The Recent Extension of Muskwari Sorghums in Northern Cameroon[1]

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Abstract

The extension of transplanted sorghum in northern Cameroon began in the 1950s and is now attaining remarkable proportions. It concerns from 150,000 to 200 000 ha throughout the plains in the extreme north according to the climatic conditions of the year. This spread has been caused mainly by the increase in food crop requirements resulting from population increase and also the development of cotton growing on land previously used for rainfed food crops. Studies have been performed at the local area ('*terroir*') level to gain a better understanding of the reasons for the phenomenon and its effects on farming systems. The spread can be as much as 200% in 20 years and is on vertisols and also seemingly less propitious vertic soils. It has been made possible by the perfecting of cultivation techniques and the endogenous dissemination of farming know-how, with an astonishing diversity of environments and varieties cultivated. Growers using the cropping system are encountering new constraints—especially weed growth—and are calling for external aid. An R&D programme initiated by the DPGT project (*Développement Paysannal et Gestion des Terroirs*) is leading to support services managed collectively by farmers' organisations.

INTRODUCTION

The increased cultivation of transplanted sorghum observed over the past 50 years or so has caused a marked change in the landscapes of the plains of the Extreme Northern Province of Cameroon. The crop is grown in vast areas of clayey soil, called *karal* (plural *kare*) that are difficult to till during the rainy season. Clearing is performed collectively in large areas, with the almost complete elimination of trees, exposing the crops to attack by seed-eating birds (Seignobos, 1993). The

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landscape is thus marked by large uniform areas covered with sorghum for part of the dry season, alternating with zones of rainfed flood recession crops. The vegetative cycle of sorghum is set in the dry season, with the use of soil water reserves. Cultivation is started at a fairly precise moment in the farming calendar and sorghum, esteemed as a foodstuff for humans, allows the growing of a second grain crop in the middle of the dry season. Muskwari sorghum cultivation is increasing to feed a growing population while spreading the climatic risks and releasing cultivable land for rainfed farming. The development of cotton has certainly contributed to the increase of transplanted sorghum aimed at compensating the necessary decrease in the areas under rainfed crops (Seignobos et al., 1995). All these factors account for the success of muskwari, with production exceeding 40% of the grain produced in the Extreme Northern Province (Fusillier and Bom Konde, 1997).
The cultivation of new *kare* has been possible through the adapting of cultural methods to varied environments and constraints. The improvement and spread of know-how have been achieved by the rural population and the agricultural research sector has long remained outside these dynamics. However, the use of new land and determination to intensify cropping mean that growers are running up against new constraints in agriculture and land management.
This article is aimed at showing the spread of transplanted sorghum, specifying its determinant factors and the changes induced in farming systems. Distinction is made between two study levels: the Extreme Northern Province and small regions around two study sites (Figure 1). Lines of research and intervention are then described with a view to accompanying these small-scale farming dynamics.

Figure 1 : Location of [illegible] sites in the Extreme Northern region of Cameroon

A BRIEF VIEW OF THE CULTIVATED ENVIRONMENTS AND CULTURAL TECHNIQUES

In *fulfulde*, the language of the Fulani of Cameroon, muskwari is a generic term grouping all sorghums[2] transplanted on vertisols at the end of the rainy season. Numerous local varieties are adapted to the soil heterogeneity of the cultivated environments. The Extreme Northern Province of Cameroon is characterised by the juxtaposition of sedimentary plains and granite massifs favouring the formation of different vertisols on which muskwari is grown (Raimond, 1999). More or less degraded forms of these soils are observed, with different local names according to their appearance (cracks, colour, type of herbaceous cover, etc.) and the topographic position (Seignobos, 1993). The closure and hardening of the upper horizons is observed in some land at the top of the toposequence, leading to *harde*, the final stage of vertisol degradation.

The first difficulty in crop management is the mastery of the agricultural calendar. The success of muskwari requires above all good co-ordination of the nursery plant production period and the replanting date as governed by the presumed end of the rains and the withdrawal of water from the flooded *kare* (Barrault et al., 1972). Farmers perform staggered sowing in nurseries every 5 to 10 days from August onwards to obtain seedlings suitable for transplantation throughout September and October. Cleaning fields and transplanting are the most important jobs. Preparation consists of scything the plant cover that has grown during the rainy season, followed by burning off. Growers must then find substantial labour for a relatively short time so as not to delay transplanting. This is done with a dibble. Two seedlings are generally planted per hole, which is then filled with water. Replanting density is intentionally low (approximately 10,000 plants/ha) to limit competition for water. Harvesting is from mid-January to mid-March with yields varying from 500 to 1,500 kg/ha and even 2 tonnes/ha in the most productive land that is flooded until the end of the rainy season in October.

A MARKED INCREASE IN THE DIAMARÉ AND KAÉLÉ PLAINS

Replanted sorghum has spread mainly in the Diamaré and Kaélé plains, which now account for 85% of muskwari growing in northern Cameroon. The areas under sorghum practically doubled in 20 years, reaching 170,000 ha in 1999 (Figure 2). Transplanted sorghum is also grown in the Bénoué basin and in the Logone and Chari towards lake Chad.

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[2] *Sorghum bicolor* (L.) Moench, *durra* or *durra-caudatum* types (Raimond, 1999).

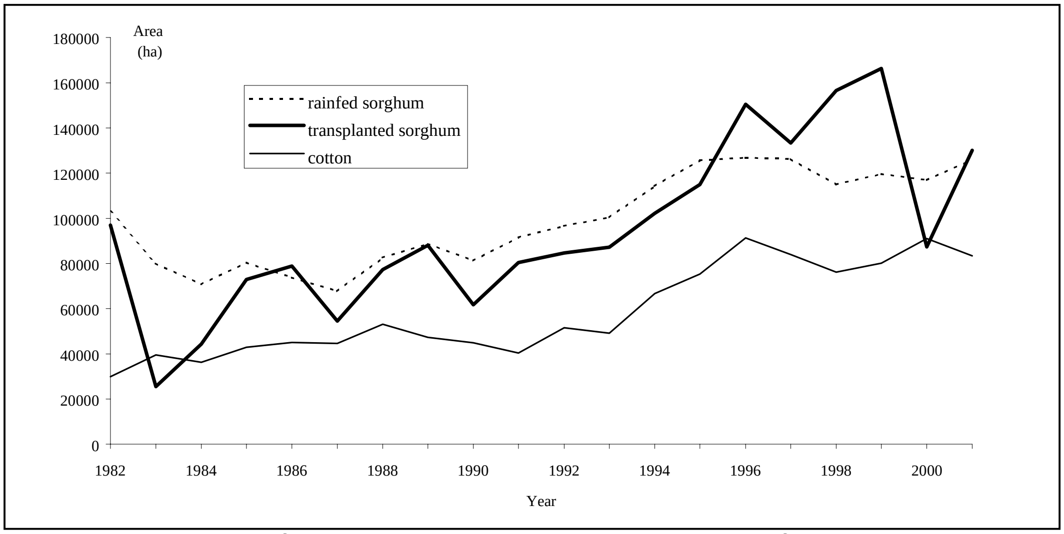


Figure 2 Evolution of the main crops in the cotton belt of the Extreme North Province of Cameroon (source: SODECOTON)

The strong inter-annual variation of the areas under transplanted sorghum is shown in Figure 2. The coefficient of variation of muskwari areas is 55% in comparison with 21% for rainfed sorghum and 34% for cotton during the same reference period. Shortage of rain, especially at the end of the rainy season, accounts for the strong decrease in cultivated areas in certain years. In this case, a non-negligible proportion of *kare*, generally the higher degraded or intermediate vertisols, are not planted. Given the position of this land and the smaller clay content, these vertic soils dry more quickly and may be left unused if the rains finish early.

However, examination of all the crops reveals an overall increase in cultivated areas from 1982 to 2001. This should be related first of all to the strong population increase (about 3.7% per year) throughout the period. The increase in muskwari seems more marked than that of rainfed sorghum and cotton. The latter roughly follows the variation in the areas under rainy season sorghum, with which it is usually rotated. This overall trend in the entire cotton zone in the Extreme North Province does not show the complementarity of cotton and muskwari in the regions in which there has been the most clearing of new *kare*. An approach at the scale of small regions seems necessary for the accurate differentiation of farming systems with regard to the spread of muskwari.

ANALYSIS OF THE DYNAMICS IN TWO VILLAGE AREAS

Two study sites were chosen to illustrate the progress of counter-season sorghums in agrosystems:

– Balaza, a Fulani village in the heart of Diamaré plain in a traditional muskwari production region in which the cultivation of new *kare* has accelerated over the past 20 years or so;

– Mowo, in the foothills of the Mandara mountains inhabited by the Mofou, a population of mountain origin, and where transplanted sorghum has been adopted more recently.

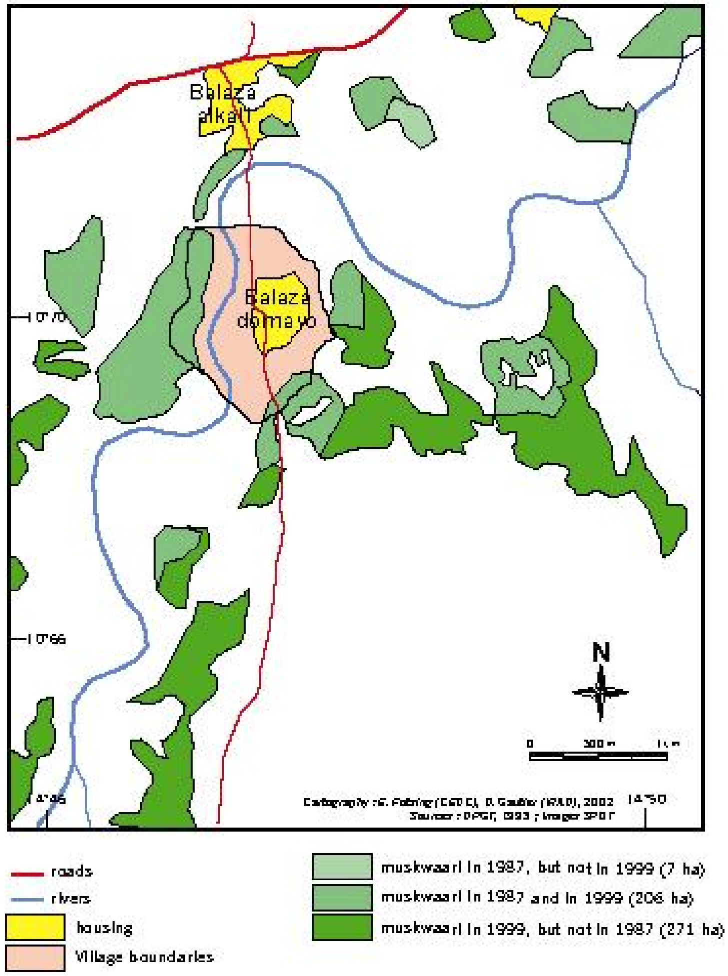
Diachronic analysis of satellite images was used to demonstrate the increase in the areas under transplanted sorghum in the small regions around each site. The study then focused on the distribution of the cultivated areas within the site using data collected during surveys and topographical work conducted by ORSTOM (Seignobos et al., 1995) (Iyebi-Mandjek and Seignobos, 1995). The values for Mowo in 2000 were obtained by surveys.

Evolution from 1987 to 1999 at small region level

The dominant farming landscapes in the plains consist of alternate muskwari and rainfed crops featuring mainly of rotations of cotton and sorghum.

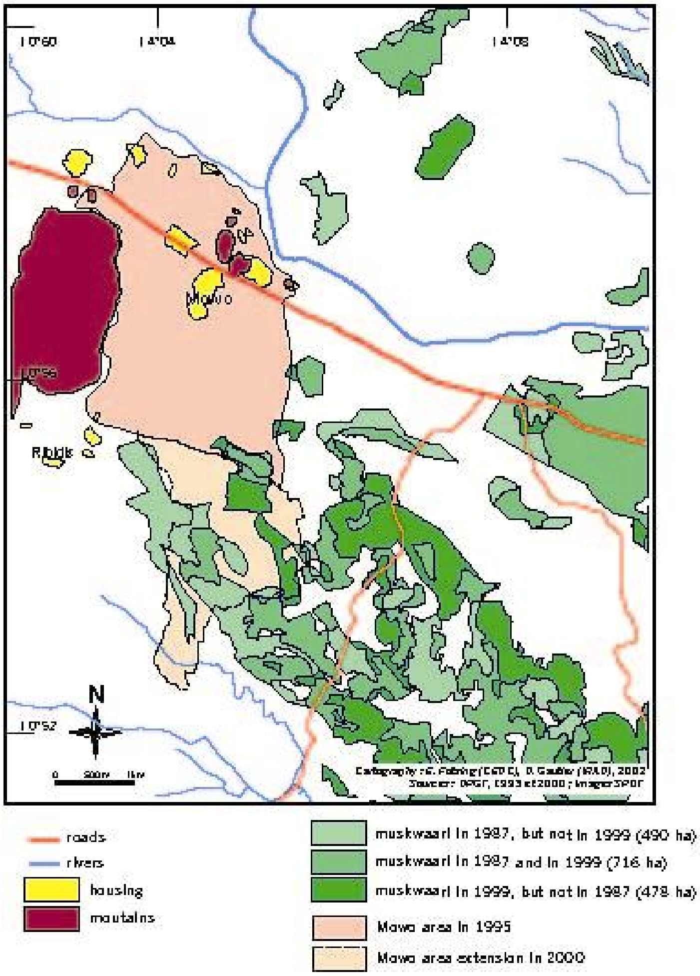
At Balaza, the surfaces under transplanted sorghum increased by 224% from 1987 to 1999 (Figure 3). In the 3,050-hectare rectangular sector analysed around Balaza, the area under muskwari increased from 7% in 1987 to 16% in 1999. Of the 213 ha of muskwari cultivated in 1987, only 7 ha was not cultivated in 1999. The other 206 hectares was still cultivated in 1999 and complemented by 271 ha of new land under muskwari. The more than doubling of the area was therefore performed by the use of new land with practically no accompanying abandoning of land.

Figure 3: Evolution of muskwaari areas from 1987 to 1999 in Balaza Region



The situation seems different at Mowo where an increase of only 1% was observed (Figure 4). Detailed examination shows that 490 ha of the 1,206 ha under transplanted sorghum in 1987 was abandoned in 1999 (i.e. 41%) whereas the remaining 716 hectares still cultivated in 1999 was increased by 478 ha. About 40% of the land was nevertheless renewed in an area that hardly changed between the two dates.

Figure 4: Evolution of muskwaari areas from 1987 to 1999 in Mowo Region



In the foothills zone, the land that can be used for muskwari consists mainly of more or less degraded vertic soil. Its intermediate character means that it is suitable for both counter-season sorghum and rainfed crops. The choice of crop will depend on the climatic scenario of the year, the farmer's ambitions and available resources—especially labour for the preparation of *karal* land.

Evolution of crops in the study sites

At Balaza, a village dominated by Fulani, transplanted sorghum is an old crop adopted in the nineteenth century and already well represented in the site in 1983. The areas surveyed in 1995 displayed a 150% increase in muskwari from 1983 to 1995, clearly illustrating the importance of the crop in farmers' strategies.

At Mowo, muskwari appeared within the limits of the village area between 1994 and 2000 although several farmers grew it in neighbouring villages. A recent survey of the cultivated land showed that the total areas cultivated have increased since 1994 (Seignobos and Teyssier, 1998). The cultivation of fields in the south of the area thus enabled the development of new *kare*. Rainfed sorghum is still the dominant crop, cultivated alone or with peanut or cowpea.

Table 2. Several indicators of the changes in the Balaza site in the Diamaré (Seignobos et al., 1995)

	Pop.	Number of farms	Cultivated area	muskwari	rainfed sorghum	cotton
1983	106	26	50 ha	20 ha	14 ha	11 ha
1995	180	38	102 ha	50 ha	21 ha	28 ha
Change	70%	46%	104%	150%	50%	155%

Table 3 Several indicators of changes at the Mowo site (Iyebi-Mandjek and Seignobos, 1995)

	Pop.	Number of farms	Cultivated area	muskwari	rainfed sorghum	cotton
1991	1026	150	303 ha	0 ha	186 ha	73 ha
1994	1350	-	452 ha	7 ha	276 ha	138 ha
2000	1500	243	555 ha	21 ha	240 ha	167 ha
Change (1991-2000)	46%	62%	83%		29%	129%

In addition to the increase in the area under muskwari, a common feature of the evolution of these two agrosystems is the substantial development of cotton. The spread of cotton has thus strengthened the position of muskwari as a staple food crop, accounting for the clearing of the land with vertic soil still available.

At Balaza, the main strategy consists of using the complementarity of muskwari and cotton and assembling capital in the form of livestock. Farmers try to put the greatest possible area under transplanted sorghum to ensure food self-sufficiency and simultaneously increase the area under cotton to obtain a regular cash income (Seignobos et al. 1995). Some farmers succeed in generating a surplus thanks to the double grain harvest. Income-based strategies increasingly involve the sale of surplus grain. Muskwari is overall the most appreciated and is sold in larger

proportions and at a higher price, especially when it is supplied to towns (Madi, 2000).
For the farmers of Mowo, cultivation of transplanted sorghum is aimed above all at food self-sufficiency. The Mandara mountain foothills are more densely populated than Diamaré plain. Although rainfed sorghum is dominant, more than a third of the farms suffered from food shortage in 1991. Cotton income and migration to towns made up the deficit (Iyebi-Mandjek and Seignobos, 1995). The slump was the occasion for a return of migrants, leading to strong demand for land, triggering the cultivation of the bush zones in the south of the area. Growing muskwari on the *harde* and vertic soils was an opportunity to strengthen farm food security.
In both cases, the cultivation of new land has considerably reduced the available areas of bush and has led to the adaptation and perfecting of the cropping system.

The use of new land and innovations in cultural techniques

The extension of transplanted sorghum was at the expense of grazing land in both areas. This land is now closed to livestock from the end of July onwards to limit soil compaction that would limit soil moisture absorption. Livestock benefits only from the first herbaceous regrowth at the beginning of the rainy season. Sorghum stems are often stored after the harvest and form an important dry-season forage resource, partially making up for the decrease in grazing land and ligneous forage.
The typical vertisols are now used to a great extent and new *kare* mainly consist of more or less vertic land, requiring the adaptation of cultural techniques. Use of *harde* requires development for muskwari. Farmers build and maintain a close network of small ridges forming enclosures so that rainwater is retained and infiltrates. After three or four years, the *karal harde* recovers vertisol characteristics (shrinkage cracks, microrelief, etc.) and production is comparable to that on the other vertisols. The technique improves the water balance and has strongly contributed to improving the productivity of muskwari land.
Many farmers consider that weed management is essential for successful cropping. Manual weeding is performed at the first rains to control ligneous plants and certain weeds that may hinder soil moisture absorption. Year after year, farmers encourage the growth of annual Gramineae that are easily scythed and burn fiercely, limiting regrowth of hardy plants during the cropping cycle (Donfack and Seignobos, 1996). The recent introduction of herbicide treatment in the crop management sequence is resulting in better weed control and reduces *karal* preparation time (Mathieu and Marnotte, 2001). The innovation was developed to control certain perennial weeds and replaces scything without calling burning off into question. Herbicide is already enabling the use of *kare* infested by perennial weeds (wild rice with rhizomes, *Cyperus*, etc.). Land

preparation time is a limiting factor for the transplanting area and a reduction should also reduce inter-annual variation in areas.

The dissemination of innovations has been by the circulation of information and collective learning in a rural society over a period of several decades. However, the process is not homogeneous among communities. In the foothills zones where muskwari is fairly recent, farmers are still learning and seem more innovative than in traditional replanted sorghum zones. They are more open to accepting new techniques and local varieties from other regions.

The changes in cropping systems reveal both intensification to increase *kare* productivity and extensive practices. The improvement of burning off and even the use of herbicide is aimed firstly at improving labour productivity (Seignobos et al, 1995). With the twin objective of increasing areas and reducing risks, farmers use the heterogeneity of the environments farmed by seeking to use different types of *karal.* However, landholding distribution during waves of land clearance is very unequal from one farmer to another.

Access to *karal* differs according to holding type

This aspect calls for a brief reminder of the rules governing landholding throughout the Diamaré plains. In the dominant Fulani system, it is considered that land is acquired by the right of conquest. It belongs to the common law authority which redistributes it against payment of the *Zakhat*, a land tax. Families have only the right of use, although this is durable and can be passed on.

Not all farmers in Balaza and Mowo grow transplanted sorghum. In Fulani circles, the large crop and livestock farms that have long been operating in the villages have appropriated most of the muskwari land. They formed 20% of farms in Balaza in 2000, holding nearly 50% of the *kare*. The village has reached landholding saturation since the spread of transplanted sorghum. All the land is cultivated and fallows have disappeared. Small farms, often run by migrants who arrived less than 20 years ago, form 25% of the survey sample. These operators are strongly limited by the shortage of available land. They all rent fields and only 20% grow transplanted sorghum as there is little *karal* for rent and this is often more expensive than land for rainfed crops (as much as CFAF 20,000 per ha). The cultivated areas are too small in relation to food crop requirements and most supplement their incomes by working as labourers on the large farms.

Fewer than 40% of the 243 farmers counted in Mowo in 2000 grow transplanted sorghum and more than half of the land concerned is outside the area. Transplanted sorghum is limited to the largest farms that have acquired capital in the form of a cleared and/or purchased area of *karal*. The recent cultivation of 'bush' zones in the south of the area has thus formed an opportunity for certain farmers to enlarge their holdingsncrease after negotiation for fields with the common law authorities (Seignobos and Teyssier, 1998).

These exchanges and reflection concerning the possibilities for landholding security should therefore be monitored within the framework of research on the changes in transplanted sorghum cropping systems.

THE NEED FOR RESEARCH AND FARMER SUPPORT SERVICES

The strong transplanted sorghum dynamics in the Extreme Northern Province is resulting in a number of changes in agrarian systems that should be monitored and accompanied.

Knowledge for orienting agrosystem evolution

At the regional scale, clearing for muskwari sorghum reduces the area available for firewood gathering and grazing. Today, most of the firewood supply for Maroua is from the clearing of land for muskwari. What will be the source of supply when transplanted sorghum spreads more slowly? The spread of muskwari also considerably reduces grazing land. Research must be continued on monitoring the spread of transplanted sorghum and analysing the consequences for the management of natural resources and for activities that depend directly on the latter.
At the local scale, muskwari dynamics are borne by farmers' determination to distribute their crops in space and time to ensure food security, to achieve better risk management, to make the most profit and spread this better over the year. The issue for the agricultural research sector is the accompaniment of farmers' strategies and their ability to adapt to new constraints. This involves better understanding of the diversity of cultural practices to guide the evolution of the cropping system while using the enriching and endogenous dissemination of farmers' know-how.

Towards support services managed collectively by farmers' organisations

An R&D programme initiated by the DPGT project (*Développement Paysannal et Gestion des Terroirs*) designed responses to weed problems. Other questions are raised concerning phytosanitary problems and the knowledge and distribution of local varieties. Control of stem borers (*Sesamia cretica*, etc.) is currently a leading preoccupation of farmers and should be targeted specifically.
The references being assembled on these technical problems are disseminated within the framework of advisory systems managed by farmers' organisations. The APROSTOCs (*Associations de Producteurs et de Stockeurs de Céréales*) that resulted from DPGT intervention are gradually acquiring a network of farmer advisers who support the improvement of muskwari sorghum growing.

These services are based on informal networks for the dissemination of information in order to make the best use of farmers' know-how and to achieve greater effectiveness in technology transfers. The farmer advisers are members of the rural communities in which they operate. They call upon farmers who are recognised and influential in village societies to help with training work and test technical improvements. These support services also lead to the stimulation of exchanges between production zones.
An alternative to the present form of public research and extension services is taking shape behind this with the service partly financed by farmers.

CONCLUSION

The dynamics of the spread of muskwari sorghum growing is resulting in deep-seated changes in agrarian systems in the Extreme North. The crop is spreading at the expense of natural areas used for wood collection and grazing. Its spread requires a change in farmers' strategies and cultural practices. The crop has become an important factor in the food security of farmers. Market sales, especially in the traditional production zones with grain surpluses, are increasingly a supplementary source of income. The present cotton sector slump may strengthen this function.
The trend is accompanied by the perfecting of crop management sequences. By adopting new cultural techniques, farmers have succeeded not only in improving yields but also in extending the crop to *harde* soils considered unsuitable for farming and to the vast plains subjected to prolonged flooding. The extensive cultural practices favoured by farmers to reduce risks by using the whole range of vertic soils available exist side by side with intensive practices such as the systematic development of certain *kare* and the increasing use of inputs (herbicide, seed treatment, etc.).
The capacity for adaptation and the dynamism of rural communities revealed by the evolution of muskwari sorghum should inspire new forms of research steering and organisation by giving a role to the stakeholders in the definition and implementation of programmes (Sebillotte, 2000). Muskwari sorghum is an excellent subject for a pluridisciplinary programme to provide direct support for farmers' efforts and their organisations in improving farming systems.

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oral presentation, small farm diversification and competitiveness, farming systems knowledge and information system.