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Original Research Article

Overview of the Burkina Faso seed system: Case of the formal seed system

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The seed law adopted since 2006 in Burkina Faso remains little known as its tools are unsuited to the conditions of the farmers. So, it must be revised to take into account the knowledge levels of different seed producers. To increase crops yields, the country has initiated an extension program of improved varieties. Despite the efforts to replace local seed system, the impact remains in general below expectation. In order to develop documentation on the seed sector and to have more information about the formal seed system, an investigation was carried out in six districts of Burkina Faso. The study revealed that the majority of farmers grow on a small area and only a small number of crops are improved seeds. Moreover, for the six districts, the study showed a weakness of this sector in Burkina Faso and a localization of the majority of seed suppliers in the sudano-sahelian area of the country. The main cultivated crops are traditional cereals and leguminous species. Nevertheless, a continuous increase of seed suppliers was observed during the last ten years. Maize and cowpea are respectively the cereal and leguminous crops which had high certified seed production during 2001-2010 period. So, a strong complementarity between formal and local sector is necessary. The seed policies of both sectors must be carefully developed in the country with contribution of all actors of the seed system.

Key words : Seed system, improved varieties, crops, survey, Burkina Faso.

INTRODUCTION

Crops yield in West and Central Africa is considered to be among the lowest in the world. This productivity is lower than that of China, Europe and USA (Tittonell and Giller, 2012). Indeed, quality seed contributes to about 40% in crop yield. For a number of food crops, the adoption of improved varieties in developing countries is significant, particularly in uniform and high production potential areas (Dalrymple, 1986a, 1986b). Thus, West and Central African governments have initiated strong programs of improved crop varieties using extension policies these last ten years through the reinforcement of formal seed system (MAHRH, 2010; CTAO, 2010; CNS, 2014).

In Burkina Faso, the formal seed sector share in the total seed supply rarely exceeds 6% in most staple crops (Compaoré et al., 2008). In 80% of the total studied crops planted, farmers have used their own seeds (Seboka and Deressa 2000 ; Kebebew et al., 2001; Lipper et al. 2005). Pearl millet and sorghum represent 73.6% of cultivated areas and improved seed made up less than 3 % of the total cultivated area in the country (Compaoré et al., 2008). However, local seed sources, other than the farmers' own seed, have the advantage that the variety or a mixture is usually known to be more adapted to the agro-ecological and socio-economic conditions of a given area (Almekinders et al., 1994).

The formal seed sector is accessed as a source of seed largely used for more recently introduced crops. Conventional wisdom suggests that these changes are associated with the loss of crop genetic diversity, decrease in the number of farmers growing landraces and the area of landrace cultivation on farms (Bellon 1996; Teklu and Hammer 2006). It is difficult to understand the scientist

who asks farmers to use improved varieties and also on-farm conserving of crop landraces genetic diversity.

According to other authors, local and formal seed supply systems are considered as complementary to variety improvement in the entire field of seed supply (Almekinders et al., 1994). For Almekinders et al. (2002), the existence of formal system in Africa, is the result of specialization of seed production and breeding, which started in the early 21th century. Strategies such as distribution of seed mini-kits (Green, 1987; Singh, 1993) and seed samples (CIAT, 1990; Grisley and Shamambo, 1993), the organization of variety demonstrations and seed fairs (Tapia, 1993) could be used for seeds diffusion.

The importance of improved and local varieties suggests a particular attention to formal seed system. But, there is not enough information about the formal seed sector in Burkina Faso. The need to provide documentation about this recent sector is important because it will contribute for agriculture valorization. The paper analyzes the formal seed supply system dynamic through a field survey in six districts of Burkina Faso.

MATERIAL AND METHOD

Study area

The Burkina Faso's economy is largely based on crop and livestock productions, which engage 90% of the workforce and contribute to 39% of the gross domestic product (Bougma et al., 2015). A variety of food crops occupy the cultivated area in the country (which amounts to around 13% of the national territory), and are mostly grown in subsistence farming systems, usually characterized by a dominant food staple cereals crops such as pearl millet, sorghum, maize, rice or fonio. Pearl millet and sorghum contribute to over 60% of the average diet of the population. The characteristics of climate of the study zones are shown in Table 1.

Study material

In seed system, two terms are used in Burkina Faso: formal and local seed sectors. Formal seed sector is considered as a seed production which is organized around breeder, foundation and certified (1 and 2) seeds whereas local seed sector is characterized by seed produced by farmers. This latter system does not involve other actors in the selection process. Seeds can often be obtained by exchange without involvement of cash. The present study was focused on formal seed system.

Conduct of survey

Surveys were conducted in six districts (Figure 1). These districts represent the three principal agroecological zones of Burkina Faso where cereals and leguminous species are important food crops. Surveys were structured to cover a representative sample of actors. A total of 119 persons representing different seed suppliers such as the individual seeds suppliers, the farmers organizations, NGOs and the farmers groups were interviewed. Data collected during survey are relative to all crops of the formal seed system except cotton, number of seeds suppliers per province and crop, quantity of seeds produced by seeds suppliers interviewed per district.

Data analysis

Data collected was used to calculate frequencies of crops production and produce diagram of parameters such as evolution of the number of seed suppliers and samples analyzed, distribution of quantities of certified seeds with Excel 2013. Xlstat pro2015 software was also used to estimate p-value, mean square through the analysis of variance (ANOVA) of seeds production within each crop of all areas.

RESULTS

Seed suppliers interviewed

The Table 2 presents the number of seed suppliers, data recorded per crop within the six districts in 2012. Overall, 29.67% of suppliers are located in sahelian site, 40% in sudano-sahelian site and 30.32% of suppliers in sudanian area. Survey identified seven (7) crops species used for seed production in the six districts. The main species cultivated are cereals and leguminous crops. There are both suppliers and crops variations within or among the six communities surveyed. Indeed, seed suppliers cultivating cowpea are the most important (41.84%), followed by suppliers producing pearl millet (17.02%) and suppliers cultivating sorghum and maize (12.76%). A minority of farmers produced soybean, peanut and oinion as seed. Lorum and Soum districts located in the sahelian site have adopted cowpea whereas Sanmatenga and Namentenga located in sudano-sahelian area have adopted pearl millet, sorghum and cowpea. Rice and maize are mainly cultivated in Nahouri and Zoundweogo districts (sudanian zone).

Quantity of seed produced by seed suppliers interviewed in each district

Seeds quantities provided by each district in 2011 and 2012 are recorded in Table 3. During this period, quantities of seeds varied significantly. The quantities of seeds produced per crops were low compared to farmers' needs. The predominance of the seeds exchanges between farmers in the local or informal system slows down the rate of purchase of seeds of the formal system. Moreover, the quantities of seeds produced in each province for the major crops do not allow seed suppliers to interact with the others. For cowpea seed production for example, quantity

Table 1. Agro-climatic characteristics of studies zones

	Sahelian zone		Sudano-Sahelian zone		Sudanian zone	
Districts	**Lorum**	**Soum**	**Namentenga**	**Sanmatenga**	**Nahouri**	**Zoundwéogo**
Annual average rain fall (mm)	300- 600	300- 600	900 -600	900 - 600	900- 1200	900-1200
Time interval between 1st et last rain (days)	110	110	150	150	180-200	180-200
Rain fall days number per year	<45	<45	50-70	50-70	85-100	85-100
Annual average temperature (°C)	29	29	28	28	27	27
Air moisture of the dry season and wet season	20% -70%	20% -70%	23%/ -75%	23%-/75%	25% -85%	25% -85%
Annual average evaporation (mm)	2200-2 500	2 200-2500	1900 - 2100	1900 - 2 100	1500-1700	1500-1 700

Sources : http://www.fao.org et MECV/SP/CONEDD, 2007

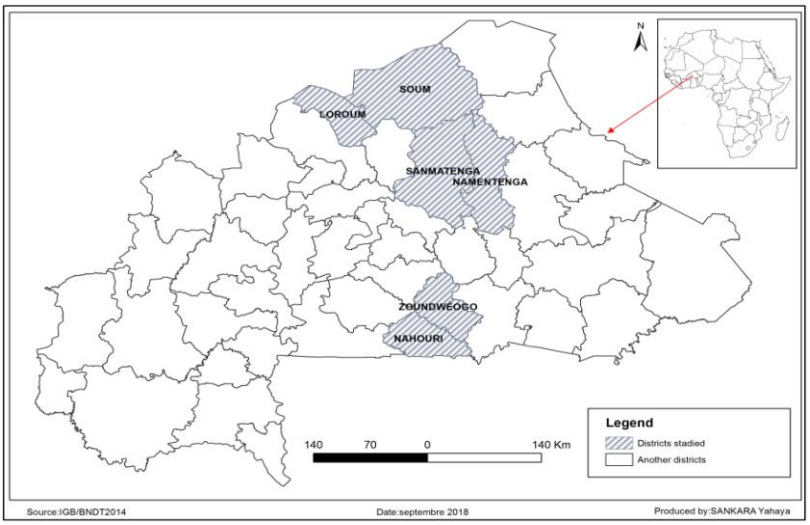

Figure 1: Localization of areas of the data gathering

Table 2. Variation of number of seed suppliers per province and crop

	Pearl millet	Sorghum	Maize	Rice	Cowpea	Sesame	Oinion	Soybean	Peanut
Lorum	1	-	-	-	4	2	2	-	-
Soum	5	1	-	-	30	1	-	-	-
Namemtenga	2	1	-	-	3	-	-	-	-
Sanmatenga	15	8	2	-	12	3	5	1	-
Nahouri	-	1	3	5	5	2	-	2	-
Zoundwéogo	1	7	13	-	5	3	-	1	2
Total	24	18	18	5	59	9	7	4	2
Frequency (%)	17.02	12.76	12.76	3.54	41.84	6.38	4.96	2.83	1.41

produced is similar in districts.

Analysis of the number of seed suppliers and lots samples analyzed in the laboratory during 2001-2010

The number of seed suppliers increased from 200 to 3500 in 10 years period (Figure 2). This number rose at a rate of about 2.08% per year. In the same time, the number of samples lots controlled increased from 250 to 4125 with a rate around 1.6% per year. A positive correlation between number of seed suppliers and number of samples analyzed in laboratory were observed. Taking account of both factors in the analysis, the results indicated that increasing of 2.08% in seed suppliers would lead to an increase of 1.6 of

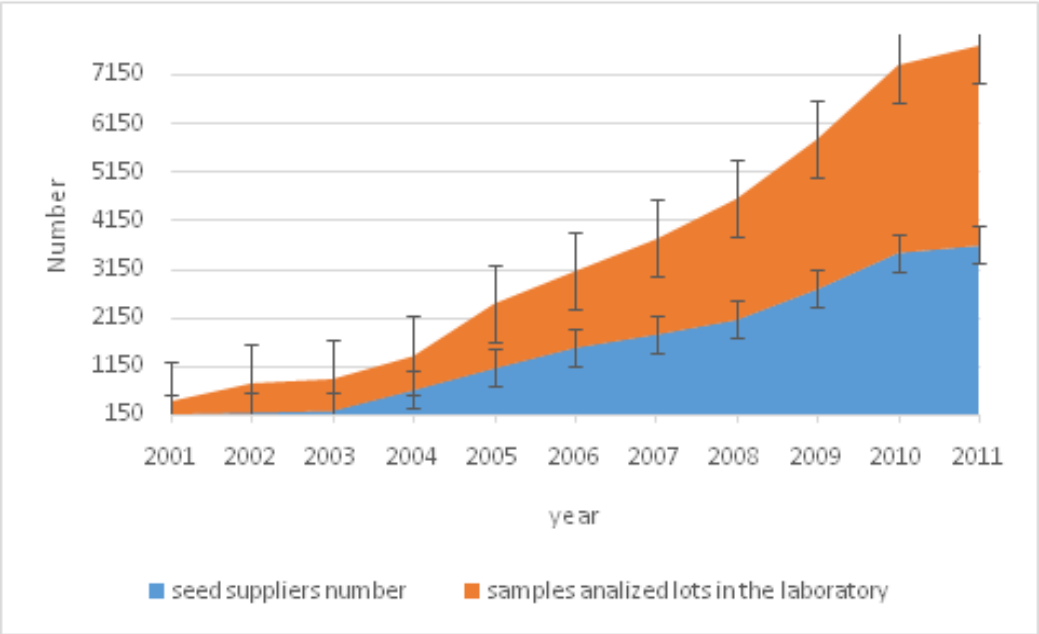

Figure 2: Evolution of number of seed suppliers and samples analyzed in the laboratory of SNS between 2001-2010

Table 3. Variation of quantity (kg) of seed produced by seed suppliers interviewed per district

Area	Lorum		Soum		Namentenga		Sanmatenga		Nahouri		Zoundwéogo	
Crops	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**	**2011**	**2012**
Pearl millet	420	0	18250	34700	2450	3700	13400	11180	-	-	4500	0
Sorghum	-	-	76650	13400	1700	3700	11350	12000	2000	3400	86500	107050
Maize	-	-	-	-	-	-	3500	4000	49500	36400	272250	198450
Rice	-	-	-	-	-	-	-	-	10000	10500	98200	284900
Cowpea	2600	1850	3040	92730	950	-	14300	12850	3000	2400	33100	28700
Sesame	500	300	200	400	-	-	1000	410	1700	7000	-	-
Oinion	20	20	-	-	-	-	794	1107	-	-	-	-
Soybean	-	-	-	-	-	-	20	25	6500	9875	7000	0
Peanut	-	-	-	-	-		-	-	-	-	12800	8050

the number of samples analyzed in the laboratory.

Analysis of seed production during 2001-2010

Cereals

During the period 2001 to 2010, pearl millet seed production was not stable (Table 4). In fact, the average pearl millet seed production increased from 5.02 t to 131.4 t. Average sorghum seed production also increased from 26.32 t to 738.8 t during the same period or 499 t/year from 2007 to 2010. Concerning maize, the average seed production increased from 112.9 t to 11302.6 t during 2001-2010. It records the best production rate by year among the others crops. Since 2005 year, it reached 2000 t/year and an index increased of 0.8 between 2005 to 2010. Average rice seed production increased during the last 10 years with a great fluctuation during the period between two consecutive years.

Leguminous

Cowpea is one of the leguminous plants which registered a big increase in seed production. In fact, cowpea seed production increased continuously during the period 2001-2010. It passed from 37.4 t in 2001 to 924.7 t in 2010. The average of sesame seed production increased during the last 10 years. The best sesame production was obtained during the period 2005-2010.

Soybean seed production over the last 10 years was the lowest among all the crops evaluated and varied between 0.73 t and 113 t/year. The increase in soybean seed production was not stable during 2001-2010 except between year 2005 and 2007. Average peanut seed production was not stable during two consecutive years.

During the period, peanut seed production recorded a

Table 4. Mean quantity (t/year) of seeds by crop recorded during the period 2001-2010

Crops	Min.	Mean	Max.	SCM	p-value
Maize	112.95	2193.90	11302.6	1808.45	0.006
Pearl millet	5.02	55.89	141.4	63.41	0.029
Cowpea	37.4	269.31	924.7	183.71	0.002
Rice	17.81	367.17	1541.2	513.90	0.064
Sesame	18.41	144.13	332.1	150.35	0.020
Soybean	11.63	54.70	114.46	46.30	0.007
Sorghum	26.32	237.72	738.8	231.60	0.015
Peanut	9.06	101.69	250.2	99.94	0.015

Min. : minimum ; max.: maximum ; SCM : mean squares

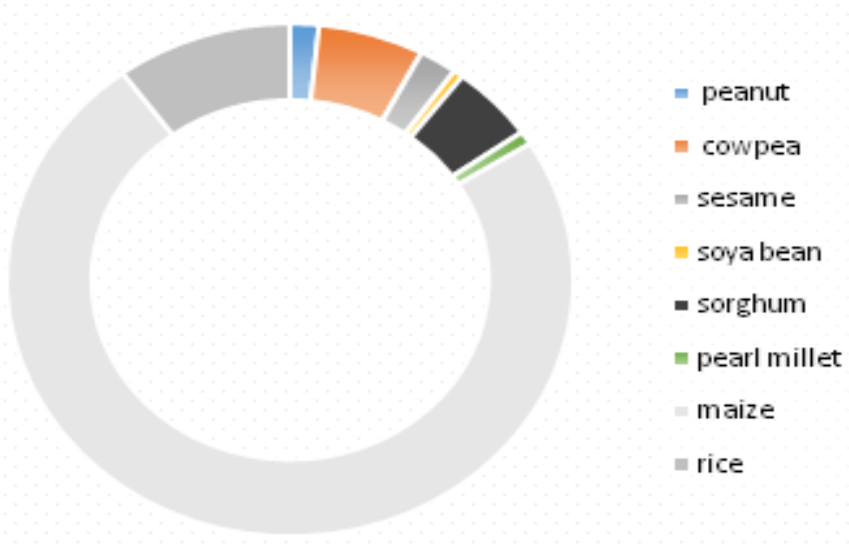

Figure 3: Distribution (%) of quantities of certified seed per crop

pick at about 9 t in 2001 to 250 t in 2010.

Distribution of certified seeds

The Figure 3 indicates distribution of quantities of certified seeds. Maize certified seed production is about 73.84% and that of rice is about 10.06%. The lowest certified seeds productions were observed with sorghum (5%) and pearl millet (1%). This analysis shows that the majority of farmers use their own seeds.

DISCUSSION

The availability of diverse crops seeds depends on the National Research Program through INERA and the decision of seeds suppliers. Seed supply system of farmers constitutes the second factor in term of importance that influences on-farm agricultural biodiversity, conservation and utilization. The frequency of drought seasons determines the level and the nature of seed exchange. Creating stronger linkages between the formal seed system and farmer exchange networks will allow new genetic material to be vetted by farmers and disseminated appropriately (Aw-Hassan et al., 2008 ; de Boef et al., 2010).

Quantity of seed produced by seed suppliers interviewed was very low. In comparison to the number of seeds suppliers per year, seed quantity produced is low. It may be explained by the fact that the majority of seed suppliers are working on very small plots which are not bigger than 1 to 2ha. This situation becomes complicated for fields inspection and makes heavy certification process and charges. That is due to the weakness of farmers' means of production and financial capacities. Increased variability in seed production between years may be linked to rapid changes of improved varieties. Similar results have been also reported by Almekinders et al. (2002). In 2011, Service National des Semences (National Seed Service) has analyzed 15818 t of seed and 824.24 t has been rejected. Production stability is associated with financial capacity, working tools, farmers training and quality foundation seed. According to Hardon and de Boef (1993), these technologies are not sufficiently adapted for the majority of the farmers in developing countries.

Burkina Faso seeds policy limits the intervention of several actors in formal seed system. Indeed, fields of trials of the «Institut National de l'Environnement et de Recherches Agricoles (INERA) cover varietal creation, crop breeding, the development and the maintenance of the innovating techniques, the generation and production of breeder and foundation seeds as well as the training of the actors. Until now, the INERA remains the single institute entitled of producing the breeder and foundation seeds. However, many countries in Africa used the quality declared seed system presented by FAO in 1993 and revised in 2006, particularly designed for countries with limited resources, which is less demanding than full seed quality control systems (FAO, 1994). A better implication of the seed producers in the formal seed system could improve considerably the production of quality seeds. In Sierra Leone, it is reported for rice that farmers may also pick up off-type plants, separate those seeds, and thus develop their own new variety (Richards, 1987; Longley, 2000). Despite the considerable effort of scientist enhanced by AGRA in Africa, the impact has in general been below expectation. Cases are reported in which, the linkage of formal institutions with the farmers' system not only serves to strengthening the latter, but also serves the formal system to establish collaborative relationships with the farmers' system (Almekinders et al., 2002). But, the importance of formal seed system is mostly associated with developing countries. When we consider a set of factors with soil poverty and farmers' preferences for seeds from their cultivars, the results shows that local seed system would have some impact on formal seed system. Many farmers select their own seed for the next planting. Surveyed individuals' point of view, formal seed sector lacks enough information and sensitization. In fact, an increase in foundation seeds price would lead to reduce the production of the seeds and suppliers number. A difficulty of obtaining the foundation seeds of quality will lead to reduce certified seeds production. An accumulation of bad growing seasons and without irrigation system would result in reducing the formal seed sector. An increase in seed production expenses could result in lowering the seed production. The price-cutting of the seeds could reduce the number of suppliers. The difficulties of forecast of seeds quantities needed and the choice of varieties by farmers decrease the number of suppliers. The lack of equipment of work and modern technologies would significantly reduce the number of seeds suppliers. The difficulties of access to good quality inputs and on time reduce the outputs of the crops. According to Almekinders et al. (1994), the formal seed sector could organize the diffusion of new cultivars and supply of good quality seed to small farmers to a large extent through the local seed systems, using and developing knowledge and expertise available in these systems.

Many seeds suppliers are not trained, neither organized. In most cases, seeds producers operate relatively isolated. There are reasons to believe that formal seed sector is under developed in Burkina Faso. For this reason, while the informal seed system contributes for 91.2% to the seed needs of the population, the production of improved seeds available compared to country needs in 2008 was 1.32% for sorghum; 0.56% for pearl millet; 40.62% for maize; 12.86% for rice; 51,27% for cowpea; 91.53 for sesame and 0.48% for peanut The improved seed coverage rates presented are still very low to boost agriculture in Burkina Faso as we desire (Tebda, 2013).

CONCLUSION

The study allowed to know more about seed systems in particular formal seed system in Burkina Faso. The majority of seed suppliers are working on very small plots. Lack of organized input dealers leads to poor access to quality seed production. The study showed also the existence of confusion between local and formal seed systems due to the cultivation by farmers of improved varieties and landraces crops in the same areas. Moreover, the limits of formal seed system are explained by its pyramidal structure in which different actors have not yet the capacity to build and to play their roles. Many of these actors are not trained, neither organized. The formal seed system is organized for the production of main crops of the country and the diffusion of improved varieties without a maintain of genetic diversity of landraces crops. Its improvement requires a global analysis on seed policy with seed suppliers in this formal seed system. Further study involving breeders and extension agents to all the production areas could help to deepen the results of this study.

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Conflict of interests

The authors declare that they have no conflicting interests.

REFERENCES

Almekinders CJM, Louwaars NP, de Bruijn GH (1994) Local seed systems and their importance for an improved seed supply in developing countries. *Euphytica* 78:207–216.

Almekinders CJML Waars NP (2002). The importance of the farmers' seed systems in a functional national seed sector. J New Seeds, 4:15-33.

A AW-Hassan, A Mazid, H Salahieh (2008). The Role of Informal Farmerto-Farmer Seed Distribution in Diffusion of New Barley Varieties in Syria. Experimental Agric. 44(3): 413–431.

Bellon MR (1996). Dynamics of Crop Infraspecific Diversity: A Conceptual Framework at the Farmer Level. Economic Botany 50(1): 26–39.

Bougma A, Galluzzi G, Sawadogo M (2015). The importance of international exchanges of plant genetic resources for national crop improvement in Burkina Faso. Working Paper no. 152. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

CIAT (1990). Gloriabamba, a successful bean variety. CIAT International 9 (2): 1.

Comité National des Semences (2014).Catalogue National des espèces et variétés agricoles du Burkina Faso.

Compaoré M, Naon F, Yamanaka K (2008). Etude de la situation actuelle sur la production et l'utilisation des semences améliorées dans les provinces de l'Oubritenga, du Passoré, du Séno, du Houet et du Boulgou du Burkina Faso. PNDSA, JICA. 101 p

Coopération Technique Afrique de l'Ouest (CTAO) – Allemagne (2001). Projet Promotion de la Production et de la Commercialisation des Semences en Afrique de l'Ouest (WASDU).Comment lancer et gérer avec succès une entreprise semencière ? Publication WASDU n° 14.

Dalrymple D (1986a). Development and spread of high yielding wheat varieties in developing countries. USAID, Washington D.C.

Dalrymple D (1986b). Development and spread of high yielding rice varieties in developing countries. USAID, Washington, D.C.

de Boef WS, Dempewolf H, Byakweli JM, Engels JMM (2010). Integrating Genetic Resource Conservation and Sustainable Development into Strategies to Increase the Robustness of Seed Systems. J. Sustaina. Agric. 34(5): 504–531.

FAO (1994). FAO seed review 1989-1990. Food and Agriculture Organisation of the United Nations, Rome.http://www.fao.org/docrep/009/j2623f/J2623F08.htm.

Green T (1987). Farmer-to-farmer seed exchange in the eastern hills of Nepal: the case of Pokhreli masino' rice. Kathmandu, Nepal, Pakhribas Agricultural Centre, working paper 05/87

Grisley W, Shamambo M (1993). An analysis of the adoption and diffusion of Carioca beans in Zambia, resulting from experimental distribution of seed. Expl. Agr. 29 (3): 379-386.

Hardon JJ, de Boef WS (1993). Linking farmers and breeders in local crop development. In: W. de Boef, K. Amanor, K. Wellard & A. Bebbington (Eds). Cultivating knowledge. Genetic diversity, farmer experimentation and crop research, pp. 64-71. IT Publications Ltd., London.

Kebebew F, Tsehaye Y, McNeilly T (2001). Morphological and Farmers Cognitive Diversity of Barley (Hordeum Vulgare) at Bale and North Shewa of Ethiopia. Genetic Resources and Crop Evolution 00: 1–10.

Lipper L, Cavatassi R, Winters P (2005). Seed Systems, Household Welfare and Crop Genetic Diversity: An Economic Methodology Applied in Ethiopia. UN FAO Agricultural andDevelopment Economics Division. ESATechnical Paper, November 2005.

Longley CA (2000). A social life of seeds: Local management of crop variability in North Western Sierra Leone. Dept. of Anthroplogy, University of London. PhD Thesis. 306 p.

MECV/SP-CONEDD (2007). Programme d'action national d'adaptation à la variabilité et aux changements climatiques (PANA du Burkina Faso) : 84p.

Ministère de l'Agriculture, de l'hydraulique et des Ressources Halieutiques (MAHRH), (2010). Stratégie de développement durable du secteur semencier du Burkina Faso 2011-2020. Document final.

Richards P (1987). Spreading risks across slopes: diversified rice production in central SierraLeone. ILEIA Newsletter 3(2):8-9.

Seboka B, Deressa A (2000).Validating farmers' indigenous social networks for local seed supply in the Central Rift Valley of Ethiopia. J. Agric. Educ. Extension 6 (4): 245–254.

Singh B (1993). IDRC Supported Rapeseed Mustard Research Project at GB Pant University of Agriculture and Technology, Panatgar, India. In: N. Thomas & N. Mateo (Eds), 1990. Seed Production Mechanisms, Proceedings of a workshop held in Singapore, 5-9 November, 1990, pp. 134-154. IDRC, Ottawa.

Tebda A (2013). Problématique de la production des semences agricoles en milieu paysan au Burkina Faso: étude de cas relative à la région du centre. Mémoire de Master professionnel. Université dOuaga 1 Prof. Joseph KI-ZERBO, 67p.

Tapia ME, Rosa A (1993). Seed fairs in the Andes: a strategy for local conservation of plant genetic resources. In: W. deBoef, K. Amanor, K. Wellard & A. Bebbington (Eds). Cultivating knowledge. Genetic diversity, farmer experimentation and crop research, pp. 111-118. IT Publications Ltd., London.

Teklu Y, Hammer K (2006). Farmers' Perception and Genetic Erosion of Tetraploid Wheats Landraces in Ethiopia. Genetic Resources and Crop Evolution 53: 1099–1113.

Tittonell P, Giller KE (2012). When yield gaps are poverty traps: The paradigm of ecological intensification in African smallholder agriculture. Field Crops Res. 2012, 1-15.,