian drought of 1997/98, modern varieties of millet, sorghum and cowpea seed were distributed in 1998 and 1999 in five countries in response to the perceived shortage of seed among farmers affected by the drought. Assessments carried out after the seed distribution suggested that there was significant adoption of some of the varieties distributed by the project. The research reported here was undertaken four years subsequent to the initial seed distribution to determine whether these varieties were still being cultivated by those farmers who had received seed from the project, and the extent to which the varieties had been adopted by farmers who had not benefited from the initial seed distribution.

The study pays particular attention on the role of farmer seed systems in facilitating the spread of new varieties. Farmer seed systems – also known as the informal seed system – refer to the ways in which farmers acquire, disseminate, manage and conserve the seeds for the crops which they grow. Farmer seed systems are distinguished from the formal seed system which consists of government or private sector mechanisms for varietal development, seed production and distribution. The dissemination and adoption of improved millet, sorghum and cowpea varieties originally distributed by the Emergency Seed Project of 1998/99 provides an ideal opportunity to better understand how farmer seed systems are working for these crops, and what type of interventions are required to strengthen these systems in times of stress.

The report is organized into three parts. Part I reviews the literature relating to the distribution of modern varieties to farmers affected by disaster, and synthesizes the findings of the research conducted in Mali and Niger on the adoption and spread of modern varieties following the Emergency Seed Project of 1998/99. Parts II and III present the detailed research results from Mali and Niger respectively, describing the ways in which farmer seed systems have resulted in varying levels of adoption of modern varieties of millet, cowpea and sorghum. Recommendations for strengthening farmer seed systems in times of stress and promoting the dissemination of modern varieties are contained in each part of the report.

# Acknowledgments

We wish to express our deep and sincere gratitude to the various individuals, research institutions and development agencies which, in one way or another, have contributed to this study. Dr Richard Jones (ICRISAT) initiated the study and provided the support and encouragement to see it through to its completion. In Niger, the study was coordinated and led by Boureima Kanfidéni (INRAN) whose energy and diligence were highly appreciated. In Mali, we thank Lamissa Diakité (IER) and Soriba Diakité (Point Sud) for coordinating and implementing the study. The production of the report itself – in French and English – would not have been possible without the patience and perseverance of our editor, Kris Vanhoutte, and translator, Frédéric Janssens, to whom we owe particular thanks. Additional translation work in data analysis and report drafting was carried out in Niger by Ramatou Boureïma and in Mali by Kadiatou Cissé. The study was funded by USAID.

The authors of the Mali report (Part II) wish to thank the Scientific Directorate and the Research Program in Rural Economy (ECOFIL) of the Rural Economy Institute (IER) for its technical and material support. We are also grateful to the National Directorate for Support to Rural Areas (DNAMR), the Regional Directorate for Support to Rural Areas (DRAMR) and the Service for Extension, Land Management and Technology (SLACAER) of Koulikoro, Ségou and Mopti for sharing their experience in survey work and their assistance in the field as interpreters and/or guides. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) provided technical and logistical support; in particular, we would like to thank Dr Eva Weltzien-Rattunde and Ibrahima Sissoko for their help in coordinating the work. Additional technical support was provided by Sasakwa Global 2000; the National Seed Service (SSN); and the West and Central African Sorghum Research Network (WCASRN). Finally, we thank the members of the field team for their professional inputs, and the farmers of Koulikoro, Ségou and Mopti regions for their hospitality during field activities.

The authors of the Niger report (Part III) thank all colleagues and partners who played a role in the study. In particular, we would like to extend our gratitude to Dr Ouendéba Botorou (Regional Coordinator, WCAMRN), Dr Bruno Gérard (ICRISAT-Sadoré), Mr Ousmane (Cartographer, ICRISAT-Sadoré), Dr Issaka Mahamane (Director General INRAN), Dr Gandah Mahamadou (Scientific Director INRAN), Mr Paul Bukner (Directorate of Agriculture), Mr Neino Gondah (Computer Specialist at the Directorate for Agriculture), Mr Issoufou Abdou (Agro-Economist, INRAN). Very special thanks go to the field interviewers and support staff who were part of the study team. We are particularly grateful to the representatives of the PASP and World Vision Offices in Ouallam,Téra and Kornaka, and to the farmers of Ouallam, Téra and Kornaka regions for their hospitality during field activities.

# Acronyms

| | |
|---|---|
| APCAM | Assemblée Permanente des Chambres d'Agriculture du Mali<br>[Permanent Assembly of Agricultural Chambers of Mali] |
| CCA ONG | Comité de coordination des actions des organisations non gouvernementales<br>[Coordination Committee of Non Governmental Organizations' Actions] |
| CIAT | International Centre for Tropical Agriculture |
| CMDT | Compagnie Malienne de développement textile<br>[Mali Cotton Company] |
| CRS | Catholic Relief Services |
| DNAMR | Direction Nationale de l'Appui au monde Rural<br>[National Directorate for Support to Rural Areas] |
| DRAMR | Direction Régionale de l'Appui au monde Rural<br>[Regional Directorate for Support to Rural Areas] |
| ECOFIL | Programme de Recherche en Economie des Filières<br>[Research Program in Rural Economy] |
| ESP | Emergency Seed Project |
| GNP | Gross National Product |
| GRU | Genetic Resources Unit |
| ICRISAT | International Crops Research Institute for the Semi-Arid Tropics |
| IER | Institut d'Economie Rurale<br>[Rural Economy Institute] |
| INRAN | Institut national de recherche agronomique du Niger<br>[National Institute for Agricultural Research of Niger] |
| INTSORMIL | International Sorghum and Millet Collaborative Research Support Programme |
| NGO | Non Governmental Organization |
| MV | Modern variety |
| ODI | Overseas Development Institute |
| ODR | Office de développement rural<br>[Rural Development Offices] |
| OHVN | Office de la Haute Vallée du Niger<br>[Office of the Upper Niger River] |
| ONVPE | Organisation nigérienne des volontaires pour la préservation de l'environnement<br>[Organization of volunteers of Niger for protecting the environment] |
| PASP | Projet Agro-Sylvo-Pastoral<br>[Agro-Sylvo-Pastoral Project] |
| RENACO | Réseau de recherche sur le niébé pour l'Afrique centrale et occidentale<br>[West and Central African Cowpea Research Network] |
| SG 2000 | Sasakawa Global 2000 |
| SLACAER | Service Locale de l'Appui Conseil, de l'Aménagement et de l'Equipement Rural<br>[Local Service Support for Counseling, Land Management and Rural Equipment] |

| | |
|---|---|
| SPSS | Statistical Package for Social Sciences |
| SSN | Service Semencier National<br>[National Seed Service] |
| USAID | United States Agency for International Development |
| WAMU | West African Monetary Union |
| WCAMRN | West and Central African Millet Research Network |
| WCASRN | West and Central African Sorghum Reseach Network |

# Executive Summary

This publication examines the question of whether emergency seed relief interventions are an effective means of disseminating modern varieties (MVs) to farmers, and explores the role of farmer seed systems in promoting the spread and adoption of MVs following the Emergency Seed Project of 1998/99 in Mali and Niger. Conventional seed relief interventions are ostensibly aimed to provide seed to farmers who – it is assumed – have little or no seed locally available. In such circumstances, it has been argued that local varieties are more appropriate than modern varieties for distribution. Recent research, however, has questioned the assumptions on which emergency seed interventions are based, revealing that seed is often available locally, particularly in chronic or recurrent crises such as those caused by drought or prolonged conflict or political instability. These findings force a re-examination of conventional beliefs surrounding the use of MVs in emergency seed interventions.

In Part I of this publication, it is argued that carefully-chosen modern varieties may usefully increase varietal diversity and thus strengthen farmer seed systems. However, it is important that emergency seed projects are not seen as an opportunity to promote MVs. Rather, the use of MVs in emergencies is best regarded as a means of enhancing diversity and providing a greater choice of varieties available to farmers. It is not always appropriate to distribute MVs in emergencies, and prior needs assessments are essential. The apparent inability of the formal seed sector to disseminate MVs effectively cannot simply be 'solved' through emergency seed projects. Recommendations for the use of MVs as part of emergency interventions are given.

Parts II and III then go on to present the findings of studies undertaken in Mali and Niger respectively to examine the spread and adoption of sorghum, millet and cowpea MVs that were distributed as part of an emergency seed project following the Sahelian drought of 1997. The results suggest that emergency seed projects are an effective means of disseminating MVs to farmers, and that such varieties have subsequently spread to other farmers and other villages through farmer seed systems. Detailed findings on the diversity of crops and varieties grown in the study areas, the level of adoption of MVs, farmers' sources for new varieties, and channels of seed acquisition and dissemination are presented. Each study concludes with recommendations for strengthening farmer seed systems in the long term.

# Contents


Preface iii
Acknowledgements iv
Acronyms v
Executive Summary vii

PART I:
Relief or agricultural development? Emergency seed projects and the dissemination of modern varieties
1. Introduction 1
2. Seed systems and variety types 2
3. Farmer seed systems and disaster 3
4. Emergency seed provisioning and seed system support 4
5. Emergency seed projects and the distribution of modern varieties 5
6. The Sahel Emergency Seed Project (ESP) of 1998/99 11
7. MV spread and adoption in Mali and Niger 12
8. Conclusions 16
9. Recommendations for the use of MVs for seed system support in emergencies 18

PART II:
Farmer seed systems and the dissemination of modern varieties in Mali
1. Introduction 20
2. The study area and project context 22
3. Socio-economic characterization of the survey population 26
4. Crop diversity and the use of modern varieties 27
5. Seed and varietal sources and dissemination channels 34
6. Conclusions and recommendations 41

PART III:
Informal mechanisms for the dissemination of crop varieties in Niger
1. Introduction 44
2. The study area and methodology 46
3. Socio-economic information of the survey population 47
4. Crop diversity and the use of modern varieties 49
5. Varietal sources and dissemination channels 56
6. Farmers' seed sources for the 2001/02 cropping season 58
7. Conclusions 61
8. Recommendations 62

ANNEXES
Annex 1. Questionnaire for sample farmers (Mali) 63
Annex 2. Questionnaire for focus group discussions (Mali) 66
Annex 3. Use of local and modern varieties according to wealth of farmer (Mali) 70
Annex 4. On-farm and off-farm seed sourcing (Mali) 73
Annex 5. Farmers' seed acquisition methods for original varieties (Mali) 76
Annex 6. Farmers' original variety sources (Mali) 78
Annex 7. Where farmers originally acquired varieties (Mali) 81
Annex 8. Provision of MV seed by farmers to other farmers (Mali) 85

Annex 9. Age composition of Village Seed Management Committees (Niger) 87
Annex 10. Varieties cultivated by sample farmers in 2001/02 (Niger) 88
Annex 11. Original sources of cowpea varieties (Niger) 96
Annex 12. Original sources of sorghum varieties (Niger) 99
Annex 13. Random sampling methodology (Niger) 102
References 106

## List of tables

PART I

Table 1.1 Number of beneficiaries and quantities of seed distributed by ESP in Mali and Niger 11

PART II

Table 2.1 Villages covered by the survey 21
Table 2.2 The main crops cultivated in the regions of the survey 23
Table 2.3 Distribution of MV millet seeds in the Ségou region 24
Table 2.4 Distribution of MV millet and cowpea seeds in the Mopti region 24
Table 2.5 Distribution of MV sorghum seeds in the Koulikoro region 25
Table 2.6 Distribution of emergency seeds in 1998 in the three regions covered by the survey 25
Table 2.7 Age groups of sample farmers 26
Table 2.8 Gender of sample farmers 26
Table 2.9 Average cultivated area by sample farmers 27
Table 2.10 Wealth distribution of sample farmers 27
Table 2.11 Names of the main millet varieties cultivated in the regions of the survey 28
Table 2.12 Names of the main sorghum varieties cultivated in the regions of the survey 29
Table 2.13 Names of the main cowpea varieties cultivated in the regions of the survey 29
Table 2.14 Number of local and modern varieties of the crops cultivated by sample farmers 30
Table 2.15 Use of modern varieties by wealth group 31
Table 2.16 Use of modern varieties by age group 32
Table 2.17 Origin of millet, sorghum and cowpea varieties in the study villages 32
Table 2.18 Comparative analysis of the introduction of varieties by crop according to systems 33
Table 2.19 Farmers' seed acquisition methods for original local and modern varieties 35
Table 2.20 Farmers' original seed sources for local and modern varieties 36
Table 2.21 Where farmers originally acquired seed of local and modern varieties 37
Table 2.22 Dissemination of MV seed by farmers to other farmers 37
Table 2.23 The relationship of farmers receiving seed from other farmers 38
Table 2.24 Provision of MV seed by farmers through gift and barter 39
Table 2.25 Provision of MV seed by farmers according to the location of the recipient 39
Table 2.26 Farmers' original seed sources for local and modern sorghum varieties in Koulikoro 39
Table 2.27 Acquisition methods for original local and modern sorghum varieties in Koulikoro 39
Table 2.28 Where farmers in Koulikoro originally acquired local and modern sorghum varieties 40

Table 2.29 Seed sources for sorghum according to wealth group of farmers in Koulikoro 40
Table 2.30 Wealth and age group of farmers in Koulikoro providing MV seed to other farmers 41

PART III

Table 3.1 Number of beneficiary villages per district in 1998 and 1999 45
Table 3.2 Villages covered by the survey 46
Table 3.3 Age groups of household heads in the sample villages (census) 47
Table 3.4 Age groups of sample farmers 48
Table 3.5 Average number of fields cultivated by sample farmers 48
Table 3.6 Average cultivated area by sample farmers 48
Table 3.7 Wealth distribution of sample farmers 49
Table 3.8 Main crops cultivated in sample villages by region in order of importance 49
Table 3.9 Number of varieties cultivated by sample villages 50
Table 3.10 Origin of millet, sorghum and cowpea varieties in the study villages 51
Table 3.11 Local names for modern varieties, as reported by sample farmers 52
Table 3.12 Percentage of sample farmers cultivating specific modern varieties by region 52
Table 3.13 Cultivation of MVs according to wealth group of farmer 53
Table 3.14 Cultivation of MVs according to age group of farmer 53
Table 3.15 Length of time that sample farmers have cultivated local and modern millet varieties 54
Table 3.16 Length of time that sample farmers have cultivated local and modern cowpea varieties 55
Table 3.17 Length of time that sample farmers have cultivated local and modern sorghum varieties 55
Table 3.18 Where farmers originally acquired local and modern millet varieties 56
Table 3.19 Farmers' seed acquisition methods for original millet varieties (local and modern) 57
Table 3.20 Farmers' original seed sources for millet 57
Table 3.21 Age group of farmers providing MV millet seed to other farmers 58
Table 3.22 Wealth group of farmers providing MV millet seed to other farmers 59
Table 3.23 Age of providers and location of recipients of MV millet seed 59
Table 3.24 On-farm and off-farm seed sources for millet, sorghum and cowpea (2001/02). 60
Table 3.25 On-farm and off-farm millet seed sources according to wealth group of the farmer (2001/02) 60

ANNEXES

Table A3.1 Millet: Use of local and modern varieties according to wealth of farmers 70
Table A3.2 Sorghum: Use of local and modern varieties according to wealth of farmer 71
Table A3.3 Cowpea: Use of local and modern varieties according to wealth of farmer 72
Table A4.1 On-farm and off-farm seed sources for millet 73
Table A4.2 On-farm and off-farm seed sources for sorghum 74
Table A4.3 On-farm and off-farm seed sources for cowpea 75
Table A5.1 Seed acquisition methods for original millet varieties (local and modern) 76
Table A5.2 Seed acquisition methods for original sorghum varieties (local and modern) 77
Table A5.3 Seed acquisition methods for original cowpea varieties (local and modern) 78
Table A6.1 Original variety sources for millet 79

Table A6.2 Original variety sources for sorghum 80
Table A6.3 Original variety sources for cowpea 81
Table A7.1 Where farmers originally acquired millet varieties 82
Table A7.2 Where farmers originally acquired sorghum varieties 83
Table A7.3 Where farmers originally acquired cowpea varieties 84
Table A8.1 Farmers' provision of MV seed according to the gender of the recipient 85
Table A8.2 Farmers' provision of MV seed according to age group of provider 85
Table A8.3 Farmers' provision of MV seed by wealth group of provider 86
Table A9.1 Age composition of Village Seed Management Committees 87
Table A10.1 Millet varieties cultivated by sample farmers in Maradi region 88
Table A10.2 Millet varieties cultivated by sample farmers in Tillabéry region 90
Table A10.3 Cowpea varieties cultivated by sample farmers in Maradi region 91
Table A10.4 Cowpea varieties cultivated by sample farmers in Tillabéry region 93
Table A10.5 Sorghum varieties cultivated by sample farmers in Maradi region 94
Table A10.6 Sorghum varieties cultivated by sample farmers in Tillabéry region 96
Table A11.1 Where farmers originally acquired cowpea varieties (Niger) 97
Table A11.2 Original sources of cowpea varieties (Niger) 98
Table A11.3 Acquisition methods for original cowpea varieties 99
Table A12.1 Where farmers originally acquired sorghum varieties 100
Table A12.2 Original sources of sorghum varieties 101
Table A12.3 Acquisition methods of original sorghum varieties 102

# PART I:

# Relief or agricultural development? Emergency seed projects and the dissemination of modern varieties

Catherine Longley

## 1. Introduction

Emergency seed projects tend to be implemented in response to natural disasters such as drought, flooding, cyclones, hurricanes, and civil conflict, particularly those involving population displacement or return. The assumption on which these projects are based presumes that farmers lose or eat their seed so that seed is no longer locally available or accessible. Recent research, however, has challenged this assumption (Longley and Sperling 2002). Studies undertaken in southern Sudan (Jones et al. 2002), Somalia (Longley et al. 2001), southern Africa (Friis-Hansen and Rohrbach 1993), Rwanda (Sperling 1996), and Sierra Leone (Longley 1997) have shown that not all farmers lose their seed, and – even if they do – seed is often locally available through grain markets or from farmers in neighboring areas. Implicit in such findings is the need to reconsider the aims and modalities of conventional emergency seed projects.

If it is assumed that farmers affected by disaster have no seed, then the aim of an emergency seed project is ostensibly to provide farmers with something to plant in the forthcoming season. However, as we shall see in section 5, there are, in practice, various other underlying objectives – often unarticulated – for which seed is given in emergencies. One of these underlying aims is the promotion of modern varieties. Some of the existing guidelines on emergency seed provisioning recommend the use of local varieties which tend to be more appropriate than modern or improved varieties (Chemonics 1996); others present a more nuanced view, advising that the choice of varieties will depend on the farming community's pre-disaster situation (ODI 1996). If the objective of an emergency seed intervention is 'to return the local farming system to a situation as close to its pre-disaster status as possible' (ODI 1996: 16), then modern varieties should only be given if farmers depended on modern varieties prior to the emergency. This paper challenges this position, suggesting that – in some recurrent or long-lasting crisis situations, and provided that adequate varietal trials have been undertaken – carefully chosen modern varieties may usefully increase varietal diversity. Rather than returning to the pre-disaster situation, such an approach aims to enhance the capacity of farmers' seed and agricultural systems. But an intervention that sets out to promote varietal diversity and strengthen local agricultural systems must be implemented very differently to an intervention that aims to provide emergency seed aid. As such, it might best be considered as part of a longer-term rehabilitation strategy as opposed to a short-term relief activity; in other words, seed system support rather than emergency seed provisioning[1] (ODI 1996).

Given the recent and ongoing debates surrounding conventional seed relief, many agencies are beginning to look for alternative approaches to supporting farmers in crisis and post-crisis situations. Based on a study of emergency seed interventions in Mali and Niger, this paper examines the issues

1 This distinction is drawn from ODI's guidelines for seed provisioning in emergencies (1996). The ODI guidelines use the term 'seed capacity building' rather than seed system support.

related to the distribution of modern varieties in crisis and post-crisis situations. This study is thought to be unique in that it examines the impact of the emergency seed intervention four years subsequent to the project itself, thus allowing for an examination of the longer-term impact on farmer seed systems and the varieties cultivated. Sections 2 and 3 provide background information regarding seed systems and variety types, and how farmer seed systems are affected by disaster. Section 4 presents an overview of 'emergency seed provisioning' and 'seed system support', suggesting that agencies need to give considerably more attention to the latter. In section 5, the arguments for and against the distribution of modern varieties in disaster and post-disaster contexts are outlined, and documented experiences from other African countries reviewed. The Sahel Emergency Seed Project of 1998/99 and the findings from the follow-up studies undertaken in 2002/3 are presented in sections 6 and 7. Conclusions regarding the use of modern varieties to promote diversity and strengthen farmer seed systems are drawn in section 8, and recommendations to agencies implementing such projects are presented in section 9.

## 2. Seed systems and variety types

Farmer seed systems refer to the processes that farmers use to produce, obtain, maintain, develop and distribute seed resources. Whilst much of the seed sown by farmers is generally that which has been saved from the previous harvest, seeds are also commonly acquired as loans, gifts or exchanges made with other farmers or through purchases at local markets. Although many of the varieties cultivated by farmers are those which have been handed down from one generation to the next, new varieties are incorporated into farmer seed systems through interactions with traders or farmers in other areas, or through the selection of off-types that might appear within a farmer's field. New varieties can also be obtained from interactions with the formal seed sector.

It is important to note that seed systems vary for different crops. This variation depends on: (a) the biological features of the crop, eg, the length of its growing season, rate of reproduction and ratio of seed to consumption; (b) agro-ecological characteristics of the crop, eg, varietal diversity, vulnerability to pests, disease and climatic variations; and (c) the local socio-economic conditions under which a particular crop is cultivated, eg, whether it is used as fodder, for food, and/or for market.

Seed of a crop with a high reproduction rate, little susceptibility to pests and disease, and which is used as food (eg, millet and other grain crops) is more likely to be saved by a farmer from one season to the next than a crop with a low reproduction rate with susceptibility to pests and disease and which is used as a cash crop (eg, cowpea and other legumes). This is because it is comparatively easy for farmers to save seed for a crop where the overall output is high and where the quantity of seed required for planting is relatively small, particularly if the crop is unlikely to be damaged by pests or disease, whether in the field or in storage. Farmers are often reluctant to spend money to buy seed of crops which are grown for subsistence purposes, whereas part of the profit made from cash crops is more readily used to purchase the seed of that crop.

The relative wealth of farmers forms a significant determinant in their modes of seed acquisition; under normal conditions better-off farmers are usually able to save seed from one season to the next, whereas poorer farmers tend to have to borrow or purchase seed at planting time, often incurring debts that must be paid off at harvest time. It is often those least able to access seed in normal times who suffer the most in terms of reduced access to seed in times of crisis.

Farmer seed systems are distinguished from the formal seed sector which consists of government, parastatal or private sector systems for varietal development, seed multiplication, processing and distribution. The private seed sector tends to focus on hybrid varieties (particularly hybrid maize) or

high-value crops (eg, French beans) since these seed types are most likely to be purchased by farmers. Seed of low-value subsistence crops, on the other hand, tends to fall under the responsibility of the public sector. Improved or modern varieties that are developed through public sector breeding and selection programs often have limited impact due to the failure of formal seed systems to disseminate them effectively. In situations of economic and/or political crisis, state and parastatal seed supply mechanisms may cease to function, and private sector seed companies may shut down their operations either temporarily or permanently.

The limited impact of public sector seed systems – whether due to lack of resources, general inefficiency or the result of civil conflict – has prompted many NGOs to become involved in local-level seed projects in recent years. These donor-funded local-level seed activities cannot readily be classified as part of either the formal seed sector or farmer seed systems, rendering the conventional formal/farmer division particularly unhelpful. Emergency seed projects are best classified as donor-funded seed activities, and tend to be implemented by NGOs, sometimes in collaboration with government agencies, parastatals, research institutes, and the private sector. Such projects have the potential to bridge the gap between formal and farmer seed systems, but often fail to understand the latter and instead merely replicate features of the formal seed system at a local level. Moreover, their short-term planning frame means that the varieties provided by such projects tend not to be new modern varieties but whatever is commercially available for large-scale procurement.

Although the terms 'local' and 'modern' are used throughout this report to describe different categories of crop varieties, farmers themselves rarely make such a distinction, and there is some element of blurring between the two. Local (or traditional) varieties refer to those varieties that are the product of farmer selections and exchanges. They tend to be well adapted to local conditions and display characteristics that are preferred by farmers. Modern (or improved) varieties are the result of formal sector plant breeding or selection processes and tend to be higher yielding than local varieties when planted in optimal conditions. Some modern varieties may be bred for certain characteristics such as disease or drought resistance, or early maturity. Some so-called modern varieties are in fact rather old, having been developed several decades ago. Where farmers have adopted these and selected them for their own local conditions, modern varieties may become local varieties, though at what point this transition takes place is often impossible to define (Tripp 1996, 2001). In other cases, a modern variety may have been derived from a local variety and therefore displays many of the same characteristics of the local variety from which it was selected.

## 3. Farmer seed systems and disaster

Unlike formal sector seed systems, farmer seed systems are inherently flexible and dynamic: this flexibility often allows them to continue to function in the face of the considerable changes brought about by disastrous events. One of the major findings of ICRISAT's assessment of the emergency response to the 1991/92 drought in southern Africa was that, contrary to assumptions made by the agencies involved in recovery efforts, many small-scale farmers were able to either retain their seed stocks or obtain seed from sources within their communities, despite the extreme severity of the drought (Friis-Hansen and Rohrbach 1993). Similarly, CIAT's assessment of the impact of war on agricultural production in Rwanda revealed, again contrary to expectations, that only about one-third of farmers had lost any of their local crop varieties and that these farmers could access lost materials through the continued functioning of local seed channels (Sperling 1996). The apparent resilience of farmer seed systems under difficult conditions suggests that there is a need to understand more fully how such systems operate, both under normal conditions and in times of crisis, and how they can be

strengthened to reduce the negative impacts of potential disasters. Parts II and III of this report describe farmer seed systems in Mali and Niger and how they can be strengthened.

Assessing the impact of a disaster on farmer seed systems requires an understanding of the crisis itself (type, timing, duration, scale and intensity), the socio-economic impacts on local populations (migration, displacement and changes in household composition), the functioning of local markets, the mobility of both farmers and traders, and the assets available to farmers, including their ability to draw on existing social networks (Longley et al. 2002). The responses of farmers to a crisis situation often involve changes in their agricultural practices and cropping patterns. Saved seed and other inputs, particularly labor, may become a constraint, and farmers may compensate for this by acquiring seed from other local sources or by altering their crops and crop varieties to types that require less labor. Different crops are affected by disaster in different ways (Sperling 1997) and farmers may alter their cropping patterns by substitution of crops and crop types. Early-maturing types often become especially important.

Whether or not disaster leads to the genetic erosion of crop diversity is a point of debate that has yet to be fully resolved. Although individual farmers or farming communities may lose their seed of specific varieties, these varieties can usually be recovered from neighboring communities or local markets once the immediate crisis is over (Sperling 1996; Archibald and Richards 2002). The seed of early-maturing varieties tends to be lost most easily[2], yet it is also these same early-maturing varieties that are usually in high demand in times of crisis because they ripen and can be eaten earlier than other varieties (Longley and Richards 1999). A farming system that includes a wide range of crops and crop varieties tends to be more resilient than one with limited diversity. For this reason, farmers in disaster-prone areas or areas of ongoing political instability will often maintain a wide range of crops and varieties to increase the resilience of their cropping system. Population displacement often allows farmers to acquire seed of new varieties in their places of refuge, and these varieties may be brought home when displaced farmers eventually return, adding to the diversity of the cropping system. It is therefore questionable as to whether disasters necessarily result in the permanent loss of varieties.

## 4. Emergency seed provisioning and seed system support

The conventional response to an emergency situation involves the blanket distribution of large quantities of seed of the main staple food crops to large numbers of farmers. Working under the pressures inherent in a crisis situation, relief agencies may not be able to procure the preferred varieties, and logistical constraints may be such that seed is delivered late in relation to the optimal planting time. The seed itself is often conditioned grain that has been bought from grain markets, and is sometimes of low physiological quality or contains a mixture of different varieties. In long-running crises such as southern Sudan or Somalia, there is the fear that repeated emergency seed distributions could unwittingly increase the vulnerability of farmers by promoting dependency on free handouts, disrupting local markets, and limiting diversity. Seed vouchers and fairs provide an alternative seed intervention approach that has been developed by Catholic Relief Services and is increasingly being implemented in emergency contexts (Remington et al. 2002).

Existing guidelines (ODI 1996) advocate a move towards longer-term capacity-building activities once the need for short-term emergency seed provisioning is over. In this report, such capacity-building activities are referred to as ‘seed system support’, as described below. However, given the different types of emergencies, and the dangers of defining an emergency such as war as being ‘over’, in

2 Early maturing varieties conveniently ripen before other varieties at a time when food is scarce. Neighbors and other relatives are keen to assist with the harvest, in the expectation that they will receive some of the output, and members of the household themselves will be keen to eat the grain. If a farmer does not take care to reserve part of the harvest output as seed it is possible that all of the grain will be consumed

practice, longer-term seed system support activities may be implemented alongside emergency seed provisioning projects, depending on local conditions. The distinction between emergency seed provisioning and seed system support may therefore become blurred unless the specific aims of the intervention are clearly articulated and the approach is designed in relation to the aims.

Seed system support aims to enhance seed systems by building on their strengths, and addressing their weaknesses. Since farmer seed systems form an integral part of broader cropping systems, seed system interventions need not necessarily focus on seed per se, but on the general improvement of agricultural production and farming systems. Seed system support not only addresses seed quality and availability (particularly *varietal* availability) within functioning production systems, but also aims to allow farmers to *access* seed in a more sustainable way. Understanding the strengths and weaknesses of seed systems is essential for the design of appropriate seed system support interventions. The introduction of appropriate new varieties to promote diversity forms one way of supporting agricultural systems, and this was the primary objective of the Sahel Emergency Seed Project of 1998/99. It is this aspect which forms the focus of the remainder of this paper.

## 5. Emergency seed projects and the distribution of modern varieties

Two opposing views exist among agencies and individuals involved in the implementation of emergency seed relief projects. Some agronomists or seed specialists that have been trained in the formal sector believe that the spread of MVs will lead to increased productivity and food security in traditional farming systems. Emergency seed projects are therefore regarded by these individuals as an efficient way of promoting MVs and increasing productivity. On the other hand, others believe that it is best to provide 'local seed' to farmers affected by disaster since 'local seed' is better adapted to local conditions (Longley et al. 2001; Jones et al. 2002). In some cases, 'local seed' is synonymous with local varieties, yet there are examples of projects in which seed of modern varieties is procured locally (ie, within the country) and this is considered as 'local' (see subsection 5.1). There is clearly considerable confusion as to what constitutes 'local seed', and this also extends to the belief among some that it is preferable not to distribute seed of modern varieties in an emergency situation. Arguments both for and against the distribution of MVs in disaster situations are presented in the paragraphs that follow. Specific examples of projects that involved MV distribution are then briefly reviewed.

Some guidelines advise against the provision of modern varieties in emergency projects because the distribution of a small number of modern varieties has the potential to reduce the diversity of crops and varieties, thus increasing vulnerability to future disasters (Chemonics 1996). But the issue here concerns diversity, not varietal types. Limited varietal diversity exists where there are a limited number of varieties within a cropping system; whether these are local or modern varieties is of no importance. In a cropping system that is based entirely on local varieties, for example, the addition of modern varieties would broaden the range of varieties. The fear that MVs have the potential to reduce diversity is based on the assumption that either local varieties will have been lost due to the disaster, or that they will be replaced by MVs. Whilst there is no evidence to suggest that local varieties are lost due to disaster itself, it is possible that local varieties can be replaced by MVs over time, particularly where campaigns to promote MVs are aggressive[3], or where a commercial market exists for the grain of particular MVs[4].

3 In Zimbabwe, for example, hybrid maize was heavily promoted throughout the 1980s through the distribution of free seed packs. A decade later, in the throes of the century's worst drought, farmers lamented the loss of their traditional drought-tolerant varieties and ascribed this loss to the earlier promotion of hybrid maize (van Oosterhout 1996).

4 On the Philippine island of Mindoro, for example, 85% of rice area is planted to just five improved varieties and many local varieties have reportedly been lost. Farmers prefer to grow MVs because these are most popular with private traders and the Philippines National Food Authority who purchase most of the rice produced on Mindoro (Cromwell et al. 1993)

If any varieties are lost due to disaster, it is most likely that they will be early-maturing MVs since the seed of early-maturing varieties is notoriously difficult to maintain (see footnote 2). Where MVs exist in the local cropping system, it may be that early-maturing MVs are lost, particularly since farmers may not attach the same value to MVs that have been introduced from outside as to their own local varieties that have been passed down from generation to generation. In situations where such MVs have been lost, it makes sense to replace them. An example of such a project occurred in Somaliland where Save the Children (UK) implemented an emergency seed distribution in mid-1994 after the failure of the rains, at a time when farmers had previously been displaced due to conflict. Farmers requested the seed of an early-maturing MV sorghum that had been lost as a result of earlier population displacement. Although farmers were not aware of the formal name of the variety, researchers who had worked in the Ministry of Agriculture were able to provide a list of varieties that had previously been tested and found to perform well. Seed was procured from Kenya and distributed to farmers, who were very satisfied with the project (Longley and Jones 2000).

One of the arguments in favor of promoting MVs through emergency projects relates to the belief that MVs are superior to local varieties and that long-term food security can be enhanced if farmers are persuaded to abandon their local varieties in favor of higher-yielding MVs. This belief is dangerously mistaken. Although MVs may be higher yielding in optimal conditions (ie, good soil fertility, adequate moisture, and optimal management in terms of planting time, weeding, pest control, etc.), such conditions do not necessarily exist on farmers' fields. It is not uncommon for local varieties to outperform MVs in the sub-optimal conditions that tend to predominate in low resource, semi-subsistence farming systems. Moreover, the aim of any project involving MVs should not be to replace local varieties but to widen the choice of varieties available to farmers. If farmers choose to adopt a particular MV, this should not be at the expense of abandoning their own local varieties. Rather, MVs should be incorporated into local planting repertoires alongside local varieties. Not all farmers will necessarily want to adopt the MV in question, and nor should they be coerced into doing so, but it is reasonable to let farmers test MVs and decide for themselves as to whether or not they should adopt it.

Against the distribution of MVs in emergency interventions, it has been argued that to introduce a new, unfamiliar variety at a time when farmers are already struggling to cope with considerable adversity merely adds to their troubles. Indeed, at the height of an emergency, in the rare situations when farmers may have lost the seed of their own local varieties, efforts should be made to supply seed of varieties with which farmers are familiar. However, many so-called emergency seed distributions are implemented in situations when farmers have not, in fact, lost their own seed (Longley and Sperling 2002), and in such situations, subsequent studies have found that one of the main benefits of such projects was the introduction of a new variety[5]. Moreover, due to population displacement and migration, it is not uncommon for farmers themselves to acquire new varieties from other farmers during emergency situations[6].

Given the widespread failure of formal seed systems to disseminate seed of MVs to farmers effectively, emergency projects might be regarded as an opportunity to get seed of MVs out to farmers. Given that the level of donor funding typically spent on emergency seed projects is considerably more than that available for long-term MV dissemination efforts, there is the potential for MVs to be disseminated far more efficiently in an emergency than in 'normal' situations. However, such funding

5 This is mentioned for UN okra in S. Sudan (Jones et al. 2002); cowpea in S. Somalia (Longley et al. 2000); and various varieties in Kenya (see subsection 5.2).

6 For example, farmers in Bramaia District, north-west Sierra Leone who had sought refuge in neighboring Guinea during periods of conflict in the late 1990's brought the seed of a local Guinean rice variety known as *saidu gbeli* back with them when they returned to their homes. This variety – previously unknown in the District – proved to be very popular among Bramaia farmers in the immediate post-conflict period (Longley et al. 2004 forthcoming).

is typically short term and often does not allow for the long-term planning and varietal testing that usually forms an important element of MV dissemination. Yet in many cases, emergency seed projects are repeated in a particular area over several years, allowing for some consideration of the longer-term aspects. What is important here is that the objectives of an emergency intervention are clearly articulated, and the project is planned accordingly. As we shall see below, there tends to be considerable confusion over what such projects are trying to achieve, leading to inappropriate planning and poor implementation.

## 5.1 Serena sorghum in S. Sudan[7]

For well over a decade, a large number of emergency seed interventions in southern Sudan have been distributing seed of the modern sorghum variety known as Serena. Much of this seed was procured from commercial seed companies and large-scale grain traders in Uganda and Kenya and then transported to Sudan by air or road, making such operations very expensive. To reduce the costs of seed procurement and also to promote agricultural production and enterprise development in the more stable and productive areas of Western Equatoria, three projects were established with farmer groups in Tambura, Yambio and Maridi to produce seed that was then transported north-east to the drier, less productive and politically unstable province of Bahr-el-Ghazal.

A number of problems have been documented in relation to this project, largely because it was based on a set of misperceptions about farmer and formal seed systems and a failure to understand local cropping patterns (Jones et al. 2002). The main problem, however, was the choice of Serena sorghum as the variety to be promoted. Simply because the seed was produced within southern Sudan does not imply that the variety was 'local' and hence adapted to conditions in Bahr-el-Ghazal. Serena is an open-pollinated, early-maturing variety that had been bred in Uganda in the 1960's for commercial farming purposes. Since it ripened before other sorghum varieties and therefore attracted birds, it was developed with a high tannin content to reduce the incidence of bird damage. But this also gave the variety a bitter taste which was not well liked by farmers in Bahr-el-Ghazal.

Not only was Serena not well liked by the farmers, it was also not adapted to the agro-ecological conditions in Bahr-el-Ghazal. Most local sorghum varieties in this area are highly photoperiod sensitive so that growth and development are in synchrony with the growing season. Serena is a non-photoperiod sensitive variety, and when it is planted at the same time as photoperiod sensitive varieties its head rots before it is ripe due to rainfall patterns and early maturity. The fact that farmers in southern Sudan continue to grow their own local varieties and have not adopted Serena, despite its repeated distribution over a period of at least 20 years, illustrates that it is not appropriate to local cropping systems. Indeed, agronomic trials of Serena undertaken in the 1970s documented the problem of rotting heads and recommended late planting so that the heads develop in dry conditions (Slaymaker 2001). The relief agencies promoting Serena were apparently not aware of the problem of rotting heads or the recommended planting time.

## 5.2 Emergency seed aid in Kenya[8]

Seed aid has been delivered on a fairly large scale in Kenya since 1992, primarily in response to drought. A study of seed aid delivered in four sites during the long rains of 1997 reveals at least four different goals in the provision of seed aid: to provide farmers with something to plant; to allow

7 This section is drawn from Jones et al. (2002).

8 This section is based on research undertaken by Louise Sperling (2001, 2002).

farmers to achieve a self-sustaining seed production strategy; to achieve the political objective of providing constituency farmers with a free gift; and to stimulate 'progressive' modern farming practices (Sperling 2001: 28). The main crops provided were maize, beans, sorghum and cowpea.[9] In the case of maize, the varieties provided consisted mostly of hybrids (the 500 and 600 series) and the composite variety Katumani (all MVs). Although the specific varieties of each of the other crops are not detailed by the study, the vast majority of farmers interviewed (86-96%) reported that the varieties they received were 'correct'. A number of farmers commented that seed aid introduces farmers to new crops and new varieties, yet others expressed concern that maize hybrids may be risky in more marginal areas (Sperling 2001: 19).

The report usefully provides three factors that must be considered when choosing crops and varieties for emergency interventions. Crops/varieties should be: adapted to farmers' biophysical environment; adapted to farmers' preferences; and adapted to farmers' management conditions. A fourth factor is also suggested; that crops/varieties should be those that facilitate risk aversion (Sperling 2001: 53). Despite the fact that most farmers approved of the varieties provided, based on these categories, the report concludes that maize hybrids are inappropriate in an emergency distribution because farmers do not routinely plant these varieties, they do not have the necessary management expertise and their farms are in sub-optimal environments. In addition, the in-built deterioration factor of hybrids does little to promote self-reliance for farmers who cannot afford to renew their seed stocks each year. Based on these factors, one might also conclude that drought-tolerant crops or varieties of which farmers have little experience may also be inappropriate (due to unknown farmer preferences and management conditions), yet the report considers these to be more appropriate than hybrid maize in select locations due to their drought tolerance (Sperling 2001: 54).

Perhaps the most striking finding of the study is not related to the assessment of the emergency seed distribution but to the inadequacy of farmers' routine seed procurement strategies under 'normal' conditions. For both the main crops, maize and beans, farmers overwhelmingly expressed discontent with the seed acquisition mechanisms available in that prices were said to be 'exorbitant'[10], the right varieties were not available, seed was of poor quality, merchants cheated on quantity, and farmers had to travel a long distance to find the seed (Sperling 2001: 44). The only positive change in the past ten years has been the introduction of some new varieties (Sperling 2001: 46). The report concludes that – with the exception of the introduction of a new variety here and there – there is no concrete evidence to suggest that seed aid per se is strengthening farmer seed systems.

## 5.3 Input distribution projects in Malawi[11]

Since 1992, there has been a series of nine free agricultural input distribution projects at national level in Malawi[12]. The early projects were ostensibly designed as emergency responses to the drought of 1991/92 and the low rains of 1993/94. However, it has been suggested that the interventions of the mid-1990s were in fact aimed at promoting the government's long-term strategy for the widespread

9 Other crops included millet, pigeon pea, green gram, onions, kale/cabbage, tomatoes and other commercial vegetables. Some of the agencies involved in the seed distribution were also working to diversify the crop profile of farmers through the promotion of more drought-tolerant crops (Sperling 2001: 17).

10 Formal sector seed is usually at least twice the price of grain, and sometimes as much as ten times the price of grain.

11 This section is based on the various evaluation reports that were prepared following each input distribution project, together with other available documents.

12 This includes: the Drought Relief Seed Distribution Project (1992/93); Drought Recovery Inputs Programme (1994/95); the Supplementary Inputs Programme (1995/96); the Starter Pack Scheme (1998/99): Starter Pack Scheme II (1999/2000); Targeted Inputs Programme (2000/01); Targeted Inputs Programme II (2001/02); Winter Targeted Inputs Programme (2002); and the Expanded Targeted Inputs Programme (2002/03).

adoption of hybrid maize (Henry 1996). The Starter Pack Scheme of 1998/99 was very confused in what it was trying to achieve; the original proposal was for a long-term development program to allow farmers to test and experiment with improved seed and fertilizer, yet what was implemented was a short-term (one-year) project that aimed to increase household food production (Longley et al. 1999). The objectives of the Targeted Inputs Programmes of 2000/01 and 2001/02 were to increase national food production, reduce household food insecurity, provide legumes for improved soil fertility and diet, and promote the use of chemical fertilizer (Statistical Services Centre n.d.). Although the 2002 input distribution was expected to be the last such project, the subsequent southern Africa drought and food crisis prompted the Expanded Targeted Inputs Programme of 2002/03, which has been presented as a means of providing improved seed and fertilizer to farmers (FEWS NET 2003)[13].

In the case of the various free inputs programs described above, it would appear that the long-term aims of promoting hybrid maize, crop diversification (through the use of legumes) and chemical fertilizers have been implemented through a series of short-term projects that have been repeated on an almost annual basis over a period of ten years. An assessment of such programs in promoting sustainable agriculture through an increase in on-farm biodiversity states that 'Starter Pack has offered limited crops and varieties to date, but it does appear to have the *potential* to increase the diversity of the crop and variety base in Malawi if better attention is paid to variety choice and seed quality in the packs in future' (Cromwell et al. 2000: 8). This is particularly so, given the historical context of Malawi's formal seed system development and the limited range of crops and varieties that has been available to farmers over the past 30 years. The report goes on to recommend that such programs should pay greater attention to crop varieties as well as crops, provide much more extension advice, and establish a more permanent institutional basis rather than implementing them as a series of one-off exercises that tend to be planned and executed on a 'last-minute', emergency basis (Cromwell et al. 2000: 9-10). Similarly, an earlier evaluation also recommended the creation of an improved input supply system for more sustainable agricultural development (Longley et al. 1999: 48).

## 5.4 MV sorghum production and distribution in southern Somalia[14]

Between 1999 and 2001, CARE Somalia implemented the 'Seed Distribution and Production Project' (SDPP) among farmers in Bay, Bakool and Gedo regions of southern Somalia, with the aim of improving self-reliance through the introduction and distribution of high yielding sorghum varieties and the resulting increased crop production. Although SDPP was originally conceived as an emergency response to provide displaced farmers returning after civil war with seeds to restart their agricultural activities, it evolved into more of a rehabilitation and development project that trained farmers to improve agricultural production. The original project design was based on the assumption that humanitarian agencies would continue to provide emergency seed assistance long after farmers had returned to their homes, given the fragile nature of the semi-arid conditions in Somalia. It was therefore assumed that the seeds produced by the project would be distributed by emergency seed projects implemented by other agencies. As it turned out, however, few agencies were involved in emergency seed assistance in the years 2000 and 2001, partly because of the improved security situation, but also because in 2001 the main donor for Somalia changed its policy on emergency seed

13 The FEWS NET monthly report for Malawi, in announcing the Expanded Targeted Inputs Programme, states that: 'Although the seasonal rainfall forecast is favourable, farmers can derive maximum benefits in terms of crop production only if they have access to fertilizer and improved seed. However, the majority of poor households cannot afford these inputs. These households only have access to the inputs when they are targeted through government and NGO sponsored input programs.' (FEWS NET, 2003)

14 Based on personal insights from those involved in the project, together with the mid-term evaluation (Wanga, 2001) and the final project report (CARE-Somalia).

assistance to focus more on alternative agricultural interventions with longer-lasting impacts. At the same time, the results of a seed sector study of southern Somalia (Longley et al. 2001) suggested that improved sorghum varieties could be marketed through local, market-based seed systems (CARE Somalia n.d.: 3). SDPP therefore revised its original strategy and explored other approaches to ensure that poor farmers in the target area would have access to the improved seeds.

Six improved varieties of sorghum – Gadam Hamam, IESV 92043 DL, CR 35:5, F6YQ 212, Somalia Collection #1, and Somalia Collection #9 – were selected for multiplication based on earlier varietal trails that had been undertaken within Somalia, using local varieties for comparison. Technical advice was provided by ICRISAT, who also provided foundation seed of the six sorghum varieties selected for multiplication. The seed was multiplied in Somalia under contract by experienced seed multiplication groups. Demonstration plots were organized for farmers to observe the varieties in the field, and farmers were trained in the advantages of the modern varieties. Ten metric tons of three of the varieties were packaged into 1kg packs, each printed with the local Somali name of the variety, its agronomic characteristics and yield potential (printed in the Somali language). The seed packs were distributed on a loan basis to small-scale traders (mostly women) in various market centres for them to be sold to farmers. Displays containing information about the varieties were erected in the market stalls. Five metric tons of seed was sold within two weeks, and farmers continued to make enquiries. Farmers' interest in the new varieties confirmed the success of the approach. Although the mid-term evaluation of the project recommended the need for strengthening the marketing aspects of the project (Wanga 2001), the final project report states that 'the introduction of modern sorghum varieties in southern Somalia was a major achievement of SDPP because this led to a wider genetic diversity and wider options for local farmers… The introduction of the new sorghum varieties contributed tremendously … [to] the resilience of the farming systems' (CARE Somalia n.d.: ii-iii).

## 5.5 Summary

The emergency seed projects reported above from Southern Sudan, Kenya, Malawi and Somalia present varying experiences in relation to the distribution of modern varieties and farmer seed systems. In the case of southern Sudan, the widespread and repeated distribution of Serena sorghum among farmers who clearly had no interest in this variety because it was inappropriate to the local agro-ecology could be seen as an extreme example of a series of misguided interventions which had no mechanisms for recognizing or responding to their profound lack of impact. In Kenya, the introduction and promotion of drought-tolerant crops and varieties was seen to be a positive aspect of the emergency intervention, yet there were concerns that hybrid maize was inappropriate in many areas. In southern Somalia, on the other hand, the sorghum varieties promoted by the CARE project had been previously tested and were known to be appropriate, yet problems were encountered in seed distribution and marketing due to changes in donor policies relating to emergency seed distribution. Clearly, if emergency seed projects are to involve the distribution of modern varieties, it is essential that they determine which varieties may or may not be appropriate to the farmers and the agro-ecological areas targeted.

The Kenya study findings conclude that emergency seed aid per se does little to strengthen farmer seed systems. Yet it can be argued that this was never the aim of the project in the first place. In the case of Malawi, on the other hand, it is reported that emergency seed projects can potentially enhance seed systems through increasing crop and varietal diversity, provided that sufficient attention is given to the selection of varieties and seed quality in the planning and implementation of such projects. As the case of southern Sudan shows, agencies involved in emergency seed interventions generally fail to refer to

past research results and recommendations[15]. Although there is often considerable lack of clarity as to what the emergency seed projects are designed to achieve – as illustrated by both the Kenya and the Malawi experiences – the strengthening of farmer seed systems rarely features among the stated goals of conventional seed relief activities. The CARE-Somalia project is an exception in this regard, which might best be regarded as a seed system support approach. The introduction of new varieties and the promotion of crop and varietal diversity is one of the ways in which farmer seed systems can be strengthened. But – given that this is perhaps best achieved through a long-term intervention (involving varietal trials, etc) – is it appropriate that this should be undertaken as part of an emergency response? The fact that the CARE project was implemented as a three-year intervention (most emergency interventions last only for a single planting season) allowed for it to determine the appropriate varieties to be multiplied and distributed, and also for the program approach to respond to the changing context within Somalia.

Both the Kenya study and the Malawi report refer to the failure of the public seed sector in promoting new varieties and making quality seed available and accessible to farmers. It is largely due to this failure that emergency seed projects are increasingly seen as opportunities to promote and distribute modern varieties. Yet emergency seed projects tend to be implemented as a short-term response to an emergency need. Seed takes time to multiply, and the short-term planning that is typical of emergency interventions generally does not allow for the multiplication of the appropriate varieties. Despite the fact that such interventions are often repeated over many years, as the Somalia example shows, they cannot necessarily be relied upon as a long-term mechanism for the promotion of new varieties. In the case of Malawi, a more permanent institutional arrangement is recommended if the aim of promoting crop and varietal diversity is to be satisfactorily achieved. In the next section we describe an emergency seed project implemented over the course of two years which distributed MV seed to farmers in the Sahelian zone of West Africa.

**Table 1.1 Number of beneficiaries and quantities of seed distributed by ESP in Mali and Niger**

| Country | Number of Villages | Number of farmers | Quantity of sorghum (kg) | Quantity of millet (kg) | Quantity of cowpea (kg) |
|---|---|---|---|---|---|
| Mali | 448 | 2598 | 5,000 | 12,803 | 2,590 |
| Niger | 72 | - | 10,000 | 40,000 | 10,000 |

## 6. The Sahel Emergency Seed Project (ESP) of 1998/99

Following the Sahelian drought of 1997, the West and Central African Millet Research Network (WCAMRN) purchased and distributed 290 tons of seed of sorghum, cowpea and millet to drought-affected farmers in five countries (Niger, Mauritania, Mali, Burkina Faso and Senegal). The project was implemented through a network of partners from the regional and national agricultural research sectors[16] and various non-governmental organizations (NGOs). In some countries seed was provided in both 1998 and 1999. The table below shows the quantities of seed distributed in the case study countries of Mali and Niger. The varieties of each crop are listed in footnote 17.

15 This is hardly surprising, given that such documents tend to be difficult to obtain and are rarely written for non-specialist audiences.

16 The main regional partners were the West and Central African Sorghum Research Network (WCASRN); the West and Central African Cowpea Research Network (RENACO); the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and International Sorghum and Millet Collaborative Research Support Programme (INTSORMIL-CRSP). At national level, various governmental and non-governmental agencies were involved in each country.

In each country, a management committee was established, composed of representatives from the implementing agencies. The committee was responsible for identifying the areas to be targeted and the most appropriate varieties to be distributed[17]; for procuring, testing, treating and distributing the seed in the target areas; and for monitoring and evaluating the project. The areas targeted for seed distribution were those areas where the impact of the drought had been greatest in terms of food shortages (since these areas were also assumed to have the greatest need for seed); where an appropriate development partner with experience of seed projects was operating; and where farmers were suitably interested in receiving seed of modern varieties. As well as procuring seed for the 1998 seed distribution, the committee also ensured that seed was multiplied for the planned 1999 distribution. Regular meetings and field visits took place, for which minutes and reports were circulated among the agencies involved.

The seed distribution was organized slightly differently in each of the five countries. In the case of Niger, for example, the distribution at village level was organized by a Seed Management Committee that was given the responsibility of allocating seed to individual farmers and ensuring that they returned the seed with 50% interest at the end of the season. This was then kept by the Seed Management Committee in a seed bank and subsequently distributed at the beginning of the 1999 season among farmers and neighboring villages which did not benefit from the 1998 distribution. The implementing NGO partners, together with the National Seed Service, provided training to the members of the Seed Management Committees in seed multiplication techniques and seed storage. Seed stores were constructed in some villages. Regular monitoring visits by both the implementing agencies and members of the Emergency Seed Project Management Committee ensured that the project was well implemented in Niger.

Although the efficiency of the distribution varied considerably across the five countries, evaluation reports indicated that there had been significant adoption of the CSM 63E sorghum variety in Mali and HKP millet variety in Niger (Diakité 2000; Hamadou 2000). In 2002 – four years after the initial emergency seed distribution – follow-up studies were undertaken in Mali and Niger to explore further the factors related to the adoption of these varieties and to examine whether farmers who had not originally benefited from the 1998/99 project may have subsequently acquired seed of the same varieties. The results of the studies in Mali and Niger are presented in Parts II and III respectively. Key findings relating to the adoption and spread of modern varieties are presented below.

## 7. MV spread and adoption in Mali and Niger

The aims of the follow-up studies were to describe how farmer seed exchange mechanisms resulted in the dissemination of modern varieties of sorghum, millet and cowpea in Mali and Niger, and to make recommendations to relief and development agencies on how farmer seed exchange mechanisms can be strengthened. Out of the five countries in which the 1998/99 Emergency Seed Project had been implemented, it was decided to focus on Mali and Niger because the seed project had been most successful in these two countries. The fact that ICRISAT has offices in both countries also made it easier to organize the studies.

Study team leaders were identified in each country[18], preliminary meetings were held with members of the former management committee and others who had been involved in the

17 In Mali the varieties distributed were: NKK, Toroniou and Soxsat millet; Gorom Gorom cowpea; and CSM 63 E sorghum. NKK proved unpopular with the farmers and was subsequently replaced by a more popular local variety of millet. In Niger, the varieties distributed were: HKP millet; TN 5-78 and TN 27-80 cowpea; and Moto Maradi sorghum.

18 In Mali, the study team was led by Lamissa Diakité of the IER, assisted by Soriba Diakité (Point Sud). In Niger, the study team was led by Boureïma Kanfidéni of INRAN, assisted by Dary Halidou (Statistics Department).

implementation of the Emergency Seed Project, and preliminary field visits were made. Existing documents and reports were reviewed, and study sites were selected in close collaboration with those who had been involved with the project on the ground to ensure that data were collected in areas where the project had been most successful. Two survey tools were developed and tested: a farmer questionnaire for the collection of quantitative data at household level (Annex 1); and focus group discussion checklist for the collection of qualitative data at village level (Annex 2). Similar survey tools were used in both countries and were tested and modified accordingly. Survey teams in each country were trained and the data were collected in the selected study sites. In Mali, a total of 220 farmer questionnaires and 22 focus group discussions were completed. In Niger, 230 farmer questionnaires and 12 focus group discussions were completed. The quantitative data were entered into a database and analyzed using the Statistical Package for Social Sciences (SPSS), and the qualitative data were analyzed by compiling lists and comparative tables by hand.

Although it had initially been assumed that 1998/99 was the first time that beneficiary farmers had received some of the modern varieties distributed by the Emergency Seed Project, it soon became apparent that these varieties were already being grown in most of the study sites. Without any baseline data to record the level of adoption of these varieties prior to the Emergency Seed project of 1998/99, it was difficult to assess the spread of MVs resulting solely from the Emergency Seed Project, as distinct from the spread of varieties resulting from earlier seed distribution efforts. The surveys attempted to overcome this problem by asking farmers when (ie, how many years ago) they had adopted a specific variety. Another constraint was the identification of specific varieties through the local names used by farmers. In most cases, farmers were not aware of the formal name of a specific MV and had given the variety another name. These local names varied across study sites, and in talking to farmers it was sometimes difficult to distinguish MVs from local varieties and specific MVs from other MVs of the same crop. To overcome this constraint, the focus group discussions recorded the distinctive characteristics of all the main varieties cultivated within a village, and also determined the local names of the MVs that had been distributed by the Emergency Seed Project. Where possible, farmers' samples of particular varieties were inspected for identification purposes by the agronomists on the survey teams.

## 7.1 Overall rates of MV adoption

A comparison of survey results for the two countries suggest that overall rates of MV adoption are higher in Niger than in Mali. 75% of sample farmers in Niger reported cultivating at least one modern variety of either millet, cowpea or sorghum, whereas the same result for Mali was only 33%. These figures, however, hide significant differences between crops and study areas within each country. In Niger, the cowpea variety TN 5-78 displayed the highest rates of adoption, being planted by 63% of sample farmers in Maradi. In Mali, the sorghum variety CSM 63E was particularly well liked in Koulikoro, where approximately 48% of sample farmers reported to have planted MV sorghum in the 2001/02 season.

Can these rates of MV adoption be attributed to the Emergency Seed Project of 1998/99, or are they due to earlier MV dissemination efforts? If we examine when these varieties were adopted, results for MV sorghum in Koulikoro, Mali reveal that: 10% had been adopted before 1998 (ie, prior to the Emergency Seed Project); 42% were adopted in 1998 (ie, the same year as the ESP); and 48% were adopted after 1998 (ie, subsequent to the ESP). This clearly suggests that in the vast majority of cases (90%), MV sorghum was planted as a result of the 1998/99 seed distributions and the subsequent sharing of seed between farmers. Results for MV cowpea adoption in Maradi, Niger are not quite as

dramatic because a larger proportion of farmers were already planting MV cowpea: 46% had been adopted before 1998; 24% were adopted in 1998; and 30% were adopted after 1998. In other words, almost half of the sample farmers in Maradi had been growing MV cowpea prior to the ESP, and it can be concluded that slightly more than half adopted the variety as a result of the project, together with the subsequent sharing of seed among farmers and trade networks.

## 7.2 MV spread, adoption and loss at village level

As can be seen from Table 1, much larger quantities of seed were supplied to a smaller number of villages in Niger than in Mali. In Niger, almost all farmers in each beneficiary village received seed from the project, whereas in Mali only some farmers in each village (less than ten in most cases) received seed from the project. The fact that more farmers per village received seed is thought to account for the much higher rates of overall MV adoption in Niger than in Mali. Indeed, in five out of 11 beneficiary villages in Mali, farmers taking part in the focus group discussions reported that the seed of the MVs distributed had either been lost or abandoned since the ESP, possibly because the small number of farmers who had received the seed failed to look after it properly. If more farmers have the seed to begin with, then it is more likely that the seed will be maintained. Yet the abandonment of a variety also occurs when farmers do not like the particular variety provided, as illustrated by the case of a village in Tillabéry (Niger), where all 30 farmers who had received the cowpea variety KVX in 1998 had abandoned it by 2002. But the converse is also true: a variety that is well liked by farmers will be maintained and will spread to other farmers relatively quickly, even if only a small number of farmers are initially given a small quantity of the seed. This is well illustrated by the case of CSM 63E sorghum in Koulikoro, where, on average, less than four farmers per village received less than 8 kg of seed in 1998. Yet by 2002, almost half of the farmers surveyed in Koulikoro had adopted the variety.

Although well-liked varieties spread relatively quickly among farmers within the same village, it cannot necessarily be assumed that these varieties will always spread from one village to another through farmer seed systems alone. In Mali, 4 out of the 11 beneficiary villages sampled for focus group discussions had provided seed of the MVs distributed by the Emergency Seed Project to a total of 17 other villages, ranging from 2 to 20 km distant. In Niger, all six beneficiary villages sampled for focus group discussions reported to have provided the seed of the MVs to other settlements; a total of 17 hamlets and villages located within about 10 km of each beneficiary village had reportedly been given MV seed. In some cases this was the result of requests from farmers in neighboring villages; in other cases the implementing NGO had instructed the village seed committees to provide seed to other villages.

## 7.3 Farmer mechanisms for seed sharing and the sources of new varieties

How are modern varieties shared among farmers? In order to answer this question, the survey asked those farmers who cultivated MVs whether or not they had ever provided MV seed to other farmers. In Mali, almost half (47%) of the sample farmers growing MVs had given the seed to other farmers, and in Niger the figure was 61%. In Niger, survey results showed that older and wealthier farmers were more likely to give MV seed to others. In the case of MV sorghum in Mali, however, it appeared to be poorer farmers who provided MV seed to others, apparently due to the fact that it was largely the poorer farmers who had received seed from the ESP. In general, the MV seed shared by farmers was

provided to men rather than to women (probably because most of the farmers interviewed were men), to close relatives as opposed to non-relatives, and to those within the same village rather than those in neighboring villages (though it is not uncommon for farmers to provide seed to others in neighboring villages). In cases where MV seed was provided to a close relative, it tended to be given as a gift, whereas with non-relatives it tended to be bartered or exchanged for some other product. However, the mechanisms of seed provision also vary for different crops: millet tended to be given as a gift; sorghum was more likely to be exchanged; and cowpea might be sold for cash (depending on the farmers' relationship to the recipient).

The survey also asked how farmers originally acquired the seed of the varieties they cultivated, both local and modern. The term 'new variety' is used here to refer to both modern and local varieties that are new to the farmer in question, ie, that he or she is planting for the first time.[19] The acquisition of modern varieties broadly followed the same pattern as local varieties, apart from the fact that MVs can additionally be obtained on loan or credit from seed projects or organizations. Like local varieties, most MVs were acquired from sources within the farmer's own village, though the proportion of new MVs sourced from neighboring villages was higher than that for new local varieties, particularly for millet and sorghum, indicating that – in some cases – MVs do indeed spread from one village to another through farmer seed systems. While markets provided an important source of new local varieties in most of the study locations (particularly for cowpea and sorghum), their importance as a source of new MVs was comparatively less, suggesting that more use could be made of markets in promoting the spread of MVs.

Some interesting results emerged from the Niger data relating to the introduction and spread of new varieties within the two study sites. In Maradi, there was much greater dynamism in the introduction of new varieties: a relatively large number of both local and modern varieties had been introduced into the villages through farmers themselves, being bought or exchanged with other farmers elsewhere, or purchased from the local market. In Tillabéry, however, considerably more varieties were considered to be 'heritage' varieties (ie, those varieties were believed to have always existed within the village, passed down from one generation to the next), and most of the new varieties had been brought to the village by NGOs or development projects. Three main reasons are thought to explain the differences in the varietal dynamics of the two study areas in Niger: (i) the Hausa farmers of Maradi are much more commercially-oriented than the Djerma of Tillabéry and thus have greater access to new varieties through local markets and trade networks; (ii) access to new varieties in Maradi is also enhanced by close family networks that exist between Maradi and places such as Nigeria and Tahoua; (iii) the Maradi sample area is located near to the Nigerian border, and the surrounding areas are predominantly agricultural, in contrast to Tillabéry, where the surrounding areas are largely pastoral, thus limiting the availability of new seed varieties among neighbors. These three factors not only make new seed varieties available within reasonable proximity to Hausa farmers of Maradi, but the existence of both trade and social networks provides a means through which farmers can access these new varieties. These results clearly show that the spread of new varieties relates to the broader livelihood patterns of particular ethnic groups, features of their social organization, and their proximity to and interactions with other agricultural communities.

19 The distinction between new varieties, old varieties (ie, those that are familiar to local farmers and have been cultivated for a number of years, and heritage varieties (ie, very old varieties that have been passed down from one generation to the next) must be locally defined and is often necessarily subjective.

## 7.4 Impact on varietal diversity

The survey results showed no evidence that the distribution of MVs had led to the loss of local varieties. In Mali, for example, the survey recorded between 11 and 15 differently named cowpea varieties in each of the three study regions. There were no MVs recorded in the region with just 11 varieties (Koulikoro); 3 MVs were recorded where there were 14 varieties (Ségou); and 4 MVs where there were 15 varieties (Mopti) (see Part II). Though these results cannot be taken as conclusive, they appear to suggest, if anything, that MVs increase varietal diversity. Similar patterns were also found for sorghum and millet. In Niger, the situation in the two study areas was rather more complicated because the two language groups (Hausa and Djerma) recognized and named varieties in very different ways, making it difficult to draw comparisons between the two areas based on variety names alone. Although Djerma farmers in the study area of Tillabéry reported that a number of varieties had been abandoned over the years, these were varieties with low drought tolerance and was clearly related to changing climatic patterns (ie, increasing aridity), not necessarily the introduction of MVs[20]. Hausa farmers of Maradi, on the other hand, reported no loss of varieties, only the introduction of new varieties, both local and modern. The varieties that are cultivated within farming systems clearly change over time, but results from Mali and Niger do not suggest that there has been a loss of local varieties due to the introduction of MVs.

# 8. Conclusions

Experiences from the various emergency seed projects reviewed above reveal that the introduction of MVs can be a positive feature, even when this was not necessarily the original aim of the project. In some cases, the introduction and adoption of a new variety that is both suitable to the local agro-ecology and well liked by farmers has occurred purely by chance rather than by design, eg, the introduction of 'UN okra' in southern Sudan. In other cases, eg, Serena sorghum in southern Sudan, the variety distributed has been inappropriate and has not been adopted by farmers. In general, conventional emergency seed projects have paid insufficient attention to the choice of variety for distribution, and it is an almost random 'hit or miss' situation as to whether the variety is appropriate. In projects where greater attention has been paid to the choice of variety, eg, CARE's sorghum seed distribution project in southern Somalia, or the emergency seed project reported here in Niger and Mali, farmers appreciate the varieties provided and they are subsequently spread through local markets and farmer seed systems. Rather than returning to the pre-disaster situation, the advantage of such MVs is that they increase the varietal diversity of local cropping systems and thus enhance resilience to future disasters.

The case of the emergency seed project in Mali and Niger shows that – provided the varieties are appropriate and well liked by farmers – such projects, together with subsequent spread of varieties through farmer seed systems, provide an effective means of disseminating MVs to farmers. Emergency seed projects thus have considerable potential to promote the adoption of MVs and might be regarded as being far more efficient than formal seed sector activities to promote such varieties. Indeed, it is largely the failure of formal seed sector activities to disseminate MVs which has prompted the use of emergency seed distributions to promote MVs. But herein lies the danger: the effectiveness with which emergency seed projects are able to get MVs out to farmers is such that where MVs are promoted over-zealously, it is possible that they may replace local varieties, reduce diversity and

20 One exception might be the local millet variety *haini kira* which was reported to be gradually being replaced by the modern variety, HKP. The reason for this, however, was that HKP displayed greater drought tolerance than *haini kira* (see Part III).

increase vulnerability. Such a scenario is unlikely to result from a one-off emergency seed distribution but is possible where such distributions are repeated over several years, as part of a long-term campaign to promote MVs. To avoid this danger, emergency seed projects must not be seen as an opportunity to promote MVs. Rather, they are best regarded as a means of enhancing diversity and providing a greater choice of varieties available to farmers. It is also important to realize that the failures of the formal seed sector cannot simply be 'solved' through emergency seed projects. As the example from Malawi shows, a long-term, sustainable seed supply system is still required.

When is it appropriate or not appropriate to distribute MVs as part of an emergency seed project? A detailed assessment must first be undertaken. If the scale of the disaster makes it impossible to undertake an assessment, then it is unlikely that MVs will be appropriate. In situations where there is an overall shortage of seed locally available to farmers due to a combination of long-term and widespread population displacement, the suspension of farming activities, and the lack of functioning local markets and transport systems[21], then it is also unlikely that MVs will be appropriate. It is in the less acute disaster situations – either where the impact of disaster has not been as great, or where the disaster is recurrent or chronic (eg, drought or long-term political instability), or when the acute phase is over and farming systems are beginning to recover – that the distribution of MVs might be appropriate. It is essential that the aims of an emergency seed intervention should be well thought-out and clearly articulated according to the actual findings of the assessment rather than the assumptions made by donors or project planners. MVs should only be used as part of a project that aims to support and strengthen farmer seed systems through enhancing diversity.

As we have seen in the examples described above, the choice of variety is absolutely crucial and requires very careful thought, often involving advice from agricultural researchers familiar with the local farming systems, or reference to past experience or varietal trials. Hybrids should only be provided in contexts where farmers have had previous experience with hybrids. If the project aims to promote varietal diversity as opposed to providing seed to farmers who may have little else to plant, this necessarily has implications for how the project is designed and implemented, particularly regarding the quantities of seed provided and the targeting of farmers and agro-ecological areas. Seed quality also becomes very important. Recommendations regarding these aspects are outlined below.

Recent research findings into the impacts of emergency seed projects and a greater understanding of farmer seed systems in disaster contexts outlined at the beginning of this paper suggest that the time has come for emergency seed provisioning to be re-conceptualized. Rather than providing seed to farmers who may not have lost their seed to begin with, or who may merely need help in accessing seed that is locally available, such projects can also strengthen existing seed systems through the provision of seed system support. Although seed system support or seed capacity building was originally conceived as an approach that should be implemented *after* an emergency, once short-term emergency seed distributions were over (ODI 1996), the chronic nature of many emergencies, and the tendency to provide emergency relief seed on a repeated basis suggests that seed system support should perhaps be regarded as an emergency response that is appropriate in chronic, repeated, or long-term emergencies. Such support can take various forms, for example: improving the quantity and quality of local seed through reducing damage by pests and disease, or enhancing local seed storage facilities; or increasing access to locally available seed through the use of vouchers, or enhancing market infrastructure. Promoting crop diversity to enhance the resilience of seed systems is another form of seed system support.

21 Such situations – though they provide the underlying rationale on which conventional emergency seed distributions have been based – are thought to be very rare in reality, occurring only in the most extreme disaster contexts where farming is effectively impossible for a large part of the population for more than two seasons.

# 9. Recommendations for the use of MVs for seed system support in emergencies

As noted above, it may not always be appropriate to provide MVs in emergency situations. A detailed needs assessment is a prerequisite to understand the specific problem to be addressed and determine the precise aim of any intervention for seed system support. A well-defined project aim, together with an understanding of the existing farmer seed system should determine the way in which the project is designed and implemented. Adequate planning and preparation is essential; seed system support interventions cannot be implemented in a rush. For this reason, seed system support projects are, in general, only suitable where the funding structures will allow for a project to be planned and implemented across at least two planting seasons.

## 9.1 Prior needs assessment

Conventional emergency seed projects tend to rely on the results of food needs assessment to determine whether or not seed is required. However, this has been shown to be inappropriate, and a methodology for assessing seed systems has recently been developed (Longley et al. 2002). The methodology proposes two tools: the Seed Systems Profile to better understand the socio-economic and agro-ecological aspects of farmers' seed systems; and a five-step framework for assessing the ways in which farmer seed systems have been affected by a particular disaster (ICRISAT-Mozambique 2003). In assessing the need for an emergency seed intervention, a better understanding of farmer seed systems allows for the identification of the strengths and weaknesses of such systems and the development of interventions that effectively build on the strengths and address the weakness to enhance resilience and reduce vulnerability.

## 9.2 Choice of variety

If the needs assessment recommends that the distribution of MVs would strengthen farmer seed systems through enhancing varietal diversity, then time must be taken to determine the appropriate MVs for distribution. This may involve consultations with farmers, local extension agents and others in the Ministry of Agriculture, or experts from national or international agricultural research institutes. It has been suggested above that varieties should be: adapted to farmers' biophysical environment; adapted to farmers' preferences; adapted to farmers' management conditions; and should facilitate risk aversion (Sperling 2001: 53). Where specific varieties deemed appropriate by researchers have not previously been grown or tested in the target area, it may be necessary to conduct varietal trials (where conditions allow for this) before selecting the varieties to be distributed. Since MVs tend to be developed for optimal conditions, it is possible that an appropriate MV simply does not exist. This was seen to be the case for sorghum in parts of southern Sudan, where there was a very wide range of farmers' own local varieties that were deemed to be considerably more appropriate than any MV that might have been introduced (Jones et al. 2002).

## 9.3 Implementation approach

If the aim of an emergency seed system support project is to enhance the diversity of crops and/or varieties available to farmers, then this will not be implemented in the same way as a project that, for example, aims to provide seed to farmers who may have little seed of their own to sow. The quantities

of seed delivered are likely to be smaller, with more attention paid to seed quality and its presentation, and care must be taken to make farmers aware of the name and characteristics of the variety provided, particularly if they may not be familiar with the variety in question. Geographically, it may well be the case that different varieties are appropriate in different agro-ecological areas, and thus need to be targeted accordingly. In terms of targeting at community level, a rights-based approach may advocate for blanket targeting (Archibald and Richards 2002), though if household or individual targeting is necessary, then for greater long-term impacts, it may be best to target the better-off, more experienced farmers within a community. This is because these farmers are perhaps most likely to maintain the seed and pass it on to other farmers, as the results from Niger show. However, this does not imply that poorer farmers do not also share seed of new varieties, as illustrated by results from Koulikoro in Mali. In either case, farmers must be aware of the aims of the project and encouraged to share the varieties with other farmers in subsequent seasons.

## 9.4 Monitoring and follow-up

Close monitoring of projects involving MVs is necessary during the growing season and after the harvest to ensure that the varieties provided are appropriate and well liked by farmers. Where a new variety that was previously unfamiliar to farmers has been provided, it may be advisable to involve agricultural researchers in the monitoring activities to help determine whether there might be specific crop management practices needed for that variety to perform well under the local conditions. If the aim of a project is to promote diversity, then longer-term follow-up is also necessary (after a few seasons) to ensure that the variety is having positive impacts on local seed systems and is not reducing diversity. Since emergency seed projects are not necessarily designed to be sustainable, then it may also be necessary to ensure that there are links to a sustainable means through which farmers can access fresh seed of the MVs in question if necessary.

# PART II:

# Farmer seed systems and the dissemination of modern varieties in Mali

Lamissa Diakité, Soriba Diakité and Catherine Longley

## 1. Introduction

### 1.1. Context and objectives of the study

In 1997/98, the Sahel was affected by a drought that resulted in reduced cereal production. In response to this situation, there was a felt need for emergency seed relief in the areas most affected. Researchers from local agronomic research institutions and certain non-governmental organizations (NGOs), through the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the West and Central African Research Networks on Sorghum and Millet (WCAMRN and WCASRN) developed a project entitled: 'Fulfilling seed requirements in famine threatened areas in West Africa' later referred to as 'Emergency Seed Project' in this report. The project was approved for funding by the Office for Foreign Disaster Assistance of the United States Agency for International Development (USAID) in April 1998. The amount of US$250,000 was allocated to five Sahelian countries (Mali, Senegal, Burkina Faso, Niger and Mauritania) for the procurement and supply of seeds to farmers affected by the drought.

In Mali, the amount of US$30,000 (about 16.5 million CFA) was used to procure and distribute seed of modern varieties[22] of millet, sorghum and cowpea in the disaster-affected areas of Koulikoro (Banamba, Nara Kolokani), Ségou (Macina, Ségou) and Mopti (Bankass, Douentza, Koro) during the years 1998 and 1999.

The evaluation of the project indicated that there was significant adoption of some of the modern varieties that had been distributed. Given that earlier studies have shown that informal or farmer seed systems[23] can be strengthened by greater access to seed of new varieties (Ndjeunga et al. 2000), the project led to considerable interest in further exploring the following questions:

- Are emergency seed relief interventions an effective means of disseminating modern varieties to farmers?
- What has been the role of informal seed systems in promoting the spread and adoption of modern varieties?

Prompted by these questions, the present study was undertaken in the regions of Koulikoro, Ségou and Mopti. A similar, comparative study was also undertaken in Niger, the results of which are reported in Part III of this report. The overall research project had three objectives:

- To describe how informal seed exchange mechanisms have resulted in the dissemination of modern varieties of sorghum, millet and cowpea in Mali and Niger.

22 The term 'modern variety' is synonymous with 'improved variety' and refers to varieties that have been developed through modern plant breeding methods within the formal seed sector.

23 An informal or farmer seed system refers to the ways in which farmers acquire, disseminate, manage and conserve the seeds for the crops which they cultivate. It is distinguished from the formal seed sector which consists of government or private sector systems for varietal development, seed production and distribution. This report uses the term 'farmer seed system' synonymously with 'informal seed system'.

- To make recommendations to relief and development agencies on how informal seed exchange mechanisms can be strengthened.
- To develop a sustainable system for breeder/foundation seed production[24].
  This study reports on the first two objectives.

## 1.2. Methodology

A field survey was undertaken using a household questionnaire and focus group discussions, as described below. All available reports and documentation (including minutes of meetings, field reports and activity reports) relating to the 1998/99 Emergency Seed Project were reviewed. Additional information was sought from the institutions and NGOs who participated in the implementation of the project: ICRISAT, Rural Economy Institute (IER), National Directorate for Support to Rural Areas (DNAMR), Regional Directorate for Support to Rural Areas (DRAMR) and Sasakawa Global 2000 (SG 2000). A preliminary field visit to the villages of Niamabougou and Yaranbougou in Kolokani Cercle was conducted in October 2001.

### 1.2.1 Site selection

All the institutions and NGOs involved in the Emergency Seed Project were involved in the site selection for the study since they were most familiar with each of the regions and villages covered by the project. Villages that received seed from the Emergency Seed Project were selected, together with non-beneficiary villages located between 5 and 10 km from each beneficiary village. A total of 22 villages were included in the study, as shown in Table 2.1.

**Table 2.1 Villages covered by the survey**

| Region | Beneficiary villages | Non-beneficiary villages |
|---|---|---|
| Koulikoro | Koira<br>Wolokoro<br>Serampara | Douabougou<br>Tassilima<br>Gounguédé |
| Ségou | Sina Bamanan<br>Matomo Bamanan<br>Nènèbougou<br>Fing | Tomi<br>Kologo<br>Soun Bamanan<br>Fougoula |
| Mopti | Manko<br>Drimbé<br>Dallah<br>Falembougou | Torbani<br>Amba<br>Gnimignama<br>Petaka |

Source: IER/ICRISAT Surveys, 2002.

### 1.2.2. Survey implementation

The survey was conducted in collaboration with the Research Program in Rural Economy (ECOFIL) and IER. Two survey tools were used: a household questionnaire (Annex 1) and focus group

24 As noted in Part I emergency seed projects to promote diversity through the distribution of MVs must be linked to more permanent formal seed sector systems for the sustainable supply of MV seed.

discussions (Annex 2). The questionnaire and discussion checklist were reviewed, tested, and corrected during a two-day training exercise for the enumerators, which included a visit to the village of Katibougou (near the ICRISAT office, 25 km from Bamako). At the end of the training, the enumerators were divided in three teams to undertake the survey in the three regions. Each team was composed of three enumerators.

The field data were collected between 15 and 24 May 2002 with the technical support of all partners and logistical support provided by ICRISAT. Twenty-two focus group discussions and 220 household questionnaires were completed. The focus group discussions included men and women farmers, with an average of 14 farmers per discussion. The selection of respondents for the questionnaires was made through random sampling, drawn from a list of all households in the village compiled at the end of the focus group discussions.

Quantitative data from the questionnaires were entered into a database and analyzed at ECOFIL/IER using the Statistical Package for Social Sciences (SPSS). The qualitative data from the focus group discussions were used to complement the information generated by the questionnaire.

# 2. The study area and project context

## 2.1. Agro-ecology

Mali is a landlocked country influenced by the hot and dry climate of the Sahara and the monsoon that enters the Gulf of Guinea. There are three major climatic areas, as described below:

- The Sahara extends to the northern part of the country, delineated in the south by the cities of Gao, Tombouctou, Kidal and Nioro. This area is characterized by low and irregular rainfall (less than 200 mm per year). The low annual rainfall allows some grasses and hardy thorn bushes to grow.
- The Sahelian area covers the part between the Sahara and the cities of Kayes, Ségou and Mopti. This area is characterized by rainfall of 500 to 700 mm per year. The vegetation is essentially composed of acacia. The main activity is livestock, associated with dry cereal agriculture in the south of this area.
- The Sudanian zone is located south of the country between the cities of Ségou and Sikasso. The rainfall can reach 1200 mm per year. It is composed of vast savannah plains, dominated by the shea butter tree (*Byturospermum parkii*), the kapok tree (*Bombax costatum*), the African locust bean tree (*Parkia biglobosa*) and the apple ring acacia (*Faidherbia albida*)[25].

The regions covered by the survey fall into the Sahelian and Sudanian zones. The country is irrigated by two rivers: the Niger and the Senegal.

Agriculture is an essential sector of the economy, providing up to 48% of GNP and serving as a source of income for more than 80% of the population. The main food crops are millet, sorghum, maize and rice. Millet, sorghum and maize are grown under rain fed conditions. Cash crops include hibiscus, groundnuts, and various garden products (mostly vegetables). Table 2.2 shows the main crops grown in the regions that were surveyed.

## 2.2 The Emergency Seed Project of 1998/99

The objectives of the Emergency Seed Project were:

- To purchase and distribute 300 tons of appropriate varieties of millet, sorghum and cowpea seeds to farmers from 5 Sahelian countries harshly affected by the drought of 1997/98.

25 Also known as *Acacia albida.*

**Table 2.2 The main crops cultivated in the regions of the survey**

| Region | Food crops | Cash crops |
|---|---|---|
| Koulikoro | sorghum<br>millet<br>maize<br>cowpea beans<br>hibiscus | groundnut<br>cowpea fodder<br>hibiscus<br>sugar cane/sweet sorghum<br>okra<br>bambara groundnut (*Voandzeia subterranean*) |
| Ségou | millet<br>sorghum<br>maize<br>cowpea bean<br>fonio (*Digitaria exilis*)<br>rice<br>bambara groundnut (*Voandzeia subterranean*) | groundnut<br>okra<br>cowpea fodder<br>hibiscus<br>watermelon<br>sesame<br>cassava |
| Mopti | millet<br>sorghum<br>maize<br>cowpea bean<br>rice | groundnut<br>bambara groundnut (*Voandzeia subterranean*)<br>calabash<br>garden products: shallot, garlic, okra, hot pepper<br>hibiscus<br>watermelon<br>sesame<br>squash (kafounè) |

Source: IER/ICRISAT, Surveys 2002.

- To produce local seeds and/or certified modern variety seeds of the above cited crops for the 1999/2000 cropping season.
- To measure the impact of the emergency distribution of millet, sorghum and cowpea seeds in the selected countries.

After the allocation of funds, a committee was set up in order to coordinate all project activities. This committee was composed of representatives of DNAMR, the National Seed Service (SSN), IER, ICRISAT, the Permanent Assembly of the Agricultural Chambers of Mali (APCAM), the Coordination Committee of Non Governmental Organizations Actions (CCA ONG) and the West and Central African Research Networks on Sorghum and Millet (WCAMRN and WCASRN). The mandate of the committee was:

- To identify regions affected by drought and the varieties appropriate for these areas.
- To procure and distribute seeds in selected areas.
- To develop a strategy for germination tests, fungicide treatment and seeds distribution.
- To study the impact of the 'Emergency Seeds' operation.

The committee held regular meetings throughout the implementation of the project. Field trips were organized and a project evaluation was undertaken. The following description of the project is based on the reports produced by the committee.

In Ségou, the SSN distributed 6883 kg of millet seeds, of the modern varieties: Toroniou (6723 kg) and Soxsat (160 kg). For the treatment of these seeds, 8.6[26] kg of Super Hanoï were distributed. This distribution covered 111 villages and the seed was shared among 886 farmers, as shown in Table 2.3.

**Table 2.3 Distribution of MV millet seeds in the Ségou region**

| Sites | Number of villages | Number of farmers | Millet seeds quantity (kg) | | | Hanoï (kg) |
|---|---|---|---|---|---|---|
| | | | Toroniou | Soxsat | Total | |
| Macina | 26 | 146 | 900 | 40 | 940 | 1.2 |
| Monimpé | 33 | 185 | 2700 | 40 | 2740 | 2.4 |
| Sarro | 26 | 292 | 1400 | 40 | 1440 | 1.3 |
| Saye | 26 | 263 | 1723 | 40 | 1763 | 1.7 |
| Total | 111 | 886 | 6723 | 160 | 6883 | 6.6 |

Source: 'Emergency Seeds' evaluation report.

In Mopti, the distribution operations were conducted by SG 2000 and the Service for Extension, Land Management and Technology (SLACAER). A total of 5950 kg of millet seeds (NKK) and 2590 kg of cowpea seeds (Gorom Gorom) was distributed (Table 2.4). In some areas, however, the modern millet variety NKK was replaced by a local variety which was better adapted to the local conditions.

**Table 2.4 Distribution of MV millet and cowpea seeds in the Mopti region**

| Sites | Number of villages | Number of farmers | Seeds quantity (kg) | |
|---|---|---|---|---|
| | | | Millet | Cowpea |
| Mopti | 28 | 232 | 1300 | 321 |
| Djénné | 6 | 37 | 370 | 0 |
| Badiangara | 49 | 91 | 550 | 150 |
| Douentza | 33 | 411 | 1700 | 0 |
| Teninkou | 42 | 120 | 500 | 0 |
| Youwarou | 4 | 112 | 1500 | 0 |
| Koro | 0 | - | 0 | 800 |
| Bankass | 0 | - | 0 | 1319 |
| Total | 162 | 1083 | 5920 | 2590 |

Source: 'Emergency Seeds' evaluation report.

In Koulikoro, 5000 kg of the modern sorghum variety CSM 63E was distributed by DRAMR and SLACAER, as shown by Table 2.5.

Table 2.6 provides a summary of the 1998 seed distributions across the three regions. The sorghum variety distributed was CSM 63E; the millet varieties were Toroniou, Soxsat, NKK, and a local variety; the cowpea variety was Gorom Gorom.

26 8.6 kg of Super Hanoï were distributed and 2 kg were stored for later use.

**Table 2.5 Distribution of MV sorghum seeds in the Koulikoro region**

| Cercle | Arrondissement | Number of villages | Number of farmers | Sorghum seeds quantity (kg) |
|---|---|---|---|---|
| Banamba | Central | 10 | 13 | |
| | Touba | 11 | 18 | 200[1] |
| | Madina sacko | 03 | 03 | |
| Kolokani | Central | 09 | 90 | 485 |
| | Didièni | 29 | 233 | 1500 |
| | Massantola | 01 | 03 | 15 |
| Nara | Central | 38 | 79 | 800 |
| | Dilly | 08 | 20 | 200 |
| | Falou | 23 | 52 | 600 |
| | Guiré | 18 | 29 | 300 |
| | Mourdiah | 25 | 89 | 900 |
| Total | 11 | 175 | 629 | 5000 |

Source: 'Emergency Seeds' evaluation report

**Table 2.6 Distribution of emergency seeds in 1998 in the three regions covered by the survey**

| Region | Number of villages | Number of farmers | Quantity of sorghum seeds (kg) | Quantity of millet seeds (kg) | Quantity of cowpea seeds (kg) |
|---|---|---|---|---|---|
| Koulikoro | 175 | 629 | 5000 | 0 | 0 |
| Ségou | 111 | 886 | 0 | 6883 | 0 |
| Mopti | 162 | 1083 | 0 | 5920 | 2590 |
| Total | 448 | 2598 | 5000 | 12803 | 2590 |

Source: 'Emergency Seeds' evaluation report.

The following observations were made after the project was implemented:

- The Toroniou millet variety was well appreciated by producers as it had good productivity levels and responded well to local climatic conditions.
- The NKK millet variety met different reactions depending on the areas:
    - In Douentza, the variety was well appreciated due to its yield.
    - In Koro and Bankass, the variety was replaced by better-adapted local varieties.
    - In Bandiagara, the variety was not well liked due to its early maturity and the rocky texture of the soil.
- The Sorghum CSM 63E variety was well appreciated by producers and led to seed exchanges between beneficiaries and non-beneficiaries in the distribution area.
- The cowpea Gorom Gorom variety was well liked in the distribution zones, and was already familiar to some farmers through IER.

27 This is the quantity of seeds distributed in the entire area of Banamba.

## 3. Socio-economic characterization of the survey population

This section provides a description of the survey population in terms of socio-economic characteristics, ie, ethnicity, age, gender, and relative wealth.

The great majority of household heads interviewed were men over 50 years in age. Local customs privilege the older over the younger and men over women, both as household heads and for giving information (Table 2.7 and 2.8). Out of 220 interviewees, 59% were 50 years and over; 39% were between 26 and 49 years, and less than 2% were 25 years or under (see Table 2.8). The age limits ranged from 19 to 88 years. Given the small number of young people in the sample, the analysis presented in section 5 uses only two age groups: those of under 50 years, and those of 50 or above.

**Table 2.7 Age groups of sample farmers**

| Region | Age group | Number | Percentage (%) |
|---|---|---|---|
| Koulikoro | Youth[1] | 2 | 3.4 |
| | Adults[2] | 22 | 37.3 |
| | Elderly[3] | 35 | 59.3 |
| Ségou | Youth | 0 | 0.0 |
| | Adults | 33 | 41.3 |
| | Elderly | 47 | 58.8 |
| Mopti | Youth | 1 | 1.3 |
| | Adults | 31 | 39.2 |
| | Elderly | 47 | 59.5 |
| All regions | Youth | 3 | 1.4 |
| | Adults | 86 | 39.4 |
| | Elderly | 129 | 59.2 |

[1]Youth: 19-25 years [2]Adults: 26-49 years [3]Elderly: 50+

Source: IER/ICRISAT Surveys, 2002.

**Table 2.8 Gender of sample farmers**

| Region | Gender | Number | Percentage (%) |
|---|---|---|---|
| Koulikoro | Men | 60 | 100.00 |
| | Women | 0 | 0 |
| Ségou | Men | 80 | 100.00 |
| | Women | 0 | 0 |
| Mopti | Men | 72 | 89.90 |
| | Women | 8 | 10.10 |
| Total | Men | 212 | 96.33 |
| | Women | 8 | 3.67 |

Source: IER/ICRISAT Surveys, 2002.

The size of cultivated land was used as an indication of the relative wealth of a household. Table 2.9 shows the average number and size of fields cultivated by a sample household: accuracy of these figures was not verified by actual measurements, but is based on information provided by the farmers.

When comparing the average size of farms across the regions, there appears to be greater availability of cultivable land in the regions of Koulikoro and Ségou than in Mopti.

In Koulikoro and Ségou, we considered 'poorer farmers' (ie, comparatively less wealthy) as those cultivating an area below or equal to 10 ha, and we considered 'better-off farmers' (ie, comparatively wealthier) as those cultivating more than 10 ha. In Mopti, given the tendency for comparatively smaller farms, the 'poorer farmers' were those cultivating an area less than 5 ha and 'better-off farmers' were those having more than 5 ha. Based on these categorizations, Table 2.10 shows the differentiation of the sample households according to relative wealth. Overall, 57.1% of the survey households were considered 'poorer farmers', and 42.9% were 'better-off farmers'.

**Table 2.9 Average cultivated area by sample farmers**

| Region | Type of field | Number of fields | | | Area (ha) | | |
|---|---|---|---|---|---|---|---|
| | | Min. | Max. | Average | Min. | Max. | Average |
| Koulikoro | House fields | 0 | 10 | 2 | 0 | 70 | 8.72 |
| | Bush fields | 0 | 6 | 2 | 0 | 40 | 8.46 |
| | **Total fields** | **1** | **11** | **4** | **2** | **110** | **16.88** |
| Ségou | House fields | 0 | 5 | 1 | 0 | 30 | 5.31 |
| | Bush fields | 0 | 4 | 1 | 1 | 50 | 10.18 |
| | **Total fields** | **1** | **7** | **2** | **1** | **70** | **13.02** |
| Mopti | House fields | 1 | 6 | 2 | 1 | 10 | 2.94 |
| | Bush fields | 1 | 6 | 2 | 1 | 20 | 3.97 |
| | **Total fields** | **1** | **6** | **3** | **1** | **20** | **4.98** |

Source: IER/ICRISAT, 2002.

**Table 2.10 Wealth distribution of sample farmers**

| Region | Poorer farmers | | Better-off farmers | | All farmers | |
|---|---|---|---|---|---|---|
| | Number | Percentage (%) | Number | Percentage (%) | Number | Percentage (%) |
| Koulikoro | 28 | 54.9 | 23 | 45.1 | 51 | 100 |
| Ségou | 41 | 51.3 | 39 | 48.8 | 80 | 100 |
| Mopti | 47 | 65.3 | 25 | 34.7 | 72 | 100 |
| All Regions | 116 | 57.1 | 87 | 42.9 | 203 | 100 |

Source: IER/ICRISAT Surveys, 2002.

# 4. Crop diversity and the use of modern varieties

## 4.1 Varietal diversity

The diversity of agro-ecological zones described in subsection 2.1 (from the Sudanian zone to the Sahelian and Saharan zone) is paralleled by a diversity of crops and varieties that are cultivated according to the agro-ecological characteristics of each particular zone. Diversity of variety also plays

an important role in the socio-cultural environment; various crops are used for ceremonies of marriage, baptism and burials, as well as rituals for genies, sacred woods and fetishes (Diakité, 2003). In this section, we examine the range of different varieties (local and modern) of millet, sorghum and cowpea cultivated by the sample farmers as well as the origin of these varieties in the local farming systems. An important observation that needs to be made from the outset is the difficulty in identifying varieties at the village level. A single variety can be known by different names in different places, often taking the name of the person who first brought it into the village. It is therefore very difficult to distinguish different varieties based on their names alone. With this caveat, the following three tables list the different names of millet, sorghum and cowpea varieties recorded as being cultivated by sample farmers in the regions surveyed. The names of modern varieties are written in bold italics.

Table 2.11 suggests that there is a very wide diversity of millet in Ségou and Mopti. This reflects the importance of millet in these two regions, which together produce more than 50% of the national millet production. Modern varieties of millet are grown in all three regions. Table 2.12 shows that there is a comparatively smaller range of sorghum varieties grown in Ségou than in Koulikoro and Mopti, and modern sorghum varieties did not appear among the main varieties cultivated by sample farmers in Ségou. The region of Koulikoro along with Sikasso produces more than 50% of the national sorghum production. Table 2.13 shows the cowpea varieties (a leguminous cash crop) which are extensively cultivated in all three regions.

**Table 2.11 Names of the main millet varieties cultivated in the regions of the survey**

| Millet varieties by region | | |
|---|---|---|
| Koulikoro | Ségou | Mopti |
| Bouaba | Bôni | Bamana gnô |
| Bagua | Bonibâ | Cadô gnô |
| Djenidjé | Bonibo | Faranka gnô |
| Sanioba | *Care gnochi* | Gaouri |
| *Sanio télima* | Dianbaldi | Gomangalsenon |
| Sanio fima | *Guéfoué* | Gnô chima |
| Sanio djema | Gno biléni | Haberi |
| Souna | *Gnofin (Toroniou)* | Haireri |
| Tiotioni | Hollandai souna | Haulalcaira |
| | Kotoumou | Icmvis 99001 |
| | Morougata | Icmvis92326 |
| | Nonchi-gno | Kéri |
| | Niôba | *Kouloukangno* |
| | Séguètana | *Projet gnô* |
| | Soula kandian | Niouna |
| | Souna | Nacki |
| | Tougouka gnoni | Sanguè |
| | *Toroniou* | Sonkorodji |
| | *Tassoumani* | Tabidji |
| | Wara koukala | Tannious |
| | | *Toroniou* |
| | | Tchioukidji |

Source: IER/ICRISAT Surveys, 2002.

**Table 2.12 Names of the main sorghum varieties cultivated in the regions of the survey**

| Sorghum variety by region | | |
|---|---|---|
| Koulikoro | Ségou | Mopti |
| Amadiboubou | Guadiaba | Aimèbani |
| Baxounou | Kendé | Aimèdoumou |
| Bourdamè | Keniké | Aimèna |
| *CSM 63 E* | Kenikéba | Aimèsankinè |
| Guadiaba | Kenikébiléni | Boyori |
| Guadiabablen | Kenikédjè | Bayeri danairi |
| Guadiaba djéma | Kenikégoni | Bayeri M'banderi |
| Guadiaba télima | | Boyori danairi |
| Kenikéba | | Boyori M'bauderi |
| *Kenikételini* | | Boumodi |
| Mangaxorè | | Bandaidjè |
| Markassa | | *CSM 63 E* |
| Mangadoumbè | | *CSM 215* |
| Nioninko doumbé | | Djounoukôaimè |
| Nioninko korè | | Gniwari |
| *Nioninko koulé* | | Kelauri |
| Niéninkotainè | | Kelauri danaidjè |
| Nioninkoxorè | | *Kenikébiléni* |
| Nioninko tainè | | Kounssouli |
| Sadianioniko | | Macka keniké |
| Sobeni ba | | N'timinikala |
| Tiafouga | | Saïkô aimè |
| Tiokoïka | | N'boumbga |
| | | Nackari |

Source:IER/ICRISAT Surveys, 2002.

**Table 2.13 Names of the main cowpea varieties cultivated in the regions of the survey**

| Cowpea variety by region | | |
|---|---|---|
| Koulikoro | Ségou | Mopti |
| Boloblen | Djambelè | *Gorom-Gorom* |
| Koriafing | Koua kè | Bagudji |
| Molotainè | Kouakènyèrèla | Kangabana |
| Moloxorè | Koikinguele | *Korobalen* |
| Oualogo | Mabenfè | Kenniékoun |
| Sô djéma | *Sangaranka* | Niébé boula idjè |
| Sô télima | Sô djéma | Niébé danaidjè |
| Sô ba | Sô fing | Niébé aulèye |
| Sô guelèni | *Sô bilema* | Nimba |
| Santiguelinko | *Soukaro sô* | Nimpirou |
| Xoria | N'gnèrèla | *Sangaranka* |
| | N'guèrimblen | Sô bilema |
| | N'guèringuouè | Sô djéma |
| | Togoumaka | Sô noufini |
| | | *TN 88-63* |

Source: IER/ICRISAT Surveys, 2002.

## 4.2 Local and modern varieties

A more detailed analysis of the local and modern varieties cultivated reveal differing results depending on the crop and the region (Table 2.14). In general, the majority (over 80%) of varieties cultivated for each of the three crops studied are local varieties. Sorghum displays the highest rate of modern variety (MV) use (18%), followed by millet (14%) and cowpea (12%). However, these figures conceal important differences between the regions. There is a higher rate of millet MV use in Ségou (26%); sorghum MVs account for 30% of sorghum varieties in Koulikoro; and 25% of cowpea varieties in Mopti are MVs. Given the relatively high rate of adoption of MV sorghum in Koulikoro, we will examine this in more detail in subsections 4.4 and 5.4.

**Table 2.14 Number of local and modern varieties of the crops cultivated by sample farmers**

| Crop type | Region | | Types of varieties cultivated | | Total |
|---|---|---|---|---|---|
| | | | Local | Modern | |
| Millet | Koulikoro | Number | 92 | 3 | 95 |
| | | Percentage (%) | 97 | 3 | 100 |
| | Ségou | Number | 73 | 26 | 99 |
| | | Percentage (%) | 74 | 26 | 100 |
| | Mopti | Number | 88 | 12 | 100 |
| | | Percentage (%) | 88 | 12 | 100 |
| | Total | Number | 253 | 41 | 294 |
| | | Percentage (%) | 86 | 14 | 100 |
| Sorghum | Koulikoro | Number | 67 | 29 | 96 |
| | | Percentage (%) | 70 | 30 | 100 |
| | Ségou | Number | 39 | 1 | 40 |
| | | Percentage (%) | 98 | 2 | 100 |
| | Mopti | Number | 53 | 4 | 57 |
| | | Percentage (%) | 93 | 7 | 100 |
| | Total | Number | 159 | 34 | 193 |
| | | Percentage (%) | 82 | 18 | 100 |
| Cowpea | Koulikoro | Number | 65 | 5 | 70 |
| | | Percentage (%) | 93 | 7 | 100 |
| | Ségou | Number | 81 | 6 | 87 |
| | | Percentage (%) | 93 | 7 | 100 |
| | Mopti | Number | 49 | 16 | 65 |
| | | Percentage (%) | 75 | 25 | 100 |
| | Total | Number | 195 | 27 | 222 |
| | | Percentage (%) | 88 | 12 | 100 |

## 4.3 Adoption and loss of MVs at village level

Focus group discussions were used to determine the level of adoption and the loss of modern varieties following the 1998/99 seed distribution in the beneficiary villages. When sampling 11 beneficiary villages, we collected the following results:

- The number of farmers who grew modern varieties had increased in 4 villages.
- The number of farmers who grew modern varieties had reduced in 2 villages.
- Modern varieties were lost or abandoned in 5 villages.

These results show that farmers do not always adopt the new varieties that are introduced at the village level. The adoption of a variety is determined by the number of farmers growing that particular variety, and its relative cultivated area in a given time period.

The seed of a variety that has been adopted becomes incorporated into an informal seed dissemination process. For example, from the 11 beneficiary villages that were sampled, 4 villages provided modern variety seeds to 17 other villages ranging in distance from 2 to 20 km. Out of the 11 non-beneficiary villages sampled, only 4 villages were aware of the seed distribution project, and only 9 farmers were known to have adopted the varieties distributed.

## 4.4 Farmers' adoption of MV sorghum in Koulikoro

Here we look in more detail at the case of sorghum in Koulikoro since earlier results showed a relatively high rate of MV adoption. If we examine the time at which the farmers in Koulikoro started growing MV sorghum, we learn that out of the 29 plots of modern sorghum varieties:

- 10% had been adopted prior to 1998.
- 42% were adopted in 1998.
- 48% were adopted after 1998.

This clearly suggests that in the vast majority of cases (90%), MV sorghum was planted as a result of the 1998/99 seed distributions. However, what is also important is that the variety distributed was already familiar to farmers prior to the 1998 distribution. This factor is thought to have played a major role in promoting the subsequent widespread adoption of the variety following the 1998/99 seed distribution. Further details on farmers' sources of MV sorghum in Koulikoro are provided in section 5.

## 4.5 MV use according to wealth and age of farmers

In the regions of Ségou and Mopti, it appears that the better-off farmers (ie, 'better-off farmers' cultivating more land) are more likely to plant MVs than the poorer farmers, but the reverse is true for Koulikoro (Table 2.15). The analysis of these data by crop types (Annex 3) reveals that there are slightly more 'poorer farmers' (37%) than 'better-off farmers' (22%) growing MVs of sorghum in Koulikoro region. In Ségou, on the other hand, MVs of millet are grown slightly more by 'better-off farmers' (33%) as opposed to 'poorer farmers' (19%). These differences are thought to relate to the way in which seed distribution projects targeted farmers and will be explored further in subsection 5.4.

**Table 2.15 Use of modern varieties by wealth group**

| Region | Wealth group | Number of farmers sowing MVs in 2001/02 | Percentage (%) |
|---|---|---|---|
| Koulikoro | Poorer farmers (n=28) | 13 | 46.4 |
| | Better-off farmers (n=22) | 8 | 36.4 |
| | All farmers (n=50) | 21 | 42.0 |
| Ségou | Poorer farmers (n=41) | 9 | 21.9 |
| | Better-off farmer (n=38) | 16 | 42.1 |
| | All farmers (n=79) | 25 | 31.6 |
| Mopti | Poorer farmer (n=44) | 10 | 22.7 |
| | Better-off farmers (n=25) | 9 | 36.0 |
| | All farmers (n=69) | 19 | 27.5 |

As with the wealth differences, no clear pattern emerges from the analysis of the use of MVs according to the age of the farmer (Table 2.16). In Koulikoro, it appears that older farmers are least likely to use MVs, whereas the reverse appears to be the case in Ségou. The differences among farmers' use of MVs in Mopti are not significant.

**Table 2.16 Use of modern varieties by age group**

| Region | Age group | Number of farmers planting MVs in 2001/02 | Percentage (%) |
|---|---|---|---|
| Koulikoro | Young (n=2) | 1 | 50.0 |
| | Adults (n=31) | 14 | 45.2 |
| | Elderly (n=24) | 9 | 37.5 |
| | All farmers (n=57) | 24 | 42.1 |
| Ségou | Adults (n=36) | 9 | 25.0 |
| | Elderly (n=43) | 16 | 37.2 |
| | All farmers (n=79) | 25 | 31.6 |
| Mopti | Young (n=1) | 0 | 0 |
| | Adults (n=38) | 10 | 26.3 |
| | Elderly (n=37) | 9 | 24.3 |
| | All farmers (n=76) | 19 | 25.0 |

Source: IER/ICRISAT Surveys, 2002.

## 4.6 Varietal origins

The focus group discussions asked farmers when commonly grown varieties were introduced into the sample villages. The responses were grouped as shown in Table 2.17, showing that the majority of varieties of each crop (54-66%) are considered as 'heritage' varieties that have been passed down from one generation to the next within the village. When local and modern varieties are compared, however,

**Table 2.17 Origin of millet, sorghum and cowpea varieties in the study villages**

| Crop type | Number of local and modern varieties | Heritage (%) | Introduced more than 20 years ago (%) | Introduced 10-20 years ago (%) | Introduced 1-10 years ago (%) |
|---|---|---|---|---|---|
| Millet | Local (n=55) | 66 | 18 | 9 | 7 |
| | Modern (n=12) | 0 | 0 | 17 | 83 |
| | All varieties (n=67) | 54 | 15 | 10 | 21 |
| Sorghum | Local (n=59) | 78 | 10 | 7 | 5 |
| | Modern (n=11) | 0 | 9 | 9 | 82 |
| | All varieties (n=70) | 66 | 10 | 7 | 17 |
| Cowpea | Local (n=53) | 64 | 8 | 17 | 11 |
| | Modern (n=8) | 0 | 0 | 0 | 100 |
| | All varieties (n=61) | 56 | 6 | 15 | 23 |

Source: IER/ICRISAT Surveys, 2002.

we see (as expected) that none of the modern varieties are heritage varieties, but have been introduced between 1 and 20 years ago. The majority (82-100%) of modern varieties for sorghum and millet and all cowpea varieties (100%) have been introduced within the past 10 years. For sorghum, however, we see that a small proportion of varieties (9%) have been introduced more than 20 years ago and the same proportion (9%) between 10 and 20 years ago. The introduction of modern millet varieties is comparatively more recent: 17% have been introduced 10-20 years ago. It is particularly important to note the dynamism inherent in the local varieties cultivated; new local varieties of each crop have been introduced within each time phase.

How were these varieties introduced into the villages? Farmers' responses were classified according 'informal systems' and 'formal systems' (Table 2.18). Informal systems include the actions of farmers and traders. Seed of a new variety might be brought into the village by a farmer who has been travelling and seen the crops growing elsewhere; visitors to the village might bring seeds or grains of new varieties as a gift to their host; new varieties might be purchased through traders in the village or at local markets.

Formal systems, on the other hand, include the efforts of the government, parastatals, and non-governmental organizations to promote the adoption of modern varieties, for example, through the Mali Cotton Company (CMDT), the Office of the Niger River, the Office of the Upper Niger River (OHVN) and Rural Development Offices (ODR). These agencies operate in what are referred to as 'supervised areas', where agricultural inputs, training and equipment are provided to farmers. The areas that benefited from the emergency seed distribution are low potential agricultural areas and are therefore either partially supervised or not supervised. However, research institutions and the SSN supply seed of modern varieties for experiments and multiplication in these areas. For example, villages like Falembougou in Mopti, Sérampara and Yarangabougou in Koulikoro contain producer groups who test and multiply seed for the SSN.

**Table 2.18 Comparative analysis of the introduction of varieties by crop according to systems**

| Village type | Number of varieties introduced by crop | Informal system | Formal system |
|---|---|---|---|
| Beneficiary village | Sorghum (n=28) | 54% | 46% |
| | Millet (n=32) | 66% | 34% |
| | Cowpea (n=24) | 50% | 50% |
| | All crops (n=84) | 57% | 43% |
| Non-beneficiary village | Sorghum (n=10) | 90% | 10% |
| | Millet (n=11) | 73% | 27% |
| | Cowpea (n=9) | 67% | 33% |
| | All crops (n=20) | 77% | 23% |

Source: IER/ICRISAT Surveys, 2002.

Table 2.18 above reveals that, for all crops surveyed, the majority of varieties (57% in the beneficiary villages and 77% in the non-beneficiary villages) were introduced through informal systems. The figures for the informal introduction of cowpea varieties is slightly less compared to sorghum and millet, both of which are traditional crops that are strongly integrated in the informal system. A comparison between beneficiary villages and non-beneficiary villages clearly shows that the introduction of varieties through formal systems is more frequent in the beneficiary villages (43%) than in the non-beneficiary villages (23%).

## 4.7 Summary: Crop diversity and the adoption of modern varieties

In this section we have seen that there is a diversity of crop varieties cultivated at village level, and that there is a dynamic change of varieties over time. The data gathered by the surveys in the sample villages show that about half of the varieties cultivated are heritage varieties, and that the other half have been introduced from outside. New varieties may be tested and not necessarily adopted, and adopted varieties may be abandoned or lost over time. New varieties – both local and modern – are introduced through formal and informal systems. Informal systems tend to be slower for the diffusion of varieties though effective over time. The spread of varieties in the informal system could be increased with additional information about the variety (ie, variety name and characteristics) since the farmers' awareness is key in ensuring that new varieties are adopted. Modern varieties must be tested at the local level, and targeted for dissemination in suitable areas. If a farmer accidentally loses a new variety, s/he must know where to find more seed of that variety.

# 5. Seed and varietal sources and dissemination channels

In this section we start by looking at the 2001/02 season to consider whether farmers obtained their seed on farm (ie, from their own previous season's harvest) or off farm. We then look in more detail at farmers' original seed sources to learn how farmers acquire seed of new varieties. For each variety that the farmer cultivated in 2001/02, we investigate how many years the farmer has been cultivating that particular variety, and from whom (eg, other farmers, traders, projects, etc), and where (eg, within the village, from the market, or elsewhere) and how (eg, for cash payment, exchange, etc) the seed was originally acquired. We then examine the ways in which farmers provide seed to other farmers. The case of MV sorghum in Koulikoro is reported in greater detail.

## 5.1 On-farm and off-farm seed

For all three crops surveyed, the majority of seed sown can be considered as 'on-farm' or 'own-saved' seed since it has been saved from the previous season's harvest from the farmer's own farm. Rates of seed saving vary however across the different crops. Survey results reveal that 79% of millet plots are sown with own-saved seed; 62% of sorghum plots are sown with own-saved seed; and 56% of cowpea plots are sown with own-saved seed. Cowpea seed is very hard to store, as it is prone to insect attack. For this reason, many farmers prefer to obtain seed from off-farm sources rather than store the seed themselves.

A comparison between seed-saving practices for local and modern varieties appears to suggest that seed of MVs tends to be obtained off farm rather than on farm (Annex 4). Seed-saving rates for MVs of each of the three crops are lower than for local varieties: 54% for millet, 46% for sorghum and 19% for cowpea. Although this could perhaps be explained by the fact that farmers are advised to replace the seed of MVs every three years, it is also possible that farmers are planting a particular MV for the first time, and therefore have no on-farm seed from the previous season.

## 5.2 Farmers' original variety sources

Here we explore the ways in which farmers acquire new varieties by looking at the original seed sources for the different varieties that they cultivate. We examine how the variety has been acquired, from whom and from where. In general, farmers inherit the varieties that they cultivate. We refer to

such varieties as 'heritage' varieties; the seed is given free to the farmer by their parents or other close relatives. Other mechanisms through which farmers can acquire seed of new varieties include: cash purchase, exchange of seeds for seeds, barter or the exchange of seeds for other products, free gift, and loan or credit. Seed of new varieties can be obtained from traders, from other farmers, from relatives, or from the formal seed sector (ie, seed project or NGO, including those providing seed following the 1997 drought). Since we are interested in the dissemination of modern varieties from one place to another, we also collected data on where the farmer originally acquired the variety; whether this was within the same village, from a neighboring village, or from the market place.

Table 2.19 illustrates the mechanisms through which survey farmers originally acquired the seed of their local and modern varieties. Table 2.20 shows who provided the seed and Table 2.21 shows where the seed was acquired. Annexes 5, 6 and 7 provide additional tables presenting the same data by region. For all three crops, the data clearly show that modern varieties have been incorporated into local seed systems. MV seed is sourced not only from formal sector projects or NGOs but also from traders, other farmers and relatives. This is particularly so for MV cowpea, which is predominantly sourced from traders and other farmers, either for cash or for free. For MV millet, on the other hand, the majority (74.4%) of seed has been acquired through the formal seed sector (ie, seed project or NGO), particularly in Mopti and Ségou regions (Annex 6).

In general, for all three crops, the majority of varieties are acquired from sources within the farmers' own village (Table 2.21), suggesting that there is limited spread of varieties from one village to the next, whether directly or through local markets. However, a comparison between local and modern varieties suggests that, for all crops, and especially sorghum and millet, MVs are obtained

**Table 2.19 Farmers' seed acquisition methods for original local and modern varieties**

| Crop type | Type of variety | | Purchase in cash | Exchange seeds against seeds | Barter, seeds against other products | Loan or credit | Free | Total |
|---|---|---|---|---|---|---|---|---|
| Millet | Local | Number | 26 | 38 | 2 | 1 | 184 | 251 |
| | | % | 10.4 | 15.1 | 0.8 | 0.4 | 73.3 | 100 |
| | Modern | Number | 5 | 4 | 0 | 0 | 32 | 41 |
| | | % | 12.2 | 9.8 | 0 | 0 | 78.0 | 100 |
| | Total | Number | 31 | 42 | 2 | 1 | 216 | 292 |
| | | % | 10.6 | 14.4 | 0.7 | 0.3 | 74.0 | 100 |
| Sorghum | Local | Number | 33 | 28 | 4 | 0 | 90 | 155 |
| | | % | 21.3 | 18.1 | 2.6 | 0 | 58.0 | 100 |
| | Modern | Number | 1 | 6 | 4 | 1 | 21 | 33 |
| | | % | 3.0 | 18.2 | 12.1 | 3.0 | 63.7 | 100 |
| | Total | Number | 34 | 34 | 8 | 1 | 111 | 188 |
| | | % | 18.1 | 18.1 | 4.3 | 0.5 | 59.0 | 100 |
| Cowpea | Local | Number | 64 | 13 | 1 | 2 | 114 | 194 |
| | | % | 33.0 | 6.7 | 0.5 | 1.0 | 58.8 | 100 |
| | Modern | Number | 7 | 2 | 1 | 0 | 17 | 27 |
| | | % | 25.9 | 7.4 | 3.7 | 0 | 63.0 | 100 |
| | Total | Number | 71 | 15 | 2 | 2 | 131 | 221 |
| | | % | 32.1 | 6.8 | 0.9 | 0.9 | 59.3 | 100 |

**Table 2.20 Farmers' original seed sources for local and modern varieties**

| Crop type | Type of variety | | From a trader | From a colleague farmer | From a parent or close relative | From a project or organization | Total |
|---|---|---|---|---|---|---|---|
| Millet | Local | Number | 25 | 41 | 160 | 0 | 226 |
| | | % | 11.1 | 18.1 | 70.8 | 0 | 100.0 |
| | Modern | Number | 2 | 3 | 5 | 29 | 39 |
| | | % | 5.1 | 7.7 | 12.8 | 74.4 | 100.0 |
| | Total | Number | 27 | 44 | 165 | 29 | 265 |
| | | % | 10.2 | 16.6 | 62.3 | 10.9 | 100.0 |
| Sorghum | Local | Number | 30 | 42 | 74 | 0 | 146 |
| | | % | 20.5 | 28.8 | 50.7 | 0 | 100.0 |
| | Modern | Number | 2 | 10 | 3 | 17 | 32 |
| | | % | 6.3 | 31.2 | 9.4 | 53.1 | 100.0 |
| | Total | Number | 32 | 52 | 77 | 17 | 178 |
| | | % | 18.0 | 29.2 | 43.2 | 9.6 | 100.0 |
| Cowpea | Local | Number | 60 | 31 | 85 | 0 | 176 |
| | | % | 34.1 | 17.6 | 48.3 | 0 | 100.0 |
| | Modern | Number | 7 | 8 | 4 | 3 | 22 |
| | | % | 31.8 | 36.4 | 18.2 | 13.6 | 100.0 |
| | Total | Number | 67 | 39 | 89 | 3 | 198 |
| | | % | 33.9 | 19.7 | 44.9 | 1.5 | 100.0 |

Source: IER/ICRISAT Surveys, 2002.

**Table 2.21 Where farmers originally acquired seed of local and modern varieties**

| Crop type | Type of variety | | At the local market | In the village | In a neighboring village | Total |
|---|---|---|---|---|---|---|
| Millet | Local | Number | 16 | 177 | 40 | 233 |
| | | % | 6.9 | 76.0 | 17.1 | 100.0 |
| | Modern | Number | 2 | 22 | 14 | 38 |
| | | % | 5.3 | 57.9 | 36.8 | 100.0 |
| | Total | Number | 18 | 199 | 54 | 271 |
| | | % | 6.6 | 73.5 | 19.9 | 100.0 |
| Sorghum | Local | Number | 22 | 103 | 21 | 146 |
| | | % | 15.1 | 70.5 | 14.4 | 100.0 |
| | Modern | Number | 1 | 22 | 8 | 31 |
| | | % | 3.2 | 71.0 | 25.8 | 100.0 |
| | Total | Number | 23 | 125 | 29 | 177 |
| | | % | 13.0 | 70.6 | 16.4 | 100.0 |
| Cowpea | Local | Number | 39 | 117 | 25 | 181 |
| | | % | 21.5 | 64.7 | 13.8 | 100.0 |
| | Modern | Number | 3 | 11 | 3 | 17 |
| | | % | 17.6 | 64.8 | 17.6 | 100.0 |
| | Total | Number | 42 | 128 | 28 | 198 |
| | | % | 21.2 | 64.7 | 14.1 | 100.0 |

Source: IER/ICRISAT Surveys, 2002.

from neighboring villages more frequently than local varieties. This result is particularly important, showing that new varieties do indeed move from one village to another through informal systems.

## 5.3 The provision of seed by farmers to other farmers

As well as asking how farmers obtained the seed for the crops that they planted in the previous season, the survey also asked farmers whether or not they had provided seed of modern varieties to other farmers. Overall, for those farmers who had cultivated modern varieties, almost half (47%) reported to have given some seed to others (Table 2.22). The survey collected information both about the age, gender and wealth of farmers who provided seed to others and also of farmers who received the seed. In our sample, seed was generally provided to men rather than women (Annex 8), but this may be because most of the farmers interviewed were men. Had the sample included more women, one might expect to find that female farmers provide seed to other women. In general, farmers provided MV

**Table 2.22 Dissemination of MV seed by farmers to other farmers**

| Number of farmers per region | Yes | No |
|---|---|---|
| Koulikoro (n=24 farmers) | 58% | 42% |
| Ségou (n=25 farmers) | 44% | 56% |
| Mopti (n=19 farmers) | 37% | 63% |
| Total (n=68 farmers) | 47% | 53% |

Source: IER/ICRISAT Surveys, 2002

**Table 2.23 The relationship of farmers receiving seed from other farmers**

| Crop type | Region | | Parent/ close relative | Farmer/colleague | Seed group | Total |
|---|---|---|---|---|---|---|
| Millet | Ségou | Number | 9 | 2 | 0 | 11 |
| | | % | 82 | 18 | 0 | 100 |
| | Mopti | Number | 2 | 0 | 0 | 2 |
| | | % | 100 | 0 | 0 | 100 |
| | Total | Number | 11 | 2 | 0 | 13 |
| | | % | 85 | 15 | 0 | 100 |
| Sorghum | Koulikoro | Number | 15 | 19 | 1 | 35 |
| | | % | 43 | 54 | 3 | 100 |
| | Mopti | Number | 4 | 2 | 0 | 6 |
| | | % | 67 | 33 | 0 | 100 |
| | Total | Number | 19 | 21 | 1 | 41 |
| | | % | 46 | 51 | 2 | 100 |
| Cowpea | Ségou | Number | 0 | 1 | 0 | 1 |
| | | % | 0 | 100 | 0 | 100 |
| | Mopti | Number | 1 | 2 | 0 | 3 |
| | | % | 33 | 67 | 0 | 100 |
| | Total | Number | 1 | 3 | 0 | 4 |
| | | % | 25 | 75 | 0 | 100 |

millet seed to their close relatives rather than to other non-related farmers or seed groups[28] (Table 2.23). For sorghum and cowpea, however, farmers show a greater tendency to provide seed to non-relatives, though the number of cowpea cases is rather small and should not be regarded as conclusive.

In cases where seed is provided to a close relative, it is usually given as a gift. However, when it is given to non-relatives, it tends to be bartered or exchanged for some other product (Table 2.24). Sorghum is more likely to be exchanged than millet, which is often given as a gift. In general, seed transactions are most likely to occur between relatives of the same family, or between producers of the same village. However, it is not uncommon to see exchanges between producers of neighboring villages, particularly for sorghum (Table 2.25). In the case of our study, 4 beneficiary villages gave MV seeds to farmers in 17 other villages located at distances of between 2 and 20 km from the village. This has important implications regarding the dissemination of modern varieties, suggesting that farmers actively promote such dissemination.

What type of farmer is most likely to promote this dissemination of modern varieties? Survey results suggest that MV seed tends to be disseminated by adult farmers, as opposed to elderly farmers (Annex 8, Table A8.2) and – in the case of millet – by 'better-off farmers' as opposed to 'poorer farmers' (Table A8.3). For sorghum, there is no noticeable difference in the types of farmer willing to provide MV seed to others.

## 5.4 The spread of MV sorghum in Koulikoro

We now return to the case of MV sorghum in Koulikoro, as discussed earlier in subsection 4.4. Table 2.26 shows that out of the 29 sample farmers who had sown MV sorghum in Koulikoro, 59% were

**Table 2.24 Provision of MV seed by farmers through gift and barter**

| Crop type | Region | | Gift | Barter | Total |
|---|---|---|---|---|---|
| Millet | Ségou | Number | 8 | 3 | 11 |
| | | % | 73 | 27 | 100 |
| | Mopti | Number | 2 | 0 | 2 |
| | | % | 100 | 0 | 100 |
| | Total | Number | 10 | 3 | 13 |
| | | % | 77 | 23 | 100 |
| Sorghum | Koulikoro | Number | 18 | 16 | 34 |
| | | % | 53 | 47 | 100 |
| | Mopti | Number | 4 | 0 | 4 |
| | | % | 100 | 0 | 100 |
| | Total | Number | 22 | 16 | 38 |
| | | % | 58 | 42 | 100 |
| Cowpea | Ségou | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |
| | Mopti | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |
| | Total | Number | 2 | 0 | 2 |
| | | % | 100 | 0 | 100 |

Source: IER/ICRISAT Surveys, 2002.

28 Seed groups have been established in some villages as part of an externally-driven intervention (e.g. through an NGO or the National Seed Service). Seed groups are groups of farmers involved in the production, exchange and/or storage of seed.

**Table 2.25 Provision of MV seed by farmers according to the location of the recipient**

| Crop type | Region | | Within the village | From a neighboring village | Total |
|---|---|---|---|---|---|
| Millet | Ségou | Number | 5 | 6 | 11 |
| | | % | 45 | 55 | 100 |
| | Mopti | Number | 0 | 2 | 2 |
| | | % | 0 | 100 | 100 |
| | Total | Number | 5 | 8 | 13 |
| | | % | 38 | 62 | 100 |
| Sorghum | Koulikoro | Number | 25 | 9 | 34 |
| | | % | 74 | 26 | 100 |
| | Mopti | Number | 3 | 2 | 5 |
| | | % | 60 | 40 | 100 |
| | Total | Number | 28 | 11 | 39 |
| | | % | 72 | 28 | 100 |
| Cowpea | Ségou | Number | 0 | 1 | 1 |
| | | % | 0 | 100 | 100 |
| | Mopti | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |
| | Total | Number | 1 | 1 | 2 |
| | | % | 50 | 50 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table 2.26 Farmers' original seed sources for local and modern sorghum varieties in Koulikoro**

| Type of variety | | From a trader | From a colleague farmer | From a parent/close relative | From a project or organization | Total |
|---|---|---|---|---|---|---|
| Local | Number | 11 | 16 | 40 | 0 | 67 |
| | % | 16 | 24 | 60 | 0 | 100 |
| Modern | Number | 2 | 8 | 2 | 17 | 29 |
| | % | 7 | 28 | 7 | 59 | 100 |
| Total | Number | 13 | 24 | 42 | 17 | 96 |
| | % | 14 | 25 | 44 | 18 | 100 |

**Table 2.27 Acquisition methods for original local and modern sorghum varieties in Koulikoro**

| Type of variety | | Cash purchase | Exchange seeds against seeds | Barter seeds against other products | On credit | Gift | Total |
|---|---|---|---|---|---|---|---|
| Local | Number | 12 | 13 | 3 | 0 | 39 | 67 |
| | % | 18 | 19 | 4 | 0 | 59 | 100 |
| Modern | Number | 1 | 6 | 4 | 1 | 17 | 29 |
| | % | 3 | 21 | 14 | 3 | 59 | 100 |
| Total | Number | 13 | 19 | 7 | 1 | 56 | 96 |
| | % | 14 | 20 | 7 | 1 | 58 | 100 |

originally obtained from a project or seed organization (for free, within the village), and 28% were obtained through other farmers, either through exchange for other seed or for barter (Table 2.27). What is particularly interesting is that most of the farmers who obtained the seed from other farmers went to neighboring villages to get the seed (Table 2.28), showing that MV seed can effectively be disseminated across villages through informal seed systems.

When we examine the ways in which farmers provide MV seed to other farmers, for the case of sorghum in Koulikoro, we see that 58% of farmers reported to have provided MV seed to others (Table 2.22), and in most cases (54%) the seed was provided to another farmer or a relative (43%), as opposed to a seed group (3%) (Table 2.23). The seed was provided as a gift in 53% of cases, and through exchange in 47% of cases (Table 2.24). Contrary to expectations, most farmers who provided seed to others were less wealthy, poorer farmers from the adult age group (Table 2.29). One might expect that older, wealthier farmers would be most likely to provide seed to others, but given that the distribution targeted poorer farmers, it is perhaps not surprising to find that they also provided seed to others.

**Table 2.28 Where farmers in Koulikoro originally acquired local and modern sorghum varieties**

| Type of variety | | At the local market | In the village | From a neighboring village | Total |
|---|---|---|---|---|---|
| Local | Number | 7 | 55 | 4 | 66 |
| | % | 11 | 83 | 6 | 100 |
| Modern | Number | 1 | 19 | 8 | 28 |
| | % | 3 | 68 | 29 | 100 |
| Total | Number | 8 | 74 | 12 | 94 |
| | % | 8 | 79 | 13 | 100 |

**Table 2.29 Seed sources for sorghum according to wealth group of farmers in Koulikoro**

| Wealth group | Type of variety | | From a trader | From a colleague farmer | From a parent/close relative | From a project or an organization | Total |
|---|---|---|---|---|---|---|---|
| Poorer farmers | Local | Number | 5 | 7 | 20 | 0 | 32 |
| | | % | 15 | 22 | 63 | 0 | 100 |
| | Modern | Number | 0 | 3 | 2 | 14 | 19 |
| | | % | 0 | 16 | 11 | 74 | 100 |
| | Total | Number | 5 | 10 | 22 | 14 | 51 |
| | | % | 10 | 20 | 43 | 27 | 100 |
| Better-off farmers | Local | Number | 6 | 9 | 20 | 0 | 35 |
| | | % | 17 | 26 | 57 | 0 | 100 |
| | Modern | Number | 2 | 5 | 0 | 3 | 10 |
| | | % | 20 | 50 | 0 | 30 | 100 |
| | Total | Number | 8 | 14 | 20 | 3 | 45 |
| | | % | 18 | 31 | 44 | 7 | 100 |

## 5.5 Summary: Seed and varietal sources dissemination channels

Farmers commonly acquire their varieties through inheriting the seed from their parents or close relatives. While much of the MV seed being sown was provided through formal sector seed projects or organizations, MV seed is also acquired through traders and other farmers. In other words, MV seed

has been incorporated into farmer or informal seed systems. For millet and sorghum, once a farmer has adopted a new variety, seed is generally maintained from one season to the next by own production.

About half of the farmers sampled had given seed of modern varieties to other farmers. The diffusion of modern varieties is most successful where they are incorporated into informal systems of exchange. The data show that there are no significant differences for the adoption of modern varieties and the seed acquisition mechanisms for farmers with smaller and bigger cultivated areas. In the case of Koulikoro, however, it tended to be the less wealthy, adult farmers who were most likely to provide MV seed to other farmers (Table 2.30). This is because the 1998 Emergency Seed Project distribution targeted the less wealthy farmers.

**Table 2.30 Wealth and age group of farmers in Koulikoro providing MV seed to other farmers**

| Wealth group of farmer | Age group of farmer | | Total |
|---|---|---|---|
| | Adult[1] | Old[2] | |
| Poorer farmers | 7 | 1 | 8 |
| Percentage (%) | 87.5 | 12.5 | 100 |
| Better-off farmers | 1 | 4 | 5 |
| Percentage (%) | 20 | 80 | 100 |
| Total | 8 | 5 | 13 |
| Percentage (%) | 61.5 | 38.5 | 100 |

[1]Adult: under 50 [2]Old: above 50

## 6. Conclusions and recommendations

The results of the study suggest that MVs that are appropriate to the local agro-ecology are most likely to be adopted in areas where farmers are familiar with the varieties. In the case of Koulikoro, farmers were familiar with the MVs because they had been growing them prior to the 1998 Emergency Seed Project. Varietal diffusion through informal systems can be enhanced by encouraging more farmers to spread information and seed of MVs to others. The survey found that many farmers are already actively providing MV seed to other farmers, but more can be done to encourage other farmers to do the same.

Once farmers have adopted a new variety and it has become integrated into the farmer seed system, farmers can easily acquire the seed from other farmers, often for free. Thus, the demand for seed of a particular MV will decrease after farmers have adopted the variety and it has become widespread within the community. This has implications for the sustainability of seed multiplication projects at village level where farmers are expecting to sell the seed that they produce to other farmers.

The 1998 Emergency Seed Project was primarily intended to allow farmers access to modern varieties, not just a supply of 'seed'. A diversity of varieties on farm promotes resilience of farming systems. Each variety will perform differently under varying circumstances; therefore, by sowing several varieties, changes in environmental conditions may have a detrimental effect on one variety, but are unlikely to affect all varieties. Informal seed systems continue to function during a time of drought and are thought to be capable of allowing farmers to access seed during localized drought conditions. Reducing vulnerability to drought in the long-term requires on-farm diversity.

A number of recommendations can be made for enhancing the dissemination of modern varieties through informal systems, as follows:

- Develop appropriate varieties that meet farmer preferences.
- Promote MVs through information and by ensuring that farmers are aware of them.
- Support ways in which farmers can share information and seed of new varieties with their colleagues.

These points are further discussed below.

## 6.1 The development of appropriate varieties

Involving farmers in the breeding/selection process will help to ensure that the varieties developed are appropriate to farmers' needs. Participatory breeding methods, for example, allow for farmers to be involved in the breeding process much earlier, and on-farm testing allows farmers to become familiar with varieties, therefore helping to promote them. ICRISAT's sorghum program in Mali uses a participative selection process which allows farmers to be involved in defining the selection objectives through to the final phase of fixing the characteristics. Experimental farms are set up in villages where farmers can grow, observe, and appreciate these samples. Feedback from the farmers to the crop breeders allows for a more efficient breeding and adoption process.

## 6.2. Use of information to promote modern varieties

By 'information', we are referring to the knowledge of the existence of the variety, its local name, and its characteristics. Farmers are more likely to adopt a variety if they have some basic information about it. One way in which to promote the adoption of modern varieties, therefore, is to provide farmers with basic information about the existence of the variety, its local name, and its characteristics. Promoting MVs through the use of information can be done as part of the breeding process, where on-farm and participatory methods allow farmers to become familiar with the MV before it is released. In addition, situating demonstrations in locations where a maximum number of farmers can see them (eg, near roads/paths to markets) helps to make people aware of the variety. If farmers are allowed to access the seed outputs from demonstration plots then this will give them the opportunity to test the variety on their own farms. This can also be done through the sale of 'small seed packs'. MVs can also be promoted through the use of radio, extension systems, markets, and varietal fairs. For example, in Nara (Madina Kagoro) and Kolokani (Yarangabougou), SLACAER facilitated the sale of CSM 63 sorghum seed by packaging it in small packs that were provided to interested traders who then sold the seed packs to farmers.

## 6.3 Support dissemination of seed and information by farmers

If a popular new variety is multiplied by farmer seed groups or 'seed banks' to supply other farmers, one might expect that once all farmers wanting to grow this variety will have acquired the seed, the new variety will quickly become incorporated into local seed systems. In other words, off-farm demand for seed of a new variety lasts only until new varieties are incorporated into farmer seed systems. If the seed group continues to multiply the seed, they will find that they are no longer able to sell the seed since farmers can acquire the seed free from other farmers. In such a scenario, the only way the seed group will remain sustainable is by changing the varieties to be multiplied every 3-4 years.

Varietal 'fairs' are another mechanism by which farmers and the SSN can exchange information and seed for a range of local varieties and MVs. The Genetic Resources Unit (GRU) has organized

variety trade fairs where farmers can meet to share and exchange both information and seeds. Such variety exhibition trade fairs have taken place in Bla, Douentza, and Gao, also involving competitions and prizes for farmers. However, it is also necessary for farmers to be able to purchase or exchange seed of new varieties at these fairs.

## 6.4 Changes within the formal seed sector

Many of the recommendations above carry certain implications for change within the formal seed sector. For example, the advice concerning the replacement of seed every 3-4 years is only appropriate for those producing seed for the SSN. Sufficient basic seed of MVs must be produced by the formal sector for the promotion activities described above, and farmers must know where they can obtain seed of MVs. In order to enable farmers to ask for the specific variety that they require, MVs should be given local names that farmers can easily remember. The research sector must allow for the continuous creation of adapted varieties that meet farmer preferences. Finally, for varieties with a commercial grain market, policies should allow for private sector seed production, as described below.

## 6.5 Commercialized seed production

Since farmers are only likely to purchase seed on a regular basis if the output can be profitably sold (thus allowing for the purchase of the inputs), commercial seed production is only viable for those crops and those varieties for which the grain outputs can be sold on the commercial grain market. In Mali, such varieties currently include those that are used in agro-processing industries, eg, in biscuit production and the preparation of baby foods. In such cases, there is a need for the improved organization of seed commercialization channels at the local level to allow seed producers to be linked to selling outlets. Seed commercialization also requires the creation of a forum for the coordination and the promotion of regional exchanges in conformity with the clause of West African Monetary Union (WAMU) regarding the free circulation of goods and persons. This framework will allow the development of exchanges at all levels (research, seed multiplication and distribution) between the countries of the Sahel. Since this is beyond the remit of the present study, further research is necessary to elaborate these strategies within a detailed action plan. SG 2000 is presently involved in the commercialization of seed provision, through its involvement in millet grain purchasing for agro-processing.

# PART III:

# Informal mechanisms for the dissemination of crop varieties in Niger

Boureïma Kanfidéni, Halidou Dary and Catherine Longley

## 1. Introduction

### 1.1 Context and objectives of the study

Following the drought in the Sahel in 1997/98, the West and Central African Millet Research Network (WCAMRN) purchased and distributed cowpea, millet and sorghum seed to farmers affected by the drought in five Sahelian countries (Burkina Faso, Mali, Mauritania, Niger and Senegal). The project was implemented through a network of partners from non-governmental organizations (NGOs) and national agricultural research institutions who provided seed across two seasons in 1998 and 1999. Evaluations were undertaken following the emergency seed relief interventions in Mali and Niger revealing significant adoption of some of the modern varieties (MV) distributed by the project. The project was evaluated by Dr Seyni Hamadou, agro-economist at the Department of Research and Rural Economy (DÉCOR) of the National Institute for Agricultural Research of Niger (INRAN) in February 2000 and the results were presented at a workshop in May 2000 in Kollo, Niger.

The present study focuses on the informal mechanisms for the dissemination of crop varieties in the intervention areas of the project. A similar, comparative study was also undertaken in Mali, the results of which are reported in Part II of this report. The overall research project had three objectives:

1. To describe how informal seed exchange mechanisms have resulted in the dissemination of modern varieties of cowpea, millet, and sorghum in Mali and Niger.
2. To make recommendations to relief and development agencies on how informal seed exchange mechanisms can be strengthened.
3. To develop a sustainable system for breeder/foundation[29] seed production.

### 1.2 The Emergency Seed Project of 1998/99

The cropping season of 1997 was marked by a drought in all Sahelian countries where millet is the main crop. Millet production was considerably affected by the drought and this resulted in a substancial food and cereal reduction in the affected areas. In response to this situation the WCAMRN in coordination with its partners: WCASRN[30], RENACO[31], ICRISAT[32], and INTSORMIL-CRSP[33] developed a project entitled 'Fulfilling seed requirements in famine threatened areas in West Africa' referred to as 'Emergency Seed Project' in this report. The project was approved for funding by the

29 As noted in Part I emergency seed projects to promote diversity through the distribution of MVs must be linked to more permanent formal seed sector systems for the sustainable supply of MV seed.

30 West and Central African Sorghum Research Network

31 West and Central African Cowpea Research Network

32 International Crops Research Institute for the Semi-Arid Tropics

33 International Sorghum and Millet Collaborative Research Support Programme

United States Agency for International Development (USAID). The amount of US$250,000 was allocated to purchase 290 tons of millet, sorghum and cowpea seeds to be distributed in five Sahelian countries affected by the drought: Burkina Faso, Mali, Mauritania, Niger and Senegal.

The project in Niger was initiated as a result of a food crisis which was characterized by the scarcity of cereal crops in the rural markets. The project aimed to purchase and distribute millet, sorghum and cowpea seeds for the 1998 cropping season as well as to produce seed to be distributed to farmers for the 1999 season.

A project management committee was formed with representatives from INRAN, the Directorate for Agriculture, the Agro-Sylvo-Pastoral Project (PASP), World Vision, the Organization of volunteers of Niger for protecting the environment (ONVPE) and ICRISAT. The committee selected areas for emergency seed distribution according to the following criteria:

1. Evidence of food and seed scarcity due to the poor agricultural season.
2. The existence of a development partner in the affected area with experience in seed distribution and drought relief.
3. The motivation of the farmers in that area.

The districts of Dakoro (Maradi region), Téra (Tillabéry region) and Ouallam (Tillabéry region) were identified for project implementation.

Seeds suppliers in Maradi and Tillabéry region were identified and the Directorate for Agriculture conducted germination tests. Seed was then purchased for distribution: 40 tons of millet seed (HKP variety), 10 tons of cowpea (mainly TN 5-78 and TN 27-80 varieties), and 8 tons of sorghum (Mota Maradi variety).

World Vision and PASP were selected for project implementation in the field. Both NGOs had experience in emergency food aid, seed distribution and rural community development.

A Seed Management Committee was established in each village that benefited from the Emergency Seed Project to promote sustainability of the project. The Seed Management Committees were responsible for the distribution of seed and bound by an agreement with World Vision and PASP to ensure recovery of seed at a rate of 50% through the creation of seed banks. The seed banks were created by retaining 50% of all seed produced in the 1998 season, for distribution to other villages for sowing in the 1999 season. Those villages in turn created their own seed banks and helped other villages in the following season. Table 3.1 shows the number of beneficiary villages in 1998 and 1999.

Training was made available to farmers in seed production techniques and methods of conservation and storage of seed. Multiplication plots were established under control of the Village Seed Management Committee and some under control of individual farmers.

**Table 3.1 Number of beneficiary villages per district in 1998 and 1999**

| Region | District | 1998 | 1999 | Total |
|---|---|---|---|---|
| Tillabéry | Téra | 16 | 7 | 23 |
| | Ouallam | 9[1] | 0 | 9 |
| Maradi | Dakoro | 22 | 18[2] | 40 |
| Total | | 47 | 25 | 72 |

# 2. The study area and methodology

## 2.1 Survey planning and preparation

Preliminary meetings with each of the partners involved in the Emergency Seed Project were organized in order to inform and seek their support for the survey: the Directorate for Agriculture, the General Management of INRAN and PASP in Niamey and their field programs: the liaison bureau of PASP and World Vision.

Visits were made to the Liaison Office of PASP in Ouallam and to the villages of Boleizeido and Kounam (beneficiaries of the Emergency Seed Project) and Kaoura and Danga Daouda (non-beneficiary villages). In Téra district, World Vision was consulted and the villages of Tillim (a beneficiary village) and Tchibaré (non-beneficiary village) were visited.

Three survey tools were developed[34]: a village census form, a farmer questionnaire and a questionnaire for focus group discussions. Following discussions with individuals who had been involved in the implementation of the Emergency Seed Project 1998/99, it was agreed that the survey should cover each of the three intervention areas of the project. Eleven beneficiary villages were randomly selected from those villages that had been identified in the earlier project evaluation in 2000. Maps developed by ICRISAT/Sadoré were used to identify non-beneficiary villages located between 5 and 10 kilometres from each beneficiary village. In total 23 villages (11 beneficiary villages and 12 non-beneficiary villages) were included in the sample (Table 3.2).

**Table 3.2 Villages covered by the survey**

| District | Beneficiary villages | Non-beneficiary villages |
|---|---|---|
| Dakoro | Dan Dadji | Dogon Tachinbo |
| | Garin Gonaou | Dan Faroua |
| | Maiguiza | Tagaza |
| | Dan Dadi | Dan Falké |
| | Takalmaoua Sofoua | Dakoro Sofoua |
| | Maïbourgouma | Dogon Tapki |
| Ouallam | Guilman | Tolkoboye Fandobon |
| | Zimba | Déli Tondi Koira Tégui |
| | | Kaoura |
| Téra | Largadi | Tchibaré Téra |
| | Tillim | Tachindé |
| | Toumbindé | Lambangou |

## 2.2 Methodology

Following the preliminary meetings with partners, the survey tools were tested in the field, and supervisors and enumerators were trained. Interviewers undertook three days of training; two days were dedicated to theory and one to the practical use of the survey tools in Zimba village in Ouallam. Revision of the questionnaires took place during the theoretical sessions, and clarification of questions was covered in the practical session.

Three teams of interviewers were formed, one per area. In Dakoro, the team was made up of six enumerators and two supervisors; in Téra and Ouallam, the team comprised three enumerators and two

34 See annexes 1 and 2 for survey tools used in Mali. The survey tools used in Niger were very similar.

supervisors. Two survey managers monitored the survey process: one in Dakoro and the other for Téra and Ouallam. In each sample village 10 household heads were selected for the farmer questionnaire. The selection of these household heads was made through random sampling from a sample frame developed by the village census (Annex 13). The questionnaire was implemented among a sample of 230 households from 23 villages. Focus group discussions were undertaken in 12 of these villages (4 in Maradi; 3 in Ouallam; 5 in Téra).
Survey objectives were to examine when the MVs were adopted, how farmers acquired the MV seed, the mechanisms through which farmers distributed MV seed to other farmers, and the type of farmers most likely to disseminate MV seed.

# 3. Socio-economic information of the survey population

This section provides a description of the survey population in terms of socio-economic characteristics ie, age group, gender and relative wealth.

## 3.1 Socio-economic information of sample villages and Seed Management Committees

A village census form was used to collect data relating to the composition of the sample villages. The overall average number of households per sample village in the two regions was 144: Tillabéry region had an average number of 186 households per village; Maradi had an average number of 106 households per village. The census showed that 98.5% of household heads in the sample villages were male, with 65.0% of household heads aged between 26 and 49 years, as shown in Table 3.3.

The village census form was also used to examine the composition of the Village Seed Management Committees, who were responsible for managing the seed distributed by the Emergency Seed Project. In Maradi, the average number of household heads on the Village Seed Management Committee was 11.7, whereas in Tillabéry it was found to be 15.4. Assuming that all committee members were also household heads, the average size of the committee can be seen to reflect the comparative size of the village. Of the 12 sample villages with village seed committees, women household heads were members of the committees in only two villages (Dan Dadji and Maï Bourgouma in Maradi Region). In terms of age, the composition of the committees was biased against the younger household heads (Annex 9). As the report will show, however, the predominance of older men on the Village Seed Management Committees appears not to have restricted younger male farmers access to seed of the modern varieties.

**Table 3.3 Age groups of household heads in the sample villages (census)**

| Region | Youth (= 25 years) | | Adults (26-49 years) | | Elderly (50+ years) | |
|---|---|---|---|---|---|---|
| | Number | Percentage (%) | Number | Percentage (%) | Number | Percentage (%) |
| Maradi | 402 | 25.74 | 973 | 62.29 | 187 | 11.97 |
| Tillabéry | 318 | 19.80 | 1087 | 67.68 | 201 | 12.52 |
| Total | 720 | 22.73 | 2060 | 65.03 | 388 | 12.25 |

## 3.2 Socio-economic information of sample farmers

A total of 230 individual household heads (farmers) were interviewed: 226 were male and 4 were female (10 farmers per sample village in each of the 23 sample villages). The gender composition of 98.3% males in the sample mirrors the results of the census in that the vast majority of household heads are male. In terms of age, our sample included a slightly lower proportion of adult household heads than that of the village census (Table 3.4).

**Table 3.4 Age groups of sample farmers**

| Region | Youth (=25 years) | | Adults (26-49 years) | | Elderly (50+ years) | |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % |
| Maradi | 22 | 18.3 | 57 | 47.5 | 41 | 34.2 |
| Tillabéry | 13 | 11.8 | 62 | 56.4 | 35 | 31.8 |
| Total | 35 | 15.2 | 119 | 51.7 | 76 | 33.0 |

The survey collected information concerning the number and size of fields cultivated by the sample households in order to obtain an indication of their relative wealth. Table 3.5 shows that the maximum number of upland fields cultivated by farmers in Maradi is considerably higher than in Tillabéry, but that the average number of each type of field is only slightly higher in Maradi than in Tillabéry.

**Table 3.5 Average number of fields cultivated by sample farmers**

| Region | Upland fields | | | Lowland fields | | |
|---|---|---|---|---|---|---|
| | Min | Average | Max | Min | Average | Max |
| Maradi | 0 | 2.31 | 12 | 0 | 1.29 | 5 |
| Tillabéry | 0 | 2.13 | 5 | 0 | 0.89 | 4 |

Table 3.6 shows the size of the area cultivated by sample farmers in the two regions based on estimates given by the sample farmers. The total farm size is larger in Maradi than in Tillabéry. This is because in Tillabéry (and particularly in Téra), there is a greater tendency towards pastoralism than crop cultivation.

**Table 3.6 Average cultivated area by sample farmers**

| Region | Area of upland fields (ha) | | | Area of lowland fields (ha) | | | All fields (ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Min | Average | Max | Min | Average | Max | Min | Average | Max |
| Maradi | 0 | 6.78 | 30 | 0 | 4.63 | 50 | 1 | 11.42 | 80 |
| Tillabéry | 0 | 7.28 | 50 | 0 | 3.18 | 55 | 2 | 10.47 | 105 |

The figures for overall average farm size (the sum of the areas for upland fields and lowland fields) were used to distinguish ‘better-off farmers’ (ie, comparatively wealthier), those cultivating more than 10 ha, from ‘poorer farmers’ (comparatively less wealthy), those cultivating an area below

or equal to 10 ha. The distribution of the sample households according to these wealth criteria is shown in Table 3.7.

**Table 3.7 Wealth distribution of sample farmers**

| Region | Better-off farmers | | Poorer farmers | | Total | |
|---|---|---|---|---|---|---|
| | Number | % | Number | % | Number | % |
| Maradi | 51 | 41.46 | 72 | 58.54 | 123 | 100 |
| Tillabéry | 40 | 37.38 | 67 | 62.62 | 107 | 100 |
| Total | 91 | 39.57 | 139 | 60.43 | 230 | 100 |

# 4. Crop diversity and the use of modern varieties

This section examines the range and varieties of crops grown, and the adoption of modern varieties (MVs) following the distribution of seed by the Emergency Seed Project.

## 4.1 Crop diversity

The focus group discussions that were undertaken in 12 villages included details of the main crops cultivated for food and for sale in the village. The crops discussed by focus group participants are listed in order of their importance in Table 3.8. This shows that millet is the primary food crop and sorghum is a secondary food crop in both regions. The crops that are sold vary both between regions and villages; in Téra the sample villages were not within the cowpea producing area, however in Ouallam cowpea is the main cash crop.

**Table 3.8 Main crops cultivated in sample villages by region in order of importance**

| Region | Food crops | Cash crops |
|---|---|---|
| Maradi | Millet<br>Sorghum<br>Cowpea<br>Maize<br>Groundnut<br>Sesame<br>Sorrel (leaves)<br>Bambara groundnut | Groundnut<br>Cowpea<br>Cassava<br>Sorrel<br>Sesame<br>Sweet potato |
| Tillabéry | Millet<br>Sorghum<br>Cowpea<br>Maize<br>Groundnut<br>Sesame<br>Sorrel (leaves)<br>Bambara groundnut | Groundnut<br>Okra<br>Bambara groundnut<br>Cowpea<br>Sesame<br>Maize<br>Sorrel |

## 4.2 Varietal diversity

The survey collected detailed information regarding the three crops (millet, cowpea and sorghum) that were included in the emergency seed distribution. Table 3.9 shows data from the survey regarding the number of varieties that were sown by sample farmers in the 2001/02 season. According to the names

of varieties that were recorded as planted by sample farmers in the 2001/02 season it would appear that there is greater range of varieties cultivated in Maradi than Tillabéry. However, this difference relates to the way in which the two language groups of the survey regions recognize and name varieties. Among the Hausa language group of Maradi, farmers have names to distinguish varieties, whereas the Djerma speakers of Tillabéry refer to varieties primarily according to the color and shape of the grain or head, and its duration. The cowpea variety known as *doungouri kira* in Djerma simply means 'red cowpea'; *doungouri kara* is 'white cowpea' and *doungouri taria* is 'early cowpea'. In Lembangou village (Téra, Tillabéry), the name *hama kolgoto* was in fact used to refer to five different varieties of sorghum. During the preliminary field visit, it was also noted that in Tillim village (Téra, Tillabéry), the name *haini kiri* was used to refer to three different millet varieties. Annex 10 lists all the names of millet, cowpea and sorghum varieties reported to be cultivated by the sample farmers in each village in 2001/02.

**Table 3.9 Number of varieties cultivated by sample villages**

| Region | Millet | | Cowpea | | Sorghum | |
|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max |
| Maradi | 3 | 11 | 3 | 7 | 2 | 8 |
| Tillabéry | 2 | 8 | 2 | 4 | 2 | 5 |

## 4.3 Adoption and loss of varieties in the survey regions

Focus group discussions revealed that the varieties cultivated in the village have changed over time. Particularly in Maradi, a number of new varieties (both modern and local) have been introduced within living memory. At the same time, some low drought tolerant inherited varieties are becoming scarce due to changing climatic patterns.

In Tillabéry, among those varieties that were said to be cultivated less now than in the past is the millet variety *haini kira*. Though it is thought still to exist in mixture with other varieties, farmers reported that it has gradually been replaced by HKP, a more drought resistant millet variety. The cowpea variety *dunguri kira*, and the sorghum varieties *ting tanga*, *konkonguia* and *techetirou* are cultivated less now than in the past.

In Maradi farmers did not mention the loss of varieties but only the introduction of new varieties. The early-maturing millet variety *guerguera* is a local variety that was introduced 15-20 years ago from the Ader farmers of Tahoua Region; *maywa,* a long duration millet variety was introduced from Nigeria about 30 years ago. A number of different cowpea and sorghum varieties were bought from the local market town of Guidan Roumdji (on the main highway) and introduced between 2 and 20 years ago: cowpea varieties *dan kozagué* and the modern variety TN 27-80, and sorghum varieties *mota rouge, zaboua* and *Makaho da wayo.* Doukou Doukou (the location of one of the seed centres) was also a source of new varieties of millet and cowpea. It is important to note that in most cases the sample villages did not receive seed from the centre but from farmers living in the centre's neighborhood. This illustrates the effectiveness of informal seed diffusion mechanisms.

## 4.4 Varietal origins

Table 3.10 shows the ways in which varieties of millet, sorghum and cowpea were introduced into the 12 villages, based on information from the focus group discussions. There are more heritage varieties cultivated in Tillabéry. In Maradi there are more varieties introduced through informal channels; these were bought or exchanged with other farmers elsewhere or purchased from local markets.

**Table 3.10 Origin of millet, sorghum and cowpea varieties in the study villages**

| Region | | Millet | Cowpea | Sorghum | All crops |
|---|---|---|---|---|---|
| Maradi | Heritage | 4 | 3 | 5 | 12 |
| | Obtained through a development project (formal) | 1 | 2 | 2 | 5 |
| | Purchased or exchanged (informal) | 3 | 7 | 7 | 17 |
| Tillabéry | Heritage | 12 | 8 | 8 | 28 |
| | Obtained through a development project (formal) | 1 | 4 | 6 | 11 |
| | Purchased or exchanged (informal) | 0 | 3 | 2 | 5 |

The discussions indicated that varieties introduced by the formal sector were distributed through development projects or NGOs. Varieties introduced through informal mechanisms were from farmers who had brought the varieties back from elsewhere (Tables 3.18 and 3.20 and Annexes 11 and 12). This shows that farmers are passive recipients of new varieties in the formal sector, though active in the informal sector in finding new varieties. This has important implications regarding the demand for new varieties, which will be discussed further.

The difference in the varietal dynamics of the two study areas can be explained by the following:

1. The Hausa farmers of Maradi are more commercially oriented than the Djerma of Tillabéry and thus have greater access to new varieties through local markets and trade networks.
2. Access to new varieties in Maradi is enhanced by close family networks that exist between Maradi and Nigeria and Tahoua.
3. The Maradi sample area is located near to the Nigerian border, and the surrounding areas are predominantly agricultural, in contrast to Tillabéry, where the surrounding areas are largely pastoral, thus limiting the availability of new seed varieties among neighbors.

## 4.5 Cultivation of modern varieties by sample farmers

Sample farmers distinguished between those varieties that have been grown in the village for several generations (inherited) and those introduced from outside the village. Varieties introduced from outside may include MVs (from the formal seed sector) and local varieties (from other villages or regions), though farmers did not distinguish between modern varieties and local varieties[35].

MVs are often given local names that vary from place to place. For example, the millet variety HKP was referred to as *kolo haini* or *haini taria* in Tillabéry, and was known as *dan gouaki* or *dan projet* in Maradi as shown in Table 3.11. Some varieties were known as modern variety in one village, though were reported as a heritage variety in another village. For example, the millet variety known as *somno* was the local name for HKP by the Fulani agro-pastoralists of Toumbindé (Téra, Tillabéry), though *somno* also referred to a heritage variety in the village of Deli Tondi Koora Zeno (Ouallam, Tillabéry).

Of the 222 valid responses (from 230 farmers that were surveyed), 167 (75%) reported to cultivate at least one modern variety of either millet, cowpea or sorghum. Table 3.12 shows the numbers of farmers cultivating HKP (millet), TN5-78 (cowpea) and Mota Maradi (sorghum).

35 Exceptions are those varieties referred to as *Doukou Doukou* or *dan projet* which originated from the formal seed sector or were received from a government or NGO distribution project.

**Table 3.11 Local names for modern varieties, as reported by sample farmers**

| Crop | MV | Local names in Maradi (Hausa) | Local names in Tillabéry (Djerma) |
|---|---|---|---|
| Millet | HKP | dan gouaki | kolo haini |
| | | | bondaba |
| | | | HKP |
| | | | kola la |
| | | | CPT |
| Cowpea | TN 5-78 | jan wake | dan louma |
| | | dan zafi | dunguri tchirey |
| | | | gaia |
| | KVX 6G | | dunguri bera |
| | | | dunguri koira |
| | | | baboumbour |
| | TN 27-80 | | pompormaize |
| Sorghum | mota maradi | dja dawa | hama koira |
| | | fara dawa | hama tchirey |
| | | moto maradi | moto maradi |
| | | | haoussa hama |

**Table 3.12 Percentage of sample farmers cultivating specific modern varieties by region**

| Number of farmers per region | HKP | TN 5-78 | Mota Maradi |
|---|---|---|---|
| Maradi (n=116 farmers) | 67% | 63% | 29% |
| Tillabéry (n=106 farmers) | 13% | 50% | 7% |
| Total (n=222) | 41% | 57% | 19% |

Within Tillabéry region, Ouallam district had 98% of sample farmers who cultivated MVs (of any one of the three focus crops), whereas in Téra district, only 28.6% of sample farmers reported to cultivate modern varieties. The rate of MV adoption in Téra is thought to be low because the sample villages were predominantly Fulani agro-pastoralist settlements where the farmers had relatively little interest in cropping as compared to livestock herding.

## 4.6 MV use according to wealth and age of farmer

Although the data in table 3.13 might appear to suggest that the wealthier farmers are more likely to adopt MVs, this result might be biased by the fact that wealth categories are based on farm size. It is thought that the poorer farmers who have such low rates of MV adoption are in fact the agro-pastoralists of Téra. Table 3.13 shows the cultivation of MVs according to the relative wealth criteria.

Table 3.14 shows the number of sample farmers cultivating MVs according to their age. In Maradi, there is a slightly higher proportion of elderly farmers (50+ years) than adult farmers (26-49 years) who cultivated MVs, but it is the youth farmers (d”25 years) who are most likely to cultivate

**Table 3.13 Cultivation of MVs according to wealth group of farmer**

| Region | Wealth group of farmer | MVs are grown | | MVs are not grown | | Total | |
|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % |
| Maradi | Better-off farmers | 42 | 87.5 | 6 | 12.5 | 48 | 100 |
| | Poorer farmers | 60 | 88.2 | 8 | 11.8 | 68 | 100 |
| | All farmers | 102 | 87.9 | 14 | 12.1 | 116 | 100 |
| Tillabéry | Better-off farmers | 32 | 80.0 | 8 | 20.0 | 40 | 100 |
| | Poorer farmers | 33 | 50.0 | 33 | 50.0 | 66 | 100 |
| | All farmers | 65 | 61.3 | 41 | 38.7 | 106 | 100 |
| Total | Better-off farmers | 74 | 84.1 | 14 | 15.9 | 88 | 100 |
| | Poorer farmers | 93 | 69.4 | 41 | 30.6 | 134 | 100 |
| | All farmers | 167 | 75.2 | 55 | 24.8 | 222 | 100 |

**Table 3.14 Cultivation of MVs according to age group of farmer**

| Region | Farmers | MVs are grown | | MVs are not grown | | Total | |
|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % |
| Maradi | Youth [1] | 18 | 94.7 | 1 | 5.3 | 19 | 100 |
| | Adult [2] | 54 | 85.7 | 9 | 14.3 | 63 | 100 |
| | Elderly[3] | 30 | 88.2 | 4 | 11.8 | 34 | 100 |
| | All | 102 | 87.9 | 14 | 12.1 | 116 | 100 |
| Tillabéry | Youth | 8 | 66.7 | 4 | 33.3 | 12 | 100 |
| | Adult | 41 | 66.1 | 21 | 33.9 | 62 | 100 |
| | Elderly | 16 | 50.0 | 16 | 50.0 | 32 | 100 |
| | All | 65 | 61.3 | 41 | 38.7 | 106 | 100 |
| Total | Youth | 26 | 83.9 | 5 | 16.1 | 31 | 100 |
| | Adult | 95 | 76.0 | 30 | 24.0 | 125 | 100 |
| | Elderly | 46 | 69.7 | 20 | 30.3 | 66 | 100 |
| | All | 167 | 75.2 | 55 | 24.8 | 222 | 100 |

[1]Youth =25 [2]Adult 26-49 [3]Elderly 50+

MVs (94.7%). In Tillabéry, the proportion of youth and adult farmers cultivating MVs is approximately equal (66%), but the proportion of elderly farmers cultivating MVs is less (50%). As will be seen later, however, the elderly farmers have the greatest tendency to pass on MVs to other farmers.

## 4.7 Adoption of MV's distributed by the Emergency Seed Project of 1998/99

For each variety cultivated in the 2001/02 season, farmers were asked when they first started growing that variety. We were particularly interested to know whether farmers adopted the MVs distributed by the Emergency Seed Project (1998/99), and whether those farmers who did not benefit directly from the project may also have started growing the MVs.

Tables 3.15, 3.16, and 3.17 distinguish three time periods regarding the time at which each variety was first cultivated by the farmer:

1. Varieties that were first cultivated more than 4 years previous to the survey, ie, before the Emergency Seed Project.
2. Varieties that were first cultivated 4 years previous to the survey, ie, in 1998 (the first year of the project).
3. Varieties that were first cultivated less than 4 years previous to the survey, ie, subsequent to the Emergency Seed Project.

Tables 3.15, 3.16, and 3.17, show that 25.2% to 38.4% of millet, cowpea and sorghum varieties cultivated by sample farmers have been adopted within the past four years (ie, d•4 years previous to the survey). The tables indicate that farmers incorporate new varieties of cowpea and sorghum into their planting schemes more frequently than varieties of millet.

A comparison between local varieties and modern varieties shows that for all three crops, 55.9% to 72.9% of MVs were adopted more than four years ago. Thus, MVs were known in the case study villages before the Emergency Seed Project of 1998/99.

What is also notable is that the adoption of new varieties is not only restricted to MVs: 57.1% of cowpea and 53.1%[36] of sorghum varieties adopted in the past four years are local varieties while 57.4% of millet varieties adopted in the past four years are modern varieties. It would appear that even though farmers adopt new millet varieties less frequently than cowpea and sorghum (as mentioned before), it is more likely that the millet varieties will be modern varieties as opposed to local varieties.

**Table 3.15 Length of time that sample farmers have cultivated local and modern millet varieties**

| Region | Type of variety | | More than 4 years | For 4 years | Less than 4 years | Total |
|---|---|---|---|---|---|---|
| Maradi | Local varieties | Number | 89 | 11 | 24 | 124 |
| | | % | 71.8 | 8.9 | 19.3 | 100.0 |
| | MV | Number | 94 | 22 | 21 | 137 |
| | | % | 68.6 | 16.1 | 15.3 | 100.0 |
| | All varieties | Number | 183 | 33 | 45 | 261 |
| | | % | 70.1 | 12.6 | 17.3 | 100.0 |
| Tillabéry | Local varieties | Number | 117 | 5 | 6 | 128 |
| | | % | 91.4 | 3.9 | 4.7 | 100.0 |
| | MV | Number | 20 | 9 | 10 | 39 |
| | | % | 51.3 | 23.1 | 25.6 | 100.0 |
| | All varieties | Number | 137 | 14 | 16 | 167 |
| | | % | 82.0 | 8.4 | 9.6 | 100.0 |
| Total | Local varieties | Number | 206 | 16 | 30 | 252 |
| | | % | 81.8 | 6.4 | 11.8 | 100.0 |
| | MV | Number | 114 | 31 | 31 | 176 |
| | | % | 64.7 | 17.6 | 17.7 | 100.0 |
| | All varieties | Number | 320 | 47 | 61 | 428 |
| | | % | 74.8 | 11.0 | 14.2 | 100.0 |

36 These figures have been calculated by adding the number of variety types adopted four years ago and less than four years ago and calculating the percentages of each variety type. In the case of millet, for example, a total of 46 local variety types (16+30), and 62 MV types (31+31) were adopted within the past four years. In percentage terms, 42.6% of the total varieties adopted were local varieties and 57.4% were modern varieties.

**Table 3.16 Length of time that sample farmers have cultivated local and modern cowpea varieties**

| Region | Type of variety | | More than 4 years | For 4 years | Less than 4 years | Total |
|---|---|---|---|---|---|---|
| Maradi | Local varieties | Number | 105 | 9 | 37 | 151 |
| | | % | 69.5 | 6.0 | 24.5 | 100.0 |
| | MV | Number | 45 | 23 | 29 | 97 |
| | | % | 46.4 | 23.7 | 29.9 | 100.0 |
| | All varieties | Number | 150 | 32 | 66 | 248 |
| | | % | 60.5 | 12.9 | 26.6 | 100.0 |
| Tillabéry | Local varieties | Number | 60 | 33 | 10 | 103 |
| | | % | 58.3 | 32.0 | 9.7 | 100.0 |
| | MV | Number | 40 | 7 | 8 | 55 |
| | | % | 72.7 | 12.7 | 14.6 | 100.0 |
| | All varieties | Number | 100 | 40 | 18 | 158 |
| | | % | 63.3 | 25.3 | 11.4 | 100.0 |
| Total | Local varieties | Number | 165 | 42 | 47 | 254 |
| | | % | 64.9 | 16.5 | 18.6 | 100.0 |
| | MV | Number | 85 | 30 | 37 | 152 |
| | | % | 55.9 | 19.7 | 24.4 | 100.0 |
| | All varieties | Number | 250 | 72 | 84 | 406 |
| | | % | 61.6 | 17.7 | 20.7 | 100.0 |

**Table 3.17 Length of time that sample farmers have cultivated local and modern sorghum varieties**

| Region | Type of variety | | More than 4 years | For 4 years | Less than 4 years | Total |
|---|---|---|---|---|---|---|
| Maradi | Local varieties | Number | 46 | 13 | 44 | 103 |
| | | % | 44.7 | 12.6 | 42.7 | 100.0 |
| | MV | Number | 93 | 10 | 15 | 118 |
| | | % | 78.8 | 8.5 | 12.7 | 100.0 |
| | All varieties | Number | 139 | 23 | 59 | 221 |
| | | % | 62.9 | 10.4 | 26.7 | 100.0 |
| Tillabéry | Local varieties | Number | 14 | 2 | 4 | 20 |
| | | % | 70.0 | 10.0 | 20.0 | 100.0 |
| | MV | Number | 55 | 13 | 17 | 85 |
| | | % | 64.7 | 15.3 | 20.0 | 100.0 |
| | All varieties | Number | 69 | 15 | 21 | 105 |
| | | % | 65.7 | 14.3 | 20.0 | 100.0 |
| Total | Local varieties | Number | 60 | 15 | 48 | 123 |
| | | % | 48.8 | 12.2 | 39.0 | 100.0 |
| | MV | Number | 148 | 23 | 32 | 203 |
| | | % | 72.9 | 11.3 | 15.8 | 100.0 |
| | All varieties | Number | 208 | 38 | 80 | 326 |
| | | % | 63.8 | 11.7 | 24.5 | 100.0 |

The comparison between the two regions suggests that the Emergency Seed Project had greater impact in Tillabéry than Maradi in terms of the adoption of MV millet and sorghum; this is because a relatively higher proportion of farmers in Maradi had already adopted MV millet and sorghum prior to the project. In Tillabéry, cowpea is a cash crop and MVs had already been adopted before the Emergency Seed Project.

# 5. Varietal sources and dissemination channels

In this section we discuss where, how and from whom the sample farmers originally acquired the varieties that they cultivate. Tables 3.18, 3.19 and 3.20 present the survey results for millet. Similar tables for cowpea and sorghum can be found in Annexes 11 and 12 respectively.

## 5.1 Farmers' original variety sources

For both local varieties and modern varieties, in both regions surveyed, the main source of millet varieties is within the farmer's own village (Table 3.18). The same is true for sorghum (Table A12.1, Annex 12), but the market provides the main source for cowpea varieties in Maradi (Table A11.1, Annex 11). In general, farmers in Maradi acquire varieties from outside the village more than farmers in Tillabéry.

Most millet varieties are obtained from within the farmer's own village, usually as a gift (Table 3.19) from their parents or other close relatives (Table 3.20). Cowpea varieties, however, tend to be bought from traders, either within the village or at the local market (Tables A11.2 and A11.3, Annex

**Table 3.18 Where farmers originally acquired local and modern millet varieties**

| Region | Type of variety | | From a local market | In the village | From a neigh-boring village | Other | Total |
|---|---|---|---|---|---|---|---|
| Maradi | MV | Number | 16 | 78 | 37 | 6 | 137 |
| | | % | 11.7 | 56.9 | 27.0 | 4.4 | 100.0 |
| | Local varieties | Number | 25 | 69 | 29 | 1 | 124 |
| | | % | 20.2 | 55.6 | 23.4 | 0.8 | 100.0 |
| | All varieties | Number | 41 | 147 | 66 | 7 | 261 |
| | | % | 15.7 | 56.3 | 25.3 | 2.7 | 100.0 |
| Tillabéry | MV | Number | 5 | 29 | 2 | 3 | 39 |
| | | % | 12.8 | 74.4 | 5.1 | 7.7 | 100.0 |
| | Local varieties | Number | 11 | 113 | 4 | 0 | 128 |
| | | % | 8.6 | 88.3 | 3.1 | 0 | 100.0 |
| | All varieties | Number | 16 | 142 | 6 | 3 | 167 |
| | | % | 9.6 | 85.0 | 3.6 | 1.8 | 100 |
| Total | MV | Number | 21 | 107 | 39 | 9 | 176 |
| | | % | 11.9 | 60.8 | 22.2 | 5.1 | 100.0 |
| | Local varieties | Number | 36 | 182 | 33 | 1 | 252 |
| | | % | 14.3 | 72.2 | 13.1 | 0.4 | 100.0 |
| | All varieties | Number | 57 | 289 | 72 | 10 | 428 |
| | | % | 13.3 | 67.5 | 16.8 | 2.4 | 100.0 |

**Table 3.19 Farmers' seed acquisition methods for original millet varieties (local and modern)**

| Region | Type of variety | | Purchase in cash | Exchange seed against seed | Barter, seed against product | Loan or credit | Gift | Total |
|---|---|---|---|---|---|---|---|---|
| Maradi | MV | Number | 26 | 20 | 2 | 23 | 66 | 137 |
| | | % | 19.0 | 14.6 | 1.5 | 16.7 | 48.2 | 100.0 |
| | Local varieties | Number | 32 | 15 | 0 | 2 | 75 | 124 |
| | | % | 25.8 | 12.1 | 0 | 1.6 | 60.5 | 100.0 |
| | All varieties | Number | 58 | 35 | 2 | 25 | 141 | 261 |
| | | % | 22.2 | 13.4 | 0.8 | 9.6 | 54.0 | 100.0 |
| Tillabéry | MV | Number | 7 | 0 | 0 | 17 | 15 | 39 |
| | | % | 17.9 | 0 | 0 | 43.6 | 38.5 | 100.0 |
| | Local varieties | Number | 13 | 2 | 1 | 2 | 110 | 128 |
| | | % | 10.1 | 1.6 | 0.8 | 1.6 | 85.9 | 100.0 |
| | All varieties | Number | 20 | 2 | 1 | 19 | 125 | 167 |
| | | % | 12.0 | 1.2 | 0.6 | 11.4 | 74.8 | 100.0 |
| Total | MV | Number | 33 | 20 | 2 | 40 | 81 | 176 |
| | | % | 18.7 | 11.4 | 1.1 | 22.8 | 46.0 | 100.0 |
| | Local varieties | Number | 45 | 17 | 1 | 4 | 185 | 252 |
| | | % | 17.9 | 6.7 | 0.4 | 1.6 | 73.4 | 100.0 |
| | All varieties | Number | 78 | 37 | 3 | 44 | 266 | 428 |
| | | % | 18.2 | 8.6 | 0.7 | 10.3 | 62.2 | 100.0 |

**Table 3.20 Farmers' original seed sources for millet**

| Region | Type of variety | | From a trader | From another farmer | From a close relative | From a project or organization | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Maradi | MV | Number | 23 | 20 | 58 | 32 | 4 | 137 |
| | | % | 16.8 | 14.6 | 42.3 | 23.4 | 2.9 | 100.0 |
| | Local varieties | Number | 30 | 16 | 71 | 3 | 4 | 124 |
| | | % | 24.2 | 12.9 | 57.3 | 2.4 | 3.2 | 100.0 |
| | All varieties | Number | 53 | 36 | 129 | 35 | 8 | 261 |
| | | % | 20.3 | 13.8 | 49.4 | 13.4 | 3.1 | 100.0 |
| Tillabéry | MV | Number | 7 | 1 | 10 | 18 | 3 | 39 |
| | | % | 17.9 | 2.6 | 25.6 | 46.2 | 7.7 | 100.0 |
| | Local varieties | Number | 12 | 5 | 108 | 2 | 1 | 128 |
| | | % | 9.4 | 3.8 | 84.4 | 1.6 | 0.8 | 100.0 |
| | All varieties | Number | 19 | 6 | 118 | 20 | 4 | 167 |
| | | % | 11.4 | 3.6 | 70.6 | 12.0 | 2.4 | 100.0 |
| Total | MV | Number | 30 | 21 | 68 | 50 | 7 | 176 |
| | | % | 17.1 | 11.9 | 38.6 | 28.4 | 4.0 | 100.0 |
| | Local varieties | Number | 42 | 21 | 179 | 5 | 5 | 252 |
| | | % | 16.7 | 8.3 | 71.0 | 2.0 | 2.0 | 100.0 |
| | All varieties | Number | 72 | 42 | 247 | 55 | 12 | 428 |
| | | % | 16.8 | 9.8 | 57.7 | 12.9 | 2.8 | 100.0 |

11). Sorghum varieties tend to be received as gifts from parents or other close relatives; however, in Maradi there is a high proportion of sorghum varieties purchased from traders (Tables A12.2 and A12.3, Annex 12).

For each of the crops covered by the survey, in both locations, the acquisition of modern varieties broadly follows the same pattern as local varieties; however, modern varieties can also be obtained on loan or credit from seed projects or organizations. Projects and/or organizations appear to have had a greater impact in the adoption of MVs in Tillabéry than in Maradi, particularly for millet (Table 3.20).

## 5.2 Provision of MVs from farmer to farmer

The survey data showed that 167 or 75% of the farmers sampled reported to have cultivated at least one modern variety of either millet, cowpea of sorghum (Table 3.13). Of these, the majority reported to have given seed of modern varieties (any crop) to other farmers.

Table 3.21 shows the survey results according to the age groups of farmers that provide MV millet seed to other farmers. Table 3.22 provides information concerning the wealth group of farmers providing MV millet seed to other farmers. The results of both tables show that elderly farmers are more likely to give MV seed to others, as are wealthier farmers.

Those farmers who provided MV millet seed to other farmers were asked to give information regarding the gender, relationship and location (within or outside the village) of the recipient farmers. Table 3.23 shows the data for the age group of the providers and location of the recipients of MV millet seed. It suggests that most farmers receive their seed from within the village. However, it is the elderly who are more likely to give seed of new varieties to other farmers in other villages.

# 6. Farmers' seed sources for the 2001/02 cropping season

Tables 3.24 and 3.25 present survey data for the sources of millet, cowpea and sorghum seed sown by sample farmers in the 2001/02 cropping season. It should be noted that the data do not refer to seed

**Table 3.21 Age group of farmers providing MV millet seed to other farmers**

| Region | Age group | | Yes | No | Total |
|---|---|---|---|---|---|
| Maradi | Youth | Number | 12 | 7 | 19 |
| | | % | 63.2 | 36.8 | 100.0 |
| | Adult | Number | 45 | 18 | 63 |
| | | % | 71.4 | 28.6 | 100.0 |
| | Elderly | Number | 25 | 9 | 34 |
| | | % | 73.5 | 26.5 | 100.0 |
| | Total | Number | 82 | 34 | 116 |
| | | % | 70.7 | 29.3 | 100.0 |
| Tillabéry | Youth | Number | 8 | 4 | 12 |
| | | % | 66.7 | 33.3 | 100.0 |
| | Adults | Number | 49 | 13 | 62 |
| | | % | 79.0 | 21.0 | 100.0 |
| | Elderly | Number | 23 | 9 | 32 |
| | | % | 71.9 | 28.1 | 100.0 |
| | Total | Number | 80 | 26 | 106 |
| | | % | 75.5 | 24.5 | 100.0 |

**Table 3.22 Wealth group of farmers providing MV millet seed to other farmers**

| Region | Wealth group | | Yes | No | Total |
|---|---|---|---|---|---|
| Maradi | Poorer farmer | Number | 45 | 23 | 68 |
| | | % | 66.2 | 33.8 | 100.0 |
| | Better-off farmer | Number | 37 | 11 | 48 |
| | | % | 77.1 | 22.9 | 100.0 |
| | Total | Number | 82 | 34 | 116 |
| | | % | 70.7 | 29.3 | 100.0 |
| Tillabéry | Poorer farmer | Number | 44 | 22 | 66 |
| | | % | 66.7 | 33.3 | 100.0 |
| | Better-off farmer | Number | 36 | 4 | 40 |
| | | % | 90.0 | 10.0 | 100.0 |
| | Total | Number | 80 | 26 | 106 |
| | | % | 75.5 | 24.5 | 100.0 |

**Table 3.23 Age of providers and location of recipients of MV millet seed**

| Region | Age group of provider | | Recipients from within the village | Recipients from a neighboring village | Others | Total |
|---|---|---|---|---|---|---|
| Maradi | Youth | Number | 12 | 6 | 0 | 18 |
| | | % | 66.7 | 33.3 | 0 | 100.0 |
| | Adults | Number | 35 | 26 | 1 | 62 |
| | | % | 56.5 | 41.9 | 1.6 | 100.0 |
| | Elderly | Number | 13 | 14 | 0 | 27 |
| | | % | 48.1 | 51.9 | 0 | 100.0 |
| | Total | Number | 60 | 46 | 1 | 107 |
| | | % | 56.1 | 43.0 | 0.9 | 100.0 |
| Tillabéry | Youth | Number | 6 | 3 | 0 | 9 |
| | | % | 66.7 | 33.3 | 0 | 100.0 |
| | Adults | Number | 26 | 17 | 2 | 45 |
| | | % | 57.8 | 37.8 | 4.4 | 100.0 |
| | Elderly | Number | 16 | 15 | 0 | 31 |
| | | % | 51.6 | 48.4 | 0 | 100.0 |
| | Total | Number | 48 | 35 | 2 | 85 |
| | | % | 56.5 | 41.2 | 2.4 | 100.0 |

quantities but to a simple count of the seed sources cited per variety. We distinguish between on-farm or own-saved seed (ie, seed stored by the farmer from the previous harvest), and off-farm seed which the farmer has obtained from elsewhere (eg, through purchase or exchange, as gifts, or from a project or organization). Some farmers may not have saved sufficient seed of a particular variety from the previous harvest and therefore acquired additional seed from off-farm sources (this is indicated as 'both' in Tables 3.25 and 3.26).

**Table 3.24 On-farm and off-farm seed sources for millet, sorghum and cowpea (2001/02).**

| Region | Crop | | On-farm seed | Off-farm seed | Both | Total |
|---|---|---|---|---|---|---|
| Maradi | Millet | Number | 150 | 110 | 1 | 261 |
| | | % | 57.5 | 42.1 | 0.4 | 100.0 |
| | Cowpea | Number | 71 | 173 | 4 | 248 |
| | | % | 28.6 | 69.8 | 1.6 | 100.0 |
| | Sorghum | Number | 100 | 119 | 2 | 221 |
| | | % | 45.2 | 53.8 | 0.9 | 100.0 |
| Tillabéry | Millet | Number | 94 | 67 | 6 | 167 |
| | | % | 56.3 | 40.1 | 3.6 | 100.0 |
| | Cowpea | Number | 31 | 120 | 7 | 158 |
| | | % | 19.6 | 75.9 | 4.4 | 100.0 |
| | Sorghum | Number | 34 | 69 | 2 | 105 |
| | | % | 32.4 | 65.7 | 1.9 | 100.0 |
| Total | Millet | Number | 244 | 177 | 7 | 428 |
| | | % | 57.0 | 41.4 | 1.6 | 100.0 |
| | Cowpea | Number | 102 | 293 | 11 | 406 |
| | | % | 25.1 | 72.2 | 2.7 | 100.0 |
| | Sorghum | Number | 134 | 188 | 4 | 326 |
| | | % | 41.1 | 57.7 | 1.2 | 100.0 |

**Table 3.25 On-farm and off-farm millet seed sources according to wealth group of the farmer (2001/02)**

| Region | Wealth group | | On-farm | Off-farm | Both | Total |
|---|---|---|---|---|---|---|
| Maradi | Poorer farmers | Number | 78.0 | 67.0 | 0 | 145.0 |
| | | % | 53.8 | 46.2 | 0 | 100.0 |
| | Better-off farmers | Number | 72.0 | 43.0 | 1.0 | 116.0 |
| | | % | 62.1 | 37.1 | 0.9 | 100.0 |
| | Total | Number | 150.0 | 110.0 | 1.0 | 261.0 |
| | | % | 57.5 | 42.1 | 0.4 | 100.0 |
| Tillabéry | Poorer farmers | Number | 55.0 | 41.0 | 3.0 | 99.0 |
| | | % | 55.6 | 41.4 | 3.0 | 100.0 |
| | Better-off farmers | Number | 39.0 | 26.0 | 3.0 | 68.0 |
| | | % | 57.4 | 38.2 | 4.4 | 100.0 |
| | Total | Number | 94.0 | 67.0 | 6.0 | 167.0 |
| | | % | 56.3 | 40.1 | 3.6 | 100.0 |

A comparison of the seed sources for each of the three crops reveals that the seed management practices for the crops are very different:

- 57.0% of millet is planted from own-saved seed
- 25.1% of cowpea is planted from own-saved seed
- 41.1% of sorghum is planted from own-saved seed.

Millet is a staple food crop and farmers tend to save the seed from the previous season rather than spending money to purchase seed. The seed is usually dried well in the sun and can then be stored

safely. It is not threshed, since keeping it on the head reduces pest damage. Cowpea however, is grown largely as a cash crop, especially in Tillabéry. Cowpea seed is prone to insect attack; hence, farmers prefer to use some of the money from their cowpea sales to purchase seed each season. Sorghum is grown as a secondary crop in both of the survey regions. It tends to be cultivated in small quantities, often intercropped, and is not grown every season by all farmers. Therefore, the rates of seed saving are not as high as for millet.

Other surveys undertaken in Niger (Ndjeunga et al. 2000) and elsewhere (Tripp 2001) indicate that the figures for saving seed (on-farm seed) reported above are lower than might be expected, particularly for millet. It is possible that this particular question may have been misunderstood by the enumerators or the farmers, though the low rates of on-farm seed may perhaps also be explained by the low harvest of the previous season (2000), which was affected by drought. The survey villages fell within the areas most severely affected by the drought of 1997 and were most likely badly affected by the drought of 2000. Although the figures for on-farm seed may appear to be low, the overall pattern is as might be expected, with wealthier farmers displaying higher use of on-farm seed than poorer farmers (Table 3.25) suggesting that the data are largely accurate.

The survey data in Table 3.25 shows that the 'better-off farmers' (ie, those cultivating an area >10 ha and considered to be more wealthy) had higher rates of seed saving (on-farm seed source) than 'poorer farmers' (those cultivating an area <10 ha, comparatively less wealthy).

The survey data provide useful information regarding the nature of seed demand. Farmers prefer millet seed sourced on farm. Farmers tend to obtain cowpea seed off farm, usually purchased from a market. Sorghum seed is usually acquired from a neighbor, or purchased at a market. There is thus a higher demand for off-farm seed for cowpea and sorghum than for millet.

## 7. Conclusions

The data collected by the study show a number of differences in varietal diversity and farmer seed systems between the two regions that were surveyed. When based on the names of varieties cited by farmers, the range of millet, cowpea and sorghum varieties cultivated in Maradi is wider than in Tillabéry. However, this may be due to the way in which the Hausa farmers of Maradi and the Djerma farmers of Tillabéry distinguish crop varieties. The Djerma tend to use the same name to refer to a wide group of varieties with similar characteristics, in contrast to the Hausa who have individual names for individual varieties.

The Hausa in Maradi have a greater tendency to obtain new varieties (local and modern) from the local market and from neighboring villages. They are also better located for acquiring new varieties because the surrounding areas of the survey villages are agricultural (as opposed to pastoral in Tillabéry) and the economy is more market-oriented. The existence of an active market is thought to promote the spread and uptake of modern varieties. It is therefore recommended that the formal seed sector should take greater advantage of the local markets in disseminating seed of new varieties. The ways in which this might be done are discussed in the next section.

The level of MV adoption in Maradi is thought to be higher than in Tillabéry because the farmers in Maradi were already familiar with the MVs distributed by the Emergency Seed Project. In Tillabéry, the successful diffusion of the MV millet variety HKP is thought to relate to the early maturity of this variety, and its suitability to the local cropping system.

When examining the survey results in relation to the distribution of MVs among farmers by age and wealth grouping, 'better-off farmers' (those that are relatively more wealthy, cultivating >10 ha), and those who are older in age (elderly, 50+ years) are most likely to provide MV seed to other farmers. This is thought to be due to social customs and reciprocity.

Farmers who acquire new varieties through the informal sector are actively seeking new seed. In the formal seed sector, however, farmers are passive recipients of seed from an NGO or project. The survey findings suggest that there is an effective demand for new varieties suitable to local farming systems. They also indicate that more can be done to enable farmers to actively seek out new varieties for their farms rather than viewing farmers as passive recipients. For a farmer to actively seek out seed of a particular MV, the farmer should know of the existence of the MV; its characteristic features; its name; and where it can be obtained.

## 8. Recommendations

The adoption of modern varieties can be promoted through the use of information. By 'information' we are referring to the knowledge of the existence of the variety, its local name and its characteristics. The mass media (radio, television, newspapers, etc.) can be utilized to provide information about specific MVs. Similarly, appropriate and memorable names should be given to MVs, rather than using the number system utilized by researchers. A farmer can more easily request an MV seed by name if it is memorable or descriptive to that variety.

Farmers can be involved in the process of breeding and selection (ie, through participatory approaches) of a new MV, enabling the farmer to have some familiarity with the new variety to ensure fast adoption when it is released. Involvement of farmers in varietal demonstrations is another way of ensuring that farmers become aware of new or existing varieties. Farmers can also be provided with a small amount of seed for testing its suitability on their particular farms. By making seed available in small quantities, farmers do not have to waste their resources on growing a large quantity of a variety that might not perform well on their farm.

The survey results from Maradi region suggest that greater use can be made of local markets in promoting modern varieties. Seed fairs could be held at local markets, allowing farmers to access seed of new varieties (local and MV) with supporting information on those particular varieties. In addition, small seed packets can be sold through local traders, and demonstration plots can be set up at locations along main roads or footpaths used by farmers.

At the village level, farmer seed production groups should include farmers who are in the 'elderly' age group (50+ years) and within the 'better-off farmers' wealth group (cultivating >10 ha), as according to the survey these farmers are most likely to provide MV seed to other farmers. Where farmer seed groups have been established they should be made aware of the availability of MV seed through the formal seed sector, in order to refresh their stock or introduce newly released varieties.

# ANNEXES

## Annex 1. Questionnaire for sample farmers (Mali)

Republic of Mali
Ministry of Rural Development and Environment
Rural Economy Institute (IER)/ DNAMER/ ICRISAT/ ROCARS/ SSN
INFORMAL SEED SYSTEMS AND THE DISSEMINATION OF MODERN VARIETIES.

**Questionnaire nr 2: Farmer questionnaire**

**1**. a) Region: _____/_____/_____

b) Cercle: _____/_____/_____/

c) Arrond: _____/_____/_____/

d) Village: _____/_____/_____/

**2**. a) Name, first name(s) of the interviewer : _____

b) Date of the interview _____

**3.** a) Name, first name(s) of household head: _____

b) Gender of household head: Male =1 Female= 2 /——/

c) Age of farmer: /——/——/

d) How many fields do you usually cultivate? /——/——/

House fields /——/——/ Area /——/——/ ha

Bush fields /——/——/ Area /——/——/ ha

e) Are you a member of the Committee who organized the distribution of the emergency seeds in 1998/99?

Yes = 1 No = 2 /——/

**4**. Name the varieties (local and modern) of millet, cowpea and sorghum that you have grown the previous season (2001/02)? *For each variety, request the information required in the table below. Column 3: This information should not be obtained from the farmer.*

| Crop type (1) | Local name of the variety (2) | Type of Variety (3) | Farmers' original seed sources (4) | How many years did you grow this variety? (5) | Acquisition mechanism (6) | | |
|---|---|---|---|---|---|---|---|
| | | 1=local 2=modern | 1=on-farm 2=other sources 3=both | | A How | B From who | C Where |
| Millet | 1 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 2 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 3 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 4 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| Cowpea | 1 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 2 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 3 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| Sorghum | 1 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 2 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 3 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |
| | 4 | | /----/ | /----/----/ | /----/ | /----/ | /----/ |

**A: How?**
1 = Cash purchase
2 = Exchange seeds against seeds
3 = Barter, seeds against other products
4 = Loan or credit
5 = Free (gift or heritage)

**B: From who?**
1 = from a trader
2 = from a colleague farmer
3 = from a parent, close relative
4 = from a project or organization
5 = other, please specify:

**C: Where?**
1 = at the local market
2 = in the village
3 = in a neighboring village
4 = other, please specify:

**5. a)**. Question for the interviewer: Did the farmer cultivate modern varieties the previous season?

Yes = 1 No = 2 /——/

**b)** If yes, has the farmer given modern varieties cultivated on his fields to colleague farmers?

Yes = 1 No = 2 /——/

If yes, complete the table below (for modern varieties only)

| Crop type (1) | Name of the variety (2) | Number of receivers (3) | Relation between the receiver and the farmer (4) | Gender of the receiver 1 = male 2=female (5) | Location of the receiver (6) | Means of provision (7) |
|---|---|---|---|---|---|---|
| Millet | 1. ---------- | /-----/ | 1 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 2 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 3 /-----/ | /-----/ | /-----/ | /-----/ |
| | 2. ---------- | /-----/ | 1 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 2 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 3 /-----/ | /-----/ | /-----/ | /-----/ |
| Cowpea | 1.---------- | /-----/ | 1 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 2 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 3 /-----/ | /-----/ | /-----/ | /-----/ |
| Sorghum | ---------- | /-----/ | 1 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 2 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 3 /-----/ | /-----/ | /-----/ | /-----/ |
| | | | 4 /-----/ | /-----/ | /-----/ | /-----/ |

**(4) Relation**:

1= a parent, close relative
2= colleague farmer
3= seed group
4= other(s), please specify:

(**6) Location**:
1 = from the village
2 = from a neighboring village
3 = other(s), please specify:

**(7) Means**:
1 = gift
2 = loan
3 = sale
4 = barter
5 = other(s), please specify:

## Annex 2. Questionnaire for focus group discussions (Mali)

Republic of Mali
Ministry of Rural Development and Environment
Rural Economy Institute (IER)
DNAMER/ ICRISAT/ ROCARS

Informal seeds systems and the dissemination of modern varieties.

**Questionnaire nr 1: Village Group Discussions**

**1**. a) Name and first name of facilitator of the group discussion: _____

b) Name and first name of the informant: _____

c) Date: _____

**2.** a) Region: _____

b)Cercle: _____

c) Arrondissement: _____

d) Village: _____

e)Position (GPS): _____

f)Composition of the discussion group
*(Counts should be made at the beginning of the discussion)*

i) Men /____ /____ /____/

ii) Women /____ /____ /____/

Total /____ /____ /____/

**3.** a) Which food crops do you grow?

_____

_____

_____

b) Which cash crops do you grow?

_____
_____
_____

**4.** What are the different seed varieties per crop (millet, cowpea, sorghum) that are used in your village? *(For each variety, indicate since when this variety cultivated in your village, and how the farmer obtained this variety?)*

**a. Millet**

| Varieties cultivated | How obtained? | Since when? | Other information: |
|---|---|---|---|
| | | | |

Other comments: _____

**b. Cowpea**

| Varieties cultivated | How obtained? | Since when? | Other information: |
|---|---|---|---|
| | | | |

Other comments:_____

**c. Sorghum**

| Varieties cultivated | How obtained? | Since when? | Other information: |
|---|---|---|---|
| | | | |

Other comments:_____

**5.** Are any organizations (past and present) in the village involved in agricultural activities and/or seed production?

Yes or No: _____

*If yes, name of the organization; crop cultivated; local name of the variety; year of introduction.*

| Name of the organization | Crop cultivated | Variety | Year of introduction |
|---|---|---|---|
| | | | |

**6.** Questions for beneficiary villages of the Emergency Seed Project of 1998 and/or 1999: *If the village did not benefit proceed to question 8.*

**a) Millet seed:**

1. Which variety is distributed?
   _____
2. What is the quantity of seeds distributed the first year?
   _____
3. What are the local names for the distributed variety?
   _____
4. How many farmers have cultivated this variety the first year?
   _____
5. How many farmers are cultivating this variety today?
   _____

**b) Sorghum seed:**

1. Which variety is distributed?
   _____
2. What was the quantity of seeds distributed the first year?
   _____
3. What are the local names for the distributed variety?
   _____
4. How many farmers have cultivated this variety the first year?
   _____
6. How many farmers are cultivating this variety today?
   _____

**7.** Questions for villages having benefited from the Emergency Seed Project of 1998 and/or 1999:

**a)** Have the farmers of this village given seeds obtained from the emergency seed distribution to farmers from neighboring villages?

Yes or No: _____

**b)** If yes, list the name of these villages and their distance approximately to your village:

| Name | Distance (km) |
|---|---|
| | |

**8.** Questions for non-beneficiary villages of the Emergency Seed Project of 1998 and/or 1999:

**a)** Are you aware of the emergency seed distribution in your area?

Yes or No: _____

**b)** If yes, have you used these seeds?

Yes or No: _____

**c)** If yes, what type of seeds have you used?

| Number of farmers cultivating the variety | Crop type | Variety |
|---|---|---|
| | | |

**d)** How did you obtain these varieties?

| Cultivated varieties | Since when? | How did you obtain the variety? |
|---|---|---|
| | | |

**9.** Composition of the group discussion (counts should be made at the end)

i) Men /...../...../...../

ii) Women /...../...../...../

Total /...../...../...../

## Annex 3. Use of local and modern varieties according to wealth of farmer (Mali)

**Table A3.1 Millet: Use of local and modern varieties according to wealth of farmers**

| Region | Wealth group of farmer | | Local variety | Modern variety | Total |
|---|---|---|---|---|---|
| Koulikoro | Poorer farmers | Number | 45 | 1 | 46 |
| | | % | 98 | 2 | 100 |
| | Better-off farmers | Number | 47 | 2 | 49 |
| | | % | 96 | 4 | 100 |
| | Total | Number | 92 | 3 | 95 |
| | | % | 97 | 3 | 100 |
| Ségou | Poorer farmers | Number | 39 | 9 | 48 |
| | | % | 81 | 19 | 100 |
| | Better-off farmers | Number | 34 | 17 | 51 |
| | | % | 67 | 33 | 100 |
| | Total | Number | 73 | 26 | 99 |
| | | % | 74 | 26 | 100 |
| Mopti | Poorer farmers | Number | 56 | 5 | 61 |
| | | % | 92 | 8 | 100 |
| | Better-off farmers | Number | 32 | 7 | 39 |
| | | % | 82 | 18 | 100 |
| | Total | Number | 88 | 12 | 100 |
| | | % | 88 | 12 | 100 |

**Table A3.2 Sorghum: Use of local and modern varieties according to wealth of farmer**

| Region | Wealth group of farmer | | Local variety | Modern variety | Total |
|---|---|---|---|---|---|
| Koulikoro | Poorer farmers | Number | 32 | 19 | 51 |
| | | % | 63 | 37 | 100 |
| | Better-off farmers | Number | 35 | 10 | 45 |
| | | % | 78 | 22 | 100 |
| | Total | Number | 67 | 29 | 96 |
| | | % | 70 | 30 | 100 |
| Ségou | Poorer farmers | Number | 15 | 0 | 15 |
| | | % | 100 | 0 | 100 |
| | Better-off farmers | Number | 23 | 1 | 24 |
| | | % | 96 | 4 | 100 |
| | Total | Number | 38 | 1 | 39 |
| | | % | 97 | 3 | 100 |
| Mopti | Poorer farmers | Number | 30 | 2 | 32 |
| | | % | 94 | 6 | 100 |
| | Better-off farmers | Number | 23 | 2 | 25 |
| | | % | 92 | 8 | 100 |
| | Total | Number | 53 | 4 | 57 |
| | | % | 93 | 7 | 100 |

**Table A3.3 Cowpea: Use of local and modern varieties according to wealth of farmer**

| Region | Wealth group of farmer | | Local variety | Modern variety | Total |
|---|---|---|---|---|---|
| Koulikoro | Poorer farmers | Number | 33 | 1 | 34 |
| | | % | 97 | 3 | 100 |
| | Better-off farmers | Number | 32 | 4 | 36 |
| | | % | 89 | 11 | 100 |
| | Total | Number | 65 | 5 | 70 |
| | | % | 93 | 7 | 100 |
| Ségou | Poorer farmers | Number | 41 | 1 | 42 |
| | | % | 98 | 2 | 100 |
| | Better-off farmers | Number | 40 | 4 | 44 |
| | | % | 91 | 9 | 100 |
| | Total | Number | 81 | 5 | 86 |
| | | % | 94 | 6 | 100 |
| Mopti | Poorer farmers | Number | 31 | 10 | 41 |
| | | % | 76 | 24 | 100 |
| | Better-off farmers | Number | 18 | 6 | 24 |
| | | % | 75 | 25 | 100 |
| | Total | Number | 49 | 16 | 65 |
| | | % | 75 | 25 | 100 |

# Annex 4. On-farm and off-farm seed sourcing (Mali)

**Table A4.1 On-farm and off-farm seed sources for millet**

| Region | Type of variety | | On-farm | Off- farm | Both | Total |
|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 82 | 10 | 0 | 92 |
| | | % | 89 | 11 | 0 | 100 |
| | Modern | Number | 1 | 2 | 0 | 3 |
| | | % | 33 | 67 | 0 | 100 |
| | Total | Number | 83 | 12 | 0 | 95 |
| | | % | 87 | 13 | 0 | 100 |
| Ségou | Local | Number | 59 | 14 | 0 | 73 |
| | | % | 81 | 19 | 0 | 100 |
| | Modern | Number | 18 | 7 | 1 | 26 |
| | | % | 69 | 27 | 4 | 100 |
| | Total | Number | 77 | 21 | 1 | 99 |
| | | % | 78 | 21 | 1 | 100 |
| Mopti | Local | Number | 69 | 16 | 3 | 88 |
| | | % | 78 | 18 | 3 | 100 |
| | Modern | Number | 3 | 9 | 0 | 12 |
| | | % | 25 | 75 | 0 | 100 |
| | Total | Number | 72 | 25 | 3 | 100 |
| | | % | 72 | 25 | 3 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A4.2 On-farm and off-farm seed sources for sorghum**

| Region | Type of variety | | On-farm | Off-farm | Both | Total |
|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 50 | 17 | 0 | 67 |
| | | % | 75 | 25 | 0 | 100 |
| | Modern | Number | 14 | 13 | 2 | 29 |
| | | % | 48 | 45 | 7 | 100 |
| | Total | Number | 64 | 30 | 2 | 96 |
| | | % | 67 | 31 | 2 | 100 |
| Ségou | Local | Number | 18 | 21 | 0 | 39 |
| | | % | 46 | 54 | 0 | 100 |
| | Modern | Number | 1 | 0 | 0 | 1 |
| | | % | 100 | 0 | 0 | 100 |
| | Total | Number | 19 | 21 | 0 | 40 |
| | | % | 48 | 53 | 0 | 100 |
| Mopti | Local | Number | 34 | 15 | 2 | 51 |
| | | % | 67 | 29 | 4 | 100 |
| | Modern | Number | 0 | 2 | 1 | 3 |
| | | % | 0 | 67 | 33 | 100 |
| | Total | Number | 34 | 17 | 3 | 54 |
| | | % | 63 | 31 | 6 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A4.3 On-farm and off-farm seed sources for cowpea**

| Region | Type of variety | | On-farm | Off-farm | Both | Total |
|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 35 | 30 | 0 | 65 |
| | | % | 54 | 46 | 0 | 100 |
| | Modern | Number | 0 | 5 | 0 | 5 |
| | | % | 0 | 100 | 0 | 100 |
| | Total | Number | 35 | 35 | 0 | 70 |
| | | % | 50 | 50 | 0 | 100 |
| Ségou | Local | Number | 53 | 26 | 2 | 81 |
| | | % | 65 | 32 | 2 | 100 |
| | Modern | Number | 2 | 4 | 0 | 6 |
| | | % | 33 | 67 | 0 | 100 |
| | Total | Number | 55 | 30 | 2 | 87 |
| | | % | 63 | 34 | 2 | 100 |
| Mopti | Local | Number | 32 | 17 | 0 | 49 |
| | | % | 65 | 35 | 0 | 100 |
| | Modern | Number | 3 | 13 | 0 | 16 |
| | | % | 19 | 81 | 0 | 100 |
| | Total | Number | 35 | 30 | 0 | 65 |
| | | % | 54 | 46 | 0 | 100 |

Source: IER/ICRISAT Surveys, 2002.

## Annex 5. Farmers' seed acquisition methods for original varieties (Mali)

**Table A5.1 Seed acquisition methods for original millet varieties (local and modern)**

| Region | Type of variety | | Cash purchase | Exchange seeds against seeds | Barter, seeds against other products | Loan or credit | Free | Total |
|---|---|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 6 | 6 | 1 | 0 | 78 | 91 |
| | | % | 7 | 7 | 1 | 0 | 86 | 100 |
| | Modern | Number | 2 | 0 | 0 | 0 | 1 | 3 |
| | | % | 67 | 0 | 0 | 0 | 33 | 100 |
| | Total | Number | 8 | 6 | 1 | 0 | 79 | 94 |
| | | % | 9 | 6 | 1 | 0 | 84 | 100 |
| Ségou | Local | Number | 2 | 26 | 1 | 0 | 44 | 73 |
| | | % | 3 | 36 | 1 | 0 | 60 | 100 |
| | Modern | Number | 3 | 4 | 0 | 0 | 19 | 26 |
| | | % | 12 | 15 | 0 | 0 | 73 | 100 |
| | Total | Number | 5 | 30 | 1 | 0 | 63 | 99 |
| | | % | 5 | 30 | 1 | 0 | 64 | 100 |
| Mopti | Local | Number | 18 | 6 | 0 | 1 | 62 | 87 |
| | | % | 21 | 7 | 0 | 1 | 71 | 100 |
| | Modern | Number | 0 | 0 | 0 | 0 | 12 | 12 |
| | | % | 0 | 0 | 0 | 0 | 100 | 100 |
| | Total | Number | 18 | 6 | 0 | 1 | 74 | 99 |
| | | % | 18 | 6 | 0 | 1 | 75 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A5.2 Seed acquisition methods for original sorghum varieties (local and modern)**

| Region | Type of variety | | Cash purchase | Exchange seeds against seeds | Barter, seeds against other products | Loan or credit | Free | Total |
|---|---|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 12 | 13 | 3 | 0 | 39 | 67 |
| | | % | 18 | 20 | 4 | 0 | 58 | 100 |
| | Modern | Number | 1 | 6 | 4 | 1 | 17 | 29 |
| | | % | 3 | 21 | 14 | 3 | 59 | 100 |
| | Total | Number | 13 | 19 | 7 | 1 | 56 | 96 |
| | | % | 14 | 20 | 7 | 1 | 58 | 100 |
| Ségou | Local | Number | 9 | 13 | 0 | 0 | 17 | 39 |
| | | % | 23 | 33 | 0 | 0 | 44 | 100 |
| | Modern | Number | 0 | 0 | 0 | 0 | 1 | 1 |
| | | % | 0 | 0 | 0 | 0 | 100 | 100 |
| | Total | Number | 9 | 13 | 0 | 0 | 18 | 40 |
| | | % | 23 | 33 | 0 | 0 | 45 | 100 |
| Mopti | Local | Number | 12 | 2 | 1 | 0 | 34 | 49 |
| | | % | 24 | 4 | 2 | 0 | 69 | 100 |
| | Modern | Number | 0 | 0 | 0 | 0 | 3 | 3 |
| | | % | 0 | 0 | 0 | 0 | 100 | 100 |
| | Total | Number | 12 | 2 | 1 | 0 | 37 | 52 |
| | | % | 23 | 4 | 2 | 0 | 71 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A5.3 Seed acquisition methods for original cowpea varieties (local and modern)**

| Region | Type of variety | | Cash purchase | Exchange seeds against seeds | Barter, seeds against other products | Loan or credit | Free | Total |
|---|---|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 12 | 13 | 3 | 0 | 39 | 67 |
| | | % | 18 | 19 | 4 | 0 | 58 | 100 |
| | Modern | Number | 1 | 6 | 4 | 1 | 17 | 29 |
| | | % | 3 | 21 | 14 | 3 | 59 | 100 |
| | Total | Number | 13 | 19 | 7 | 1 | 56 | 96 |
| | | % | 14 | 20 | 7 | 1 | 58 | 100 |
| Ségou | Local | Number | 9 | 13 | 0 | 0 | 17 | 39 |
| | | % | 23 | 33 | 0 | 0 | 44 | 100 |
| | Modern | Number | 0 | 0 | 0 | 0 | 1 | 1 |
| | | % | 0 | 0 | 0 | 0 | 100 | 100 |
| | Total | Number | 9 | 13 | 0 | 0 | 18 | 40 |
| | | % | 23 | 33 | 0 | 0 | 45 | 100 |
| Mopti | Local | Number | 12 | 2 | 1 | 0 | 34 | 49 |
| | | % | 24 | 4 | 2 | 0 | 69 | 100 |
| | Modern | Number | 0 | 0 | 0 | 0 | 3 | 3 |
| | | % | 0 | 0 | 0 | 0 | 100 | 100 |
| | Total | Number | 12 | 2 | 1 | 0 | 37 | 52 |
| | | % | 23 | 4 | 2 | 0 | 71 | 100 |

Source: IER/ICRISAT Surveys, 2002.

## Annex 6. Farmers' original variety sources (Mali)

**Table A6.1 Original variety sources for millet**

| Region | Type of variety | | From a trader | From a colleague/ farmer | From a parent/close relative | Project or organization | Total |
|---|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 7 | 8 | 75 | 0 | 90 |
| | | % | 8 | 9 | 83 | 0 | 100 |
| | Modern | Number | 2 | 0 | 1 | 0 | 3 |
| | | % | 67 | 0 | 33 | 0 | 100 |
| | Total | Number | 9 | 8 | 76 | 0 | 93 |
| | | % | 10 | 9 | 82 | 0 | 100 |
| Ségou | Local | Number | 3 | 27 | 37 | 0 | 67 |
| | | % | 4 | 40 | 55 | 0 | 100 |
| | Modern | Number | 0 | 3 | 2 | 21 | 26 |
| | | % | 0 | 12 | 8 | 81 | 100 |
| | Total | Number | 3 | 30 | 39 | 21 | 93 |
| | | % | 3 | 32 | 42 | 23 | 100 |
| Mopti | Local | Number | 15 | 6 | 48 | 0 | 69 |
| | | % | 22 | 9 | 70 | 0 | 100 |
| | Modern | Number | 0 | 0 | 2 | 8 | 10 |
| | | % | 0 | 0 | 20 | 80 | 100 |
| | Total | Number | 15 | 6 | 50 | 8 | 79 |
| | | % | 19 | 8 | 63 | 10 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A6.2 Original variety sources for sorghum**

| Region | Type of variety | | From a trader | From a colleague/ farmer | From a parent/ close relative | From a project or organization | Total |
|---|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 11 | 16 | 40 | 0 | 67 |
| | | % | 16 | 24 | 60 | 0 | 100 |
| | Modern | Number | 2 | 8 | 2 | 17 | 29 |
| | | % | 7 | 28 | 7 | 59 | 100 |
| | Total | Number | 13 | 24 | 42 | 17 | 96 |
| | | % | 14 | 25 | 44 | 18 | 100 |
| Ségou | Local | Number | 11 | 19 | 9 | 0 | 39 |
| | | % | 28 | 49 | 23 | 0 | 100 |
| | Modern | Number | 0 | 0 | 1 | 0 | 1 |
| | | % | 0 | 0 | 100 | 0 | 100 |
| | Total | Number | 11 | 19 | 10 | 0 | 40 |
| | | % | 28 | 48 | 25 | 0 | 100 |
| Mopti | Local | Number | 8 | 7 | 25 | 0 | 40 |
| | | % | 20 | 18 | 63 | 0 | 100 |
| | Modern | Number | 0 | 2 | 0 | 0 | 2 |
| | | % | 0 | 100 | 0 | 0 | 100 |
| | Total | Number | 8 | 9 | 25 | 0 | 42 |
| | | % | 19 | 21 | 60 | 0 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A6.3 Original variety sources for cowpea**

| Region | Type of Variety | | From a trader | From a colleague /farmer | From a parent/ close relative | From a project or organization | Total |
|---|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 25 | 6 | 33 | 0 | 64 |
| | | % | 39 | 9 | 52 | 0 | 100 |
| | Modern | Number | 5 | 0 | 0 | 0 | 5 |
| | | % | 100 | 0 | 0 | 0 | 100 |
| | Total | Number | 30 | 6 | 33 | 0 | 69 |
| | | % | 43 | 9 | 48 | 0 | 100 |
| Ségou | Local | Number | 25 | 23 | 29 | 0 | 77 |
| | | % | 32 | 30 | 38 | 0 | 100 |
| | Modern | Number | 1 | 3 | 1 | 1 | 6 |
| | | % | 17 | 50 | 17 | 17 | 100 |
| | Total | Number | 26 | 26 | 30 | 1 | 83 |
| | | % | 31 | 31 | 36 | 1 | 100 |
| Mopti | Local | Number | 10 | 2 | 23 | 0 | 35 |
| | | % | 29 | 6 | 66 | 0 | 100 |
| | Modern | Number | 1 | 5 | 3 | 2 | 11 |
| | | % | 9 | 45 | 27 | 18 | 100 |
| | Total | Number | 11 | 7 | 26 | 2 | 46 |
| | | % | 24 | 15 | 57 | 4 | 100 |

Source: IER/ICRISAT Surveys, 2002.

## Annex 7. Where farmers originally acquired varieties (Mali)

**Table A7.1 Where farmers originally acquired millet varieties**

| Region | Type of variety | | At the local market | In the village | In a neighboring village | Total |
|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 4 | 82 | 4 | 90 |
| | | % | 4 | 91 | 4 | 100 |
| | Modern | Number | 2 | 0 | 0 | 2 |
| | | % | 100 | 0 | 0 | 100 |
| | Total | Number | 6 | 82 | 4 | 92 |
| | | % | 7 | 89 | 4 | 100 |
| Ségou | Local | Number | 2 | 59 | 12 | 73 |
| | | % | 3 | 81 | 16 | 100 |
| | Modern | Number | 0 | 20 | 6 | 26 |
| | | % | 0 | 77 | 23 | 100 |
| | Total | Number | 2 | 79 | 18 | 99 |
| | | % | 2 | 80 | 18 | 100 |
| Mopti | Local | Number | 10 | 36 | 24 | 70 |
| | | % | 14 | 51 | 34 | 100 |
| | Modern | Number | 0 | 2 | 8 | 10 |
| | | % | 0 | 20 | 80 | 100 |
| | Total | Number | 10 | 38 | 32 | 80 |
| | | % | 13 | 48 | 40 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A7.2 Where farmers originally acquired sorghum varieties**

| Region | Type of variety | | At the local market | In the village | In a neighboring village | Total |
|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 7 | 55 | 4 | 66 |
| | | % | 11 | 83 | 6 | 100 |
| | Modern | Number | 1 | 19 | 8 | 28 |
| | | % | 4 | 68 | 29 | 100 |
| | Total | Number | 8 | 74 | 12 | 94 |
| | | % | 9 | 79 | 13 | 100 |
| Ségou | Local | Number | 10 | 20 | 9 | 39 |
| | | % | 26 | 51 | 23 | 100 |
| | Modern | Number | 0 | 1 | 0 | 1 |
| | | % | 0 | 100 | 0 | 100 |
| Mopti | Local | Number | 5 | 28 | 8 | 41 |
| | | % | 12 | 68 | 20 | 100 |
| | Modern | Number | 0 | 2 | 0 | 2 |
| | | % | 0 | 100 | 0 | 100 |
| | Total | Number | 5 | 30 | 8 | 43 |
| | | % | 12 | 70 | 19 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A7.3 Where farmers originally acquired cowpea varieties**

| Region | Type of variety | | At the local market | In the village | In a neighboring village | Total |
|---|---|---|---|---|---|---|
| Koulikoro | Local | Number | 17 | 39 | 8 | 64 |
| | | % | 27 | 61 | 13 | 100 |
| | Modern | Number | 2 | 0 | 0 | 2 |
| | | % | 100 | 0 | 0 | 100 |
| | Total | Number | 19 | 39 | 8 | 66 |
| | | % | 29 | 59 | 12 | 100 |
| Ségou | Local | Number | 18 | 54 | 9 | 81 |
| | | % | 22 | 67 | 11 | 100 |
| | Modern | Number | 1 | 4 | 1 | 6 |
| | | % | 17 | 67 | 17 | 100 |
| | Total | Number | 19 | 58 | 10 | 87 |
| | | % | 22 | 67 | 11 | 100 |
| Mopti | Local | Number | 4 | 24 | 8 | 36 |
| | | % | 11 | 67 | 22 | 100 |
| | Modern | Number | 0 | 7 | 2 | 9 |
| | | % | 0 | 78 | 22 | 100 |
| | Total | Number | 4 | 31 | 10 | 45 |
| | | % | 9 | 69 | 22 | 100 |

Source: IER/ICRISAT Surveys, 2002.

# Annex 8. Provision of MV seed by farmers to other farmers (Mali)

**Table A8.1 Farmers' provision of MV seed according to the gender of the recipient**

| Region | Crop | Gender | Number | Percentage (%) |
|---|---|---|---|---|
| Koulikoro | Sorghum | Men | 13 | 92.86 |
| | | Women | 1 | 7.14 |
| | | Total | 14 | 100.00 |
| Ségou | Millet | Men | 11 | 100.00 |
| | Cowpea | Men | 1 | 100.00 |
| Mopti | Sorghum | Men | 5 | 83.33 |
| | | Women | 1 | 16.67 |
| | | Total | 6 | 100.00 |
| | Millet | Men | 3 | 100.00 |
| | Cowpea | Men | 1 | 50.00 |
| | | Women | 1 | 50.00 |
| | | Total | 2 | 100.00 |

Source: IER/ICRISAT Surveys, 2002.

**Table A8.2 Farmers' provision of MV seed according to age group of provider**

| Crop type | Age group | | Yes | No | Total |
|---|---|---|---|---|---|
| Millet | Adult | Number | 9 | 7 | 16 |
| | | % | 56 | 44 | 100 |
| | Elderly | Number | 4 | 19 | 23 |
| | | % | 17 | 83 | 100 |
| | Total | Number | 13 | 26 | 39 |
| | | % | 33 | 67 | 100 |
| Sorghum | Young | Number | 0 | 1 | 1 |
| | | % | 0 | 100 | 100 |
| | Adult | Number | 11 | 2 | 13 |
| | | % | 85 | 15 | 100 |
| | Elderly | Number | 8 | 7 | 15 |
| | | % | 53 | 47 | 100 |
| | Total | Number | 19 | 10 | 29 |
| | | % | 66 | 34 | 100 |
| Cowpea | Adult | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |
| | Total | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |

Source: IER/ICRISAT Surveys, 2002.

**Table A8.3 Farmers' provision of MV seed by wealth group of provider**

| Crop type | Wealth group | | Yes | No | Total |
|---|---|---|---|---|---|
| Millet | Poorer farmers | Number | 3 | 13 | 16 |
| | | % | 19 | 81 | 100 |
| | Better-off farmers | Number | 10 | 13 | 23 |
| | | % | 43 | 57 | 100 |
| | Total | Number | 13 | 26 | 39 |
| | | % | 33 | 67 | 100 |
| Sorghum | Poorer farmers | Number | 11 | 5 | 16 |
| | | % | 69 | 31 | 100 |
| | Better-off farmers | Number | 6 | 3 | 9 |
| | | % | 67 | 33 | 100 |
| | Total | Number | 17 | 8 | 25 |
| | | % | 68 | 32 | 100 |
| Cowpea | Poorer farmers | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |
| | Total | Number | 1 | 0 | 1 |
| | | % | 100 | 0 | 100 |

Source: IER/ICRISAT Surveys, 2002.

## Annex 9. Age composition of Village Seed Management Committees (Niger)

**Table A9.1 Age composition of Village Seed Management Committees**

| Region | Young | | Adult | | Elderly | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Number | Percentage (%) | Number | Percentage (%) | Number | Percentage (%) | Number | Percentage (%) |
| Maradi | 2 | 3.2 | 47 | 75.8 | 13 | 21.0 | 62 | 100 |
| Tillabéry | 2 | 2.1 | 77 | 79.4 | 18 | 18.6 | 97 | 100 |
| Total | 4 | 2.5 | 124 | 78.0 | 31 | 19.5 | 159 | 100 |

## Annex 10. Varieties cultivated by sample farmers in 2001/02 (Niger)

**Table A10.1 Millet varieties cultivated by sample farmers in Maradi region**

| District | Village | Local name of variety |
|---|---|---|
| Dakoro | Dan Dadji | ankoutess |
| | | ba angoure |
| | | dan djinguine |
| | | dan gouaki |
| | | guerguera |
| | | maywa |
| | | zango |
| | Maï Bourgouma | ba angoure |
| | | dan gouaki |
| | | guerguera |
| | | zango |
| | Garin Gonaou | ankoutess |
| | | ba angoure |
| | | dan gombe |
| | | dan gouaki |
| | | guerguera |
| | | matan hatsi |
| | | maywa |
| | | zanfawa |
| | | zango |
| | Maguiza | ba angoure |
| | | dan gouaki |
| | | guerguera |
| | | matan hatsi |
| | | zanfarwa |
| | | zango |
| | Takalmaoua Sofoua | ba angoure |
| | | dan gouaki |
| | | matan hatsi |
| | Dan Dadi | ba angoure |
| | | dan djinguine |
| | | dan gouaki |
| | | dan projet |
| | | guerguera |
| | | maiwa |
| | | matan hatsi |
| | | mazan hatsi |
| | | mota maradi |
| | | zanfarwa |
| | | zango |

| | | |
|---|---|---|
| | Dakoro Sofoua | ba angoure |
| | | dan gouaki |
| | | guerguera |
| | | matan hatsi |
| | Dan Falké | ba angoure |
| | | dan gouaki |
| | | guerguera |
| | Zangon Kachimbo | ba angoure |
| | | dan gouaki |
| | | zango |
| | Dogon Tapki | ba angoure |
| | | bahaouche |
| | | dan gouaki |
| | | guerguera |
| | | wuyan bijimi |
| | | zango |
| | Tagaza | ankoutess |
| | | ba angoure |
| | | dan gouaki |
| | | zanfarwa |
| | | zango |
| | Danfaraou | ba angoure |
| | | beguero |
| | | dan gouaki |
| | | guerguera |
| | | maiwa |
| | | maywa |
| | | zanfarwa |
| | | zango |

**Table A10.2 Millet varieties cultivated by sample farmers in Tillabéry region**

| District | Village | Local name of variety |
|---|---|---|
| Ouallam | Guilmane | haini tchira |
| | | somno |
| | Zimba | dare koba |
| | | haini tchira |
| | | hkp |
| | Tolkobaye Fandobon | cpt |
| | | dunguri tchira |
| | Kaoura | dare koba |
| | | dunguri tchira |
| | Déli Tondi | dunguri tchira |
| | | tchouma bi |
| Téra | Toumbindé | haini tchirey |
| | Largadi | haini tchirey |
| | | hkp |
| | | kolala |
| | | olelgari |
| | Tchibaré Téra | bondaba |
| | | gnai |
| | | haini tchirey |
| | | kolala |
| | | somno |
| | Tatchindé | haini tchirey |
| | | olelgari |
| | Lembangou | bira |
| | | bondaba |
| | | haini kara |
| | | haini tchirey |
| | | haini wassa |
| | | kolala |
| | | somno |
| | Tilim | bondaba |
| | | haini bio |
| | | haini taria |
| | | haini tchirey |
| | | hkp |
| | | kolala |
| | | olelgari |
| | | somno |

**Table A10.3 Cowpea varieties cultivated by sample farmers in Maradi region**

| District | Village | Local name of variety |
|---|---|---|
| Dakoro | Dan Dadji | alloka |
| | | ba haouche |
| | | dan zafi |
| | | farin wake |
| | | jan wake |
| | Maï Bourgouma | alloka |
| | | dan zafi |
| | | farin wake |
| | | jan wake |
| | | lakkade |
| | Garin Gonaou | alloka |
| | | dan illa |
| | | dan tchana |
| | | farin wake |
| | | jan wake |
| | Maguiza | dan illa |
| | | dan kozagui |
| | | farin wake |
| | | jan wake |
| | | lakkade |
| | Takalmaoua Sofoua | alloka |
| | | dan zafi |
| | | jan wake |
| | | lakkade |
| | | matan hatsi |
| | Dan Dadi | alloka |
| | | dan illa |
| | | dan nawa |
| | | dan zafi |
| | | farin wake |
| | | jan wake |
| | | lakkade |
| | Dakoro Sofoua | dan zafi |
| | | jan wake |
| | | lakkade |
| | Dan Falké | alloka |
| | | dan illa |
| | | dan projet |
| | | jan wake |
| | | lakkade |
| | Zangon Kachimbo | alloka |
| | | dan illa |
| | | dan zafi |
| | | lakkade |

| | | |
|---|---|---|
| | Dogon Tapki | dan zafi |
| | | farin wake |
| | | jan wake |
| | | lakkade |
| | Tagaza | alloka |
| | | alloka |
| | | dan kozagui |
| | | dan zafi |
| | | farin wake |
| | | jan wake |
| | | kwazagne |
| | Danfaraou | dan zafi |
| | | farin wake |
| | | jan wake |
| | | lakkade |
| | | maimoundaye |

**Table A10.4 Cowpea varieties cultivated by sample farmers in Tillabéry region**

| District | Village | Local name of variety |
|---|---|---|
| Ouallam | Guilmane | dan louma |
| | | dunguri koira |
| | Zimba | dan louma |
| | | dunguri koira |
| | | pompormaize |
| | | wande margue |
| | Tolkobaye Fandobon | dan louma |
| | | dunguri bi |
| | | dunguri koira |
| | Kaoura | dan louma |
| | | wande margue |
| | Déli Tondi | dan louma |
| | | dunguri tchira |
| | | pompormaize |
| | | wande margue |
| Téra | Toumbindé | dunguri kara |
| | | dunguri tchire |
| | Largadi | dunguri kara |
| | | dunguri tchire |
| | | hama tchirey |
| | Tchibaré Téra | dunguri tchire |
| | Tatchindé | dunguri tchire |
| | Lembangou | dunguri bera |
| | | dunguri kara |
| | | dunguri tara |
| | | gaia |
| | Tilim | dunguri bera |
| | | dunguri tara |
| | | dunguri tchire |

**Table A10.5 Sorghum varieties cultivated by sample farmers in Maradi region**

| District | Village | Local name of variety |
|---|---|---|
| Dakoro | Dan Dadji | bazazaga |
| | | dja dawa |
| | | fara dawa |
| | | makafo dawayo |
| | Maï Bourgouma | dja dawa |
| | | fara dawa |
| | Garin Gonaou | alloka |
| | | dja dawa |
| | | fara dawa |
| | | goumbassaou |
| | | kombassawa |
| | | makafo dawayo |
| | | moba rouge |
| | | mota maradi |
| | Maguiza | dja dawa |
| | | goumbassaou |
| | | kombassawa |
| | | makafo dawayo |
| | | mota maradi |
| | | takogo |
| | Takalmaoua Sofoua | adje bicthi |
| | | bazazaga |
| | | dja dawa |
| | | el alhadji |
| | | gaban akouya |
| | | kombassawa |
| | | makafo dawayo |
| | | mota maradi |
| | Dan Dadi | adje bicthi |
| | | bahaoussa |
| | | dja dawa |
| | | fara dawa |
| | | kombassawa |
| | | makafo dawayo |
| | | mota maradi |
| | | zaboua |
| | Dakoro Sofoua | kombassawa |
| | | makafo dawayo |
| | | mota maradi |
| | Dan Falké | bahaoussa |
| | | dja dawa |
| | | dja mota |
| | | fara dawa |
| | | makafo dawayo |
| | | mota maradi |

| | | |
|---|---|---|
| | Dakoro Sofoua | kombassawa |
| | | makafo dawayo |
| | | mota maradi |
| | Dan Falké | bahaoussa |
| | | dja dawa |
| | | dja mota |
| | | fara dawa |
| | | makafo dawayo |
| | | mota maradi |
| | Zangon Kachimbo | dja dawa |
| | | mota maradi |
| | Dogon Tapki | dja dawa |
| | | fara dawa |
| | | kombassawa |
| | | makafo dawayo |
| | | mota maradi |
| | | takoissaim |
| | Tagaza | bazazaga |
| | | dja dawa |
| | | fara dawa |
| | | makafo dawayo |
| | | matche dakoumgna |
| | Danfaraou | dja dawa |
| | | fara dawa |
| | | kombassawa |
| | | makafo dawayo |
| | | mota maradi |

**Table A10.6 Sorghum varieties cultivated by sample farmers in Tillabéry region**

| District | Village | Local name of variety |
|---|---|---|
| Ouallam | Guilmane | hama koirey |
| | | hama marga-marga |
| | | hama tchirey |
| | | sogomba |
| | | tantangalia |
| | Zimba | hama tchirey |
| | | kamadibiza |
| | Tolkobaye Fandobon | hama koirey |
| | | hama tchirey |
| | Kaoura | hama tchirey |
| | Déli Tondi | hama tchirey |
| | | kona |
| | | sogomba |
| Téra | Toumbindé | hama kara |
| | | hama tchirey |
| | Largadi | hama kara |
| | | hama tchirey |
| | | magagi kara |
| | Tchibaré Téra | hama kara |
| | | hama tchirey |
| | Tatchindé | hama tchirey |
| | Lembangou | hama kara |
| | | hama tchirey |
| | | tingtanga |
| | Tilim | hama tchirey |
| | | mota maradi |

## Annex 11. Original sources of cowpea varieties (Niger)

**Table A11.1 Where farmers originally acquired cowpea varieties (Niger)**

| Region | Type of variety | | At the local market | In the village | In a neighboring village | Other | Total |
|---|---|---|---|---|---|---|---|
| Maradi | Modern | Number | 45 | 31 | 18 | 3 | 97 |
| | | % | 18.1 | 12.5 | 7.3 | 1.2 | 100 |
| | Local | Number | 75 | 43 | 32 | 1 | 151 |
| | | % | 49.7 | 28.5 | 21.2 | 0.7 | 100 |
| | Total | Number | 120 | 74 | 50 | 4 | 248 |
| | | % | 48.4 | 29.8 | 20.2 | 1.6 | 100 |
| Tillabéry | Modern | Number | 22 | 26 | 7 | 0 | 55 |
| | | % | 40.0 | 47.3 | 12.7 | 0 | 100 |
| | Local | Number | 2 | 75 | 24 | 2 | 103 |
| | | % | 1.9 | 72.8 | 23.3 | 1.9 | 100 |
| | Total | Number | 24 | 101 | 31 | 2 | 158 |
| | | % | 15.2 | 63.9 | 19.6 | 1.3 | 100 |
| Total | Modern | Number | 67 | 57 | 25 | 3 | 152 |
| | | % | 44.1 | 37.5 | 16.4 | 2.0 | 100 |
| | Local | Number | 77 | 118 | 56 | 3 | 254 |
| | | % | 30.3 | 46.5 | 22.0 | 1.2 | 100 |
| | Total | Number | 144 | 175 | 81 | 6 | 406 |
| | | % | 35.5 | 43.1 | 19.9 | 1.5 | 100 |

**Table A11.2 Original sources for cowpea varieties**

| Region | Type of variety | | From a trader | From a colleague/ farmer | From a parent/close relative | From a project or organization | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Maradi | Modern | Number | 55 | 5 | 10 | 26 | 1 | 97 |
| | | % | 56.7 | 5.2 | 10.3 | 26.8 | 1.0 | 100 |
| | Local | Number | 94 | 16 | 38 | 2 | 1 | 151 |
| | | % | 62.3 | 10.6 | 25.2 | 1.3 | 0.7 | 100 |
| | Total | Number | 149 | 21 | 48 | 28 | 2 | 248 |
| | | % | 60.1 | 8.5 | 19.4 | 11.3 | 0.8 | 100 |
| Tillabéry | Modern | Number | 30 | 1 | 23 | 1 | 0 | 55 |
| | | % | 54.5 | 1. | 41.8 | 1.8 | 0 | 100 |
| | Local | Number | 13 | 8 | 37 | 44 | 1 | 103 |
| | | % | 12.6 | 7.8 | 35.9 | 42.7 | 1.0 | 100 |
| | Total | Number | 43 | 9 | 60 | 45 | 1 | 158 |
| | | % | 27.2 | 5.7 | 38.0 | 28.5 | 0.6 | 100 |
| Total | Modern | Number | 85 | 6 | 33 | 27 | 1 | 152 |
| | | % | 55.9 | 3.9 | 21.7 | 17.8 | 0.7 | 100 |
| | Local | Number | 107 | 24 | 75 | 46 | 2 | 254 |
| | | % | 42.1 | 9.5 | 29.5 | 18.1 | 0.8 | 100 |
| | Total | Number | 192 | 30 | 108 | 73 | 3 | 406 |
| | | % | 47.3 | 7.4 | 26.6 | 17.9 | 0.7 | 100 |

**Table A11.3 Acquisition methods for original cowpea varieties**

| Region | Type of variety | | Cash purchase | Exchange seeds against seeds | Barter seeds against other products | Loan or credit | Free | Total |
|---|---|---|---|---|---|---|---|---|
| Maradi | Modern | Number | 61 | 2 | 1 | 22 | 11 | 97 |
| | | % | 62.9 | 2.1 | 1.0 | 22.7 | 11.3 | 100 |
| | Local | Number | 100 | 6 | 0 | 0 | 45 | 151 |
| | | % | 66.2 | 4.0 | 0 | 0 | 29.8 | 100 |
| | Total | Number | 161 | 8 | 1 | 22 | 56 | 248 |
| | | % | 64.9 | 3.2 | 0.4 | 8.9 | 22.6 | 100 |
| Tillabéry | Modern | Number | 32 | 0 | 0 | 0 | 23 | 55 |
| | | % | 58.2 | 0 | 0 | | 41.8 | 100 |
| | Local | Number | 17 | 2 | 2 | 43 | 39 | 103 |
| | | % | 16.5 | 1.9 | 1.9 | 41.7 | 37.9 | 100 |
| | Total | Number | 49 | 2 | 2 | 43 | 62 | 158 |
| | | % | 31.0 | 1.3 | 1.3 | 27.2 | 39.2 | 100 |
| Total | Modern | Number | 93 | 2 | 1 | 22 | 34 | 152 |
| | | % | 61.2 | 1.3 | 0.6 | 14.5 | 22.4 | 100 |
| | Local | Number | 117 | 8 | 2 | 43 | 84 | 254 |
| | | % | 46.1 | 3.1 | 0.8 | 16.9 | 33.1 | 100 |
| | Total | Number | 210 | 10 | 3 | 65 | 118 | 406 |
| | | % | 51.7 | 2.5 | 0.7 | 16.0 | 29.1 | 100 |

## Annex 12. Original sources of sorghum varieties (Niger)

**Table A12.1 Where farmers originally acquired sorghum varieties**

| Region | Type of variety | | At the local market | In the village | In a neighboring village | Other | Total |
|---|---|---|---|---|---|---|---|
| Maradi | Modern | Number | 25 | 71 | 20 | 2 | 118 |
| | | % | 21.2 | 60.2 | 16.9 | 1.7 | 100 |
| | Local | Number | 36 | 45 | 22 | 0 | 103 |
| | | % | 35.0 | 43.7 | 21.4 | 0 | 100 |
| | Total | Number | 61 | 116 | 42 | 2 | 221 |
| | | % | 27.6 | 52.5 | 19.0 | 0.9 | 100 |
| Tillabéry | Modern | Number | 16 | 58 | 10 | 1 | 85 |
| | | % | 18.8 | 68.2 | 11.8 | 1.2 | 100 |
| | Local | Number | 2 | 16 | 2 | 0 | 20 |
| | | % | 10.0 | 80.0 | 10.0 | 0 | 100 |
| | Total | Number | 18 | 74 | 12 | 1 | 105 |
| | | % | 17.1 | 70.5 | 11.4 | 1.0 | 100 |
| Total | Modern | Number | 41 | 129 | 30 | 3 | 203 |
| | | % | 20.2 | 63.5 | 14.8 | 1.5 | 100 |
| | Local | Number | 38 | 61 | 24 | 0 | 123 |
| | | % | 30.9 | 49.6 | 19.5 | 0 | 100 |
| | Total | Number | 79 | 190 | 54 | 3 | 326 |
| | | % | 24.2 | 58.3 | 16.6 | 0.9 | 100 |

**Table A12.2 Original sources of sorghum varieties**

| Region | Type of variety | | From a trader | From a colleague /farmer | From a parent/ close relative | From a project or organization | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Maradi | Modern | Number | 35 | 10 | 68 | 3 | 2 | 118 |
| | | % | 29.7 | 8.5 | 57.6 | 2.5 | 1.7 | 100 |
| | Local | Number | 44 | 12 | 39 | 6 | 2 | 103 |
| | | % | 42.7 | 11.7 | 37.9 | 5.8 | 1.9 | 100 |
| | Total | Number | 79 | 22 | 107 | 9 | 4 | 221 |
| | | % | 35.7 | 10.0 | 48.4 | 4.1 | 1.8 | 100 |
| Tillabéry | Modern | Number | 15 | 5 | 49 | 16 | 0 | 85 |
| | | % | 17.6 | 5.9 | 57.6 | 18.8 | 0 | 100 |
| | Local | Number | 2 | 1 | 16 | 1 | 0 | 20 |
| | | % | 10.0 | 5.0 | 80.0 | 5.0 | 0 | 100 |
| | Total | Number | 17 | 6 | 65 | 17 | 0 | 105 |
| | | % | 16.2 | 5.5 | 61.9 | 16.2 | 0 | 100 |
| Total | Modern | Number | 50 | 15 | 117 | 19 | 2 | 203 |
| | | % | 24.6 | 7.4 | 57.6 | 9.5 | 0.9 | 100 |
| | Local | Number | 46 | 13 | 55 | 7 | 2 | 123 |
| | | % | 37.4 | 10.6 | 44.7 | 5.7 | 1.6 | 100 |
| | Total | Number | 96 | 28 | 172 | 26 | 4 | 326 |
| | | % | 29.4 | 8.6 | 52.8 | 8.0 | 1.2 | 100 |

**Table A12.3 Acquisition methods for original sorghum varieties**

| Region | Type of variety | | Cash purchase | Exchange seeds against seeds | Barter, seeds against other products | Loan or credit | Free | Total |
|---|---|---|---|---|---|---|---|---|
| Maradi | Modern | Number | 37 | 7 | 3 | 1 | 70 | 118 |
| | | % | 31.4 | 5.9 | 2.5 | 0.8 | 59.3 | 100 |
| | Local | Number | 43 | 11 | 2 | 6 | 41 | 103 |
| | | % | 41.7 | 10.7 | 1.9 | 5.8 | 39.8 | 100 |
| | Total | Number | 80 | 18 | 5 | 7 | 111 | 221 |
| | | % | 36.2 | 8.1 | 2.3 | 3.2 | 50.2 | 100 |
| Tillabéry | Modern | Number | 18 | 1 | 0 | 20 | 46 | 85 |
| | | % | 21.2 | 1.2 | 0 | 23.5 | 54.1 | 100 |
| | Local | Number | 3 | 0 | 0 | 1 | 16 | 20 |
| | | % | 15.0 | 0 | 0 | 5.0 | 80.0 | 100 |
| | Total | Number | 21 | 1 | 0 | 21 | 62 | 105 |
| | | % | 20.0 | 1.0 | 0 | 20.0 | 59.0 | 100 |
| Total | Modern | Number | 55 | 8 | 3 | 21 | 116 | 203 |
| | | % | 27.1 | 3.9 | 1.5 | 10.3 | 57.1 | 100 |
| | Local | Number | 46 | 11 | 2 | 7 | 57 | 123 |
| | | % | 37.4 | 8.9 | 1.6 | 5.7 | 46.3 | 100 |
| | Total | Number | 101 | 19 | 5 | 28 | 173 | 326 |
| | | % | 31.0 | 5.8 | 1.5 | 8.6 | 53.1 | 100 |

## Annex 13. Random sampling methodology (Niger)

A survey on informal seed distribution mechanisms in the intervention zones of the Emergency Seed Project; namely, Kornaka, Téra and Ouallam, was undertaken. Firstly, sample villages were selected as follows:

- As the number of villages studied by Dr Seyni in the different areas never reached 10 (8 in Kornaka, 3 in Téra and 3 in Ouallam), a random number table with only one digit numbers was used.
- For each area, all villages are numbered from 1 to N (N represents the total number of villages surveyed by Dr Seyni in each area).
- With the random number board, one row and one column were defined which are read from top to bottom starting with the intersection between the row and the column.

For instance, in Kornaka, 8 villages were surveyed by Dr Seyni. Those 8 villages are numbered from 1 to 8 as follows:

1 = Dan Dadji
2 = Maï Bougourma
3 = Magajin Koré
4 = Garin Gonaou
5 = Maguiza
6 = Takalmaoua
7 = Guidan Mayaki
8 = Dan Dadi

Here, N = 8 is the last village surveyed by Dr Seyni (hence the random number table with one digit only). Row 01 and column F were randomly selected and their intersection is equal to 4 and 4 is less than or equal to 8; so, village number 4 is selected; its name is Garin Ganaou. Because the reading is from top to bottom, villages number 6, 2, 5 and 8 are successively selected. It has to be stressed that while reading from top to bottom, number 4 is repeated three times and as it is a draw with equal probabilities and without replacement, number 4 is considered only once. The villages respectively numbered as above are Takalmaoua, Maï Bougourma, Maguiza, Dan Dadji and Dan Dadi. In addition to the 6 selected villages benefiting from seed distribution, others have been randomly drawn and did not benefit from the emergency seed distribution. Secondly, two processes were implemented. Ten sample farmers were drawn in each sample village. In the sample beneficiary villages, a stratification was established: a stratum for beneficiaries of seed distribution and another for non-beneficiaries.

Each sample village is subject to an exhaustive count of all household heads. Each of them must say whether, yes or no, s/he is a beneficiary of the USAID Emergency Seed Project. This results in a list with the total number of household heads in the sample village and, in the meantime, the total number of beneficiaries and non-beneficiaries. Then a weighting takes place on both sides as shown in the following example:

Let us suppose that in a sample village, Maguiza for instance, we have 68 household heads of which 18 benefitted from the Emergency Seed Project and 50 are not. What is the weighting a for household heads who are beneficiaries of the Emergency Seed Project and the one b for non-beneficiaries? The result will be as follows:

$$a = \frac{18}{68} = 0.26$$

$$b = \frac{50}{68} = 0.74$$

As we know that n = 10 is the total number for the sample of household heads who are to be surveyed, in order to determine n1 and n2 (n1 + n2 = n) for each stratum, we shall have n1 = 10 x a and n2 = 10 x b. Now as a = 0.26 and b = 0.74, n1 = 10 x 0.26 = 2.6 rounded off to 3 and n2 = 10 x 0.74 = 7.4 rounded off to 7. To conclude, in Maguiza, 3 household heads who are beneficiaries of the Emergency Seed Project and 7 non-beneficiaries are drawn. In order to achieve this, for each stratum and using the one digit number board, we carried out a systematic draw only for selecting the first household head to be surveyed. The process is as follows:

N = 68 : total number of household heads in Maguiza;

N1 = 18 : total number of household heads who are beneficiaries of the Emergency Seed Project;

N2 = 50 : total number of household heads who are non-beneficiaries of the Emergency Seed Project;

N1 = 3 : number of sample household heads to be drawn from stratum 1 who are beneficiaries of the Emergency Seed Project:

N2 = 7 : number of sample household heads who are non-beneficiaries of the Emergency Seed Project.

1st stratum

Calculation of the drawing interval or ratio (R)

$$R = \frac{N1}{n1} \qquad \text{if } N1 = 18 \text{ and } n1 = 3 \text{ then } R = \frac{18}{3} = 6{,}0$$

E(r), the integer part of R, is 6. Now as 6 is a one digit number, the one digit number board is used. So, a row and a column have to be randomly defined in order to determine the first sample household head. Let us define row 02 and column H. We have to select a number between 1 and 6 (which is the integer part of 6.0). In the intersection between row 02 and column H, there is 9 which is more than the entire part of R. As we read from top to bottom, if we go to the next row, we have 7 which we also have to reject because it is more than 6. In the next row, there is the number 6 which is equal to 6 (our entire part). So, the first sample household head of stratum 1 is number 6; the second household head of the same stratum is 12 as 6 + 6.0 = 12 and the third sample household head is 18 as 12 + 6.0 = 18. So, sample household heads' numbers are: 6, 12 and 18 for the first stratum.

2nd stratum

$$r = \frac{N2}{n2}$$

N2 = 50
n2 = 7

$$r = \frac{50}{7} = 7.14 \quad E(r) = 7$$

Here too, we also have a one digit table because E(r) is 7, a one digit number. As before, we determine one row and one column, row 6 and column M of which the intersection is 3 which is less than 7, so our first household head is number 3.

$2^{nd}$ HH = 3 + 7.14 = 10.14 ≈ 10
$3^{rd}$ th HH = 10.14 + 7.14 = 17.28 ≈ 17
$4^{th}$ HH = 17.28 + 7.14 = 24.42 ≈ 24
$5^{th}$ HH = 24.42 + 7.14 = 31.56 ≈ 32
$6^{th}$ HH = 31.56 + 7.14 = 38.70 ≈ 39
$7^{th}$ HH = 38.70 + 7.14 = 45.84 ≈ 46

So, numbers 3, 10, 17, 24, 32, 39 and 46 are to be surveyed.
This happens at sample village level which benefited from the USAID Emergency Seed Project. For non-beneficiary villages, the selection of sample household heads takes place within one stratum only. For example, in the abovementioned case and if we suppose that the village in question is non-beneficiary, the process will be as follows:

$$r = \frac{N}{n}$$

N = 68
n = 10

$$r = \frac{68}{10} = 6{,}8 \quad E(r) = 6$$

Using a one-digit table, define one row and one column, 4 and D for example. Their intersection is 8, which we have to reject, and then we have 3, which is less than 6; so the number of the first sample HH is 3.

$2^{nd}$ nbr of HH = 3 + 6.8 = 9.8 ≈ 10
$3^{rd}$ nbr of HH = 9.8 + 6.8 = 16.60 ≈ 17
$4^{th}$ nbr of HH = 16.60 + 6.8 = 23.40 ≈ 23
$5^{th}$ nbr of HH = 23.40 + 6.8 = 30.20 ≈ 30
$6^{th}$ nbr of HH = 30.20 + 6.8 = 37.00 ≈ 37
$7^{th}$ nbr of HH = 37.00 + 6.8 = 43.8 ≈ 44
$8^{th}$ nbr of HH = 43.8 + 6.8 = 50.60 ≈ 51
$9^{th}$ nbr of HH = 50.60 + 6.8 = 57.40 ≈ 57
$10^{th}$ nbr of HH = 57.40 + 6.8 = 64.20 ≈ 64

With the HH count list, we have numbers 3, 10, 17, 23, 30, 37, 44, 51, 57 and 64 which correspond to the names of sample household heads (HH) to be surveyed.

# References

**Archibald S** and **Richards P.** 2002. Seeds and rights: new approaches to post-war agricultural rehabilitation in Sierra Leone. Disasters 26 (4): 356-367.

**CARE Somalia.** n.d. CARE/USAID Seed Distribution and Production Report: Final Project Report. Nairobi, Kenya: CARE Somalia.

**Chemonics International** and **United States Department of Agriculture Famine Mitigation Activity.** 1996. Seeds for Disaster Mitigation and Recovery in the Greater Horn of Africa. Unpublished report submitted to USAID's Bureau for Humanitarian Response by the Development Strategies for Fragile Lands (DEFSIL) Project.

**Cromwell E** and **Wiggins S** with **Wentzel S.** 1993. Sowing beyond the state: NGOs and seed supply in developing countries. London: Overseas Development Institute.

**Cromwell E, Kambewa P, Mwanza R, Chirwa R** with **KWERA Development Centre.** 2000. The impact of Starter Pack on sustainable agriculture in Malawi. 1999-2000 Malawi Starter Pack Evaluation Module 4. Report for the Ministry of Agriculture and irrigation, Government of Malawi and the Department for International Development, UK. August 2000. http://www.rdg.ac.uk/ssc/resources/files/malawi/spmod4.pdf

**Diakité L.** 2000. Rapport d'évaluation du projet "semences d'urgence". Bamako, Mali: IER.39 pages.

**Diakité S.** 2000. Etude d'un processus de changement variétale en milieu paysan : cas du village de Gonsolo (Commune rurale de Bancoumana), Mémoire de fin de cycle IPR-IFRA/ICRISAT, 79 pages.

**Diakité S.** 2003. Le système semencier local: description, évaluation et valorisation (cas du sorgho dans 7 villages au Mali), Point Sud/ICRISAT (Rapport), Bamako, Mali: Point Sud/ICRISAT.

**Famine Early Warning Systems Network.** 2003. Monthly Food Security Report: Mid-September 2003 - mid-October, 2003. October 20, 2003. http://www.fews.net/centers/current/monthlies/report/?f=mw&m=1001060&l=en.

**Friis-Hansen E** and **Rohrbach D.** 1993. SADC/ICRISAT 1992 drought relief emergency production of sorghum and pearl millet seed: impact assessment. ICRISAT Working Paper 93/01. Patancheru, India: ICRISAT.

**Hamadou S**. 2000. Evaluation des activites menees dans le cadre du projet "Acquisition et distribution de semences d'urgence". INRAN, ROCAFREMI, ICRISAT. Niamey, Niger.

**Henry JVS.** 1996. A review of the strategy, objectives, outputs and effects of ActionAid SIP interventions in Malawi since 1992/3. Section 2, Vol. 1, pp 39-65 of ActionAid-Malawi (1997) Supplementary Inputs Programme 1995/96 agriculture season. Malawi: ActionAid-Malawi.

**ICRISAT-Mozambique.** 2003. Guidelines for Planning Local Seed System Interventions. (60 pages). Maputo: ICRISAT and the National Agronomic Research Institute (INIA). Maputo: ICRISAT.

**Jones RB, Bramel P, Longley C** and **Remington T.** 2002. The need to look beyond the production and provision of relief seed: experiences from S. Sudan. Disaster*s* 26 (4): 302-315.

**Longley C.** 1997. Effects of war and displacement on local seed systems in northern Sierra Leone. AgREN Network Paper 75. London: Overseas Development Institute.

**Longley C, Coulter J** and **Thompson R.** 1999. Malawi rural livelihoods starter pack scheme, 1998-9: Evaluation Report. Unpublished report to DFID. London: Overseas Development Institute.

**Longley C, Dominguez C, Saide MA** and **Leonardo WJ.** 2002. Do Farmers Need Relief Seed? A methodology for assessing seed systems. Disasters 26 (4): 343-355.

**Longley C, Jones R, Ahmed MH** and **Audi P.** 2001. Supporting local seed systems in southern Somalia:

a developmental approach to agricultural rehabilitation in emergency situations. AgREN paper No. 115. London: Overseas Development Institute.

**Longley C, Kamara VK** and **Fanthorpe R.** 2004 (forthcoming). Impacts of war on rural livelihoods in Kambia District, Sierra Leone. Working Paper 186. London: Overseas Development Institute.

**Longley C** and **Jones R.** 2000. Seed Sector Study of Somalia. Preliminary Inception Report. Unpublished report submitted to EC-Somalia Unit, Nairobi (November 2000).

**Longley C** and **Richards P.** 1999. Farmer seed systems and disaster. Pages 123-137 *in* Restoring farmers' seed systems in disaster situations: proceedings of the international workshop on developing institutional agreements and capacity to assist farmers in disaster situations to restore agricultural systems and seed security activities, Rome, Italy, 3-5 November, 1998. Seed and Plant Genetic Resources Service, Plant Production and Protection Division. Rome: FAO.

**Longley C** and **Sperling L,** eds. 2002. Beyond Seeds and Tools. Special Issue of Disasters, 26 (4).

**Ndjeunga J, Anand Kumar K** and **Ntare BR.** 2000. Comparative Analysis of Seed Systems in Niger and Senegal. Patancheru, India: ICRISAT.

**Overseas Development Institute Seeds and Biodiversity Programme.** 1996. Seed provision during and after emergencies. Relief and Rehabilitation Network*;* Good Practice Review 4. London: Overseas Development Institute.

**Remington T, Maroko J, Walsh S, Omanga P** and **Charles E.** 2002. Getting off the seeds-and-tools treadmill with CRS seed vouchers and fairs. Disasters 26 (4): 316-328.

**Sanogo O** and **Diakité L.** 1997. Etude sur les taux d'adoption et d'utilisation des semences sélectionnées, Bamako (Mali): FAO, 48 pages.

**Slaymaker T.** 2001. Literature review of agricultural research conducted in Southern Sudan post 1945. Consultancy report prepared for the ICRISAT-CRS-ODI seed study, Nairobi.

**Sperling L.** 1996. Executive summary and reflections of Seeds of Hope socio-economic analyses in Rwanda: the impact of war on agricultural production. CIAT report presented to IDRC.

**Sperling L.** 1997. The effects of the Rwandan war on crop production and varietal diversity: a comparison of two crops. In Louise Sperling (ed.) War and crop diversity, AgREN Network Paper 75. London: Overseas Development Institute.

**Sperling L.** 2001. Emergency seed aid in Kenya: A case study of lessons learned. Occasional Publications Series, No. 34. Kampala, Uganda: International Center for Tropical Agriculture (CIAT).

**Sperling L.** 2002. Emergency seed aid in Kenya: Some case study insights on lessons learned during the 1990s. Disasters 26 (4): 329-342.

**Tripp R.** 1996. Biodiversity and modern crop varieties: sharpening the debate. Agriculture and Human Values 13 (4): 48-63.

**Tripp R.** 2001. Seed Provision and Agricultural Development: The institutions of rural change. London, Oxford and Portsmouth (N.H.): ODI in association with James Curry and Heinemann.

**Van Oosterhout S.** 1996. What does in situ conservation mean in the life of a small-scale farmers? Examples from Zimbabwe's communal areas. Pages 35-52 *in* Using Diversity: Enhancing and maintaining genetic resources on-farm. Proceedings of a workshop held on 19-21 June 1995, New Delhi, India. (Sperling L and Loevinsohn M, eds.) New Delhi: International Development Research Centre.

**Wanga EO.** 2001. Seed Distribution and Production Project (SDDP) in Southern Somalia: Mid Term Evaluation. Report prepared for CARE Somalia. 30 March 2001.


**ICRISAT**
**International Crops Research Institute for the Semi-Arid Tropics**
Patancheru 502 324, Andhra Pradesh, India
**www.icrisat.org**

345-04