

Community seed bank: Good practice for on-farm conservation of agricultural biodiversity

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ABSTRACT

Community Seed Bank (CSB) is emerging as a reliable option for on-farm conservation of local crop diversity in the areas where genetic erosion of traditional varieties is very rapid. Our study conducted in Kachorwa of Bara district, Nepal shows that with high technological intervention and easy access to input, farmers are purchasing more high-yielding modern variety seeds that are replacing traditional landraces. Out of 33 rice landraces inventoried in 1998, the number of rice landraces at the community level decreased to 14 in five years despite the implementation of on-farm conservation programme. Farmers' tendency to purchase seed has increased from 19% in 2001 to 42% in 2005. Such rapid loss of local landraces make the farming community more dependent on outside sources for seed and thus it makes local livelihood options vulnerable during natural or economic calamities. Access to seed of local landraces is a major constraint as there is no formal institution responsible for their marketing. However, the local landraces are valuable for poor and women farmers who tend to have marginal land in which they can ill afford inputs like new varieties. The project used CSB as a contact point to access local seed and associated knowledge, and also to mobilise social, financial and human capitals for sensitizing community members on value of agricultural biodiversity. The CSB also has given greater priority to the access of seed to women group members and resource poor farmers who are not able to save or purchase seeds. Preliminary results showed that 38-43% of poor farmers have received seed of 11 to 23 landraces annually in the last three years. Community has built CSB structure with local resources and preserved all locally important landraces in local storage systems with information being documented in community biodiversity register in vernacular language. This register is further used to document traditional knowledge, genetic materials and local innovations. The CSB has resulted in community empowerment and increased social cohesiveness as it has been managed through community group actions. The CSB approach in Nepal has demonstrated that endangered, unique, and useful landraces could be conserved on-farm. This paper assesses the CSB as a good practice to provide incentive to the farmers. The analysis suggests that the urgently need of CSB to conserve agricultural biodiversity in areas with i) high technological intervention, ii) high access to inputs, iii) marginal growing environments and iv) frequent natural disasters like floods and droughts. This study has given a knowledge base and modality of grassroots strengthening for on-farm conservation of agro-biodiversity. This experience can guide the scaling up and capacity development of other regions with similar agro-ecology and with community-based institutions that have capacity to link with local level government and civil societies for other community based rural development interventions.

Key words: Agro-biodiversity, community seed bank, on-farm conservation, rice landraces, Nepal

INTRODUCTION

Food and Agriculture Organization of the United Nations (FAO) reported that the replacement of local varieties with improved or exotic varieties or both is the major cause of genetic erosion throughout the world (FAO, 1998; Chaudhary *et al.*, 2004). The loss of agro-biodiversity leads to reduction in the capacity of agricultural ecosystem to continue producing renewal resources and limits the ecosystem's ability to deal with change, which leads to decreased resilience (Vernooy,

2003). Unavailability of the options of value addition to maximize the benefits from traditional crop landraces (Singh *et al.*, 2006) and lack of sufficient quality seeds, good access of road and markets, agriculture inputs, irrigation and technical services (Sherchand *et al.*, 1998) have led to the loss of these traditional and local landraces. The loss is accelerated further by unfavourable policy that promotes modern varieties and higher inputs (Rana *et al.*, 2002).

Several studies have indicated that small scale farming households need different types of seeds to benefit from the many end uses of each crop and as a coping strategy for complex, diverse and risky environments (Joshi and Sthapit, 1990; de Boef *et al.*, 1993; Cromwell, 1996; Lewis and Mulvany, 1997; Janssen *et al.*, 1992). However, formal seed system cannot meet the seed demands of small-scale farmers, who typically desire multiple varieties of seeds for all crops which may vary from one season to the next, in small amounts, at the right time and at a reasonable cost (Friss-Hansen and Sthapit 2000). CSB can address this vital need. This approach has been implemented successfully in Ethiopia (Feyissa 2000), Bangladesh (Mazhar 2000) and Bolivia and Peru (Victor *et al.*, 2000). The concept of CSB in Zimbabwe anchored on accessibility of seed to local farmers as storage unit and sources of new and local seed (Mujaju *et al.*, 2003). The CSB approach introduced by *in situ* conservation project in Nepal has also been used as an entry point to community based management of biodiversity and it is designed to document knowledge on endangered, unique and useful landraces and to develop conservation actions that can be locally supported. In many African countries CSB methods have been used to supply the seed requirement of farmers which could be potentially not helpful for on-farm conservation of local seed in local conditions. Learning from past mistakes and failures, the CSB implemented in Kachorwa, Bara, Nepal has been piloted with the following objectives:

- to improve easy access of farmers variety seeds at the local level
- to document knowledge of traditional varieties and maintain small amount of seed
- to promote a contact point for local seeds and information and
- to promote on-farm conservation through community based conservation actions

In the study site, farmers are increasingly opting for high yielding modern varieties instead of traditional rice landraces to maintain food security (Shrestha *et al.*, 2004). Monitoring results of Community Biodiversity Register (CBR¹) revealed that the growing area and the number of rice landraces cultivated are decreasing. Furthermore, farming communities are becoming more dependent now on outside sources for seed and reducing their local seed security than a decade ago. Natural calamities such as continuous drought and floods also lead to a rapid loss of rice landraces along with a decrease in the area under cultivation (from 16.7 to 3.4 % of total rice area from 1998 to 2003) within a short period of time. This situation encouraged farmers to establish CSB (Shrestha *et al.*, 2004). The CSB has been managing seeds of rice, finger millet, pigeon pea and sponge gourd landraces. This paper assesses the value of the CSB as a good practice that can improve incentive to the farmers, community empowerment process for CSB management, and its contribution to on-farm conservation of agricultural biodiversity. It also examines the possibilities of up scaling and replicating this good practice in other parts of the country or region.

METHODS OF COMMUNITY SEED BANK IMPLEMENTATION

Study site

The study site, Kachorwa village of Bara district is located in the low altitude (80-90m asl) and sub-tropical, fertile zone of the Indo-Gangetic plain in Central *Terai* region on the southern border with India. Agriculture is the main occupation of the population. Table 1 illustrates that the farmers in this area have better access to modern varieties, modern inputs and technologies and marketing opportunities (Rana *et al.*, 2000).

¹ CBR is a register maintained by a local community or institutions to record the existence of biodiversity and associated knowledge base of communities at local level (Rijal *et al.*, 2000).

Table 1: Characteristic features of the study site.

S.N.	Variables	Unit	Kachorwa, Bara district
1.	Elevation (range)	Meters asl	80-90
2.	Annual rainfall	mm/year	1515
3.	Mean annual temperature	°C	24.6
4.	Market access	Poor/Good	Good
5.	Research & extension intervention	Low/High	High
6.	Total number of households	Number	914
7.	Mean family size	Person/HH	6.5±0.2
8.	Agriculture as main occupation	Percentage of HHs	97.0
9.	Mean agricultural land area	Hectare/HH	0.8±0.1
	Total varietal richness	Number/village	
	-Rice		53 (20)
	-Finger millet		1 (0)
	-Taro		3(0)
	-Pigeon pea		5 (0)
	-Sponge gourds		16 (0)
	-Cucumber		4 (0)

(Source: Rana *et al.*, 2000), figures in parenthesis indicate the number of modern varieties

Steps of CSB implementation

CSB is a community-managed seed conservation approach that expands the local practice from the household to the community. The establishment, continuity and the success of a CSB rely on the interest and awareness of local community on the importance of agro-biodiversity and their continuous participation. Steps undertaken to implement CSB are summarized in figure 1 and discussed below.

Step 1 : Community sensitization

Genetic erosion of traditional varieties is taking place in the study site due to high technological intervention, high access to input and frequent natural disasters like floods and drought. The farmers have perceived the alarming rate of rice landrace erosion and internalized the importance and the need for conservation. CBR and diversity fair² were used to sensitise and ascertain alarming situation in Kachorwa village.

Step 2: Strengthening local institutions

Empowerment of farmers and community based institutions were considered and used as a key to implement CSB approach. Organization of community members in a local institution and training on CSB and as well as group management were conducted to empower them. A conceptual and practical training on safe seed handling and storage was given to the members and care takers. The capacity of community based institution members to maintain CBR, multiply traditional seed to increase access and maintain a small quantity of seed in traditional seed storage structure was developed through group discussion, training and exposure visit. The seed bank source users were oriented during seed distribution and before harvest on ways to maintain quality and assured seed return. The roles of such local institution were to plan and implement village level activities that support agricultural biodiversity conservation actions and sustainable livelihoods.

Step 3: Development of rules and regulations

Rules and regulations regarding the mechanism for seed collection, regeneration, quality control and distribution were formulated to meet the community interests. Roles and responsibilities of CSB members to manage seeds were defined. The decisions were made in accordance with local context, custom and value for making it sustainable.

² Diversity fair is a competitive event to sensitize the communities on the value and use of conserving local landraces and to assess genetic diversity at community level (Rijal *et al.*, 2000).

Step 4: Construction of CSB structure using locally available materials

Locally available materials were used to construct the seed storage structure. Contributions from local people were encouraged to make the overall management of CSB locally sustainable. Traditionally, farmers use local seed storage structures such as *Mor* (made of rice straw), *Ghaila* (made of mud), *Kothi* (made of mud and bamboo), *Chaintha* and *Mouna* (made of bamboo) to store seed. In the CSB, similar storage structures were used for which they did not require any specific and additional technical knowledge to build and manage. During the construction, external supports from village development committee of equivalent NRs 12000 and from Bioversity International, NRs 72000 were also accepted.

Step 5: Collection of local seeds by various means including diversity fair

The CSB program has identified and collected rare and highly threatened landraces through CBR and diversity fair activities. The landraces grown by few households in small plots were carefully collected from individual custodians. Seed bank members also collected traditional vegetable and other crop species from nodal farmers, neighbours, relatives and neighbouring villages.

Step 6: Development of options for livelihood and income generation

Community Biodiversity Management (CBM) fund of NRs 75000 (equivalent to \$ 1050) with 33% cash contribution from community and remaining from the project was created to develop options for livelihood and income generation and linked with local crop landraces conservation. Loan for income generation activities from CBM fund was provided to 25 members each year with low interest (12 percent per annum) giving priority to the poorest of the poor members of the group. The CBM fund management guideline was developed and endorsed by all groups before establishing CBM fund. One of the rules of CBM fund was; the members who collect loan from CBM fund has to grow at least two preferred landraces in small area (rice compulsory and one among pigeon pea, sponge gourd and finger millet), which are suitable to their farm land.

Step 7: Monitoring the impacts of CSB interventions

Primary objective of the CSB was to conserve local crop landraces by creating easy access to seed and planting materials for the farmers. The indicators used for the monitoring were how many farmers saved seed for subsequent year among users; how many farmers distributed the seed for neighbours, relatives or other interested farmers; how much they earned from CBM fund; whether they followed the rules of growing at least two crop landraces; and how the farmers perceived the presence of CSB in their village.

RESULTS AND DISCUSSIONS

Local seed security and on-farm conservation of crop landraces

In order to maintain food security, farmers are increasingly opting for the high yielding modern varieties instead of traditional landraces. Farmers are purchasing more high-yielding modern variety seeds and their tendency to purchase seed has increased from 19% in 2001 to 42% in 2005 (Table 2).

Table 2: Comparison of means of informal flow of rice seed through farmers' networks between 2001 and 2005 surveys.

Means of Flow	% Flow of Genetic Materials		
	2001	2004	2005
Exchange	64	56	52
Gift	17	5	6
Purchase	19	39	42

(Source: adapted from Paudel *et al.*, 2006)

This trend is making local seed system more vulnerable every year. In the study site, 33 rice landraces were inventoried in 1998, which decreased to 14 in 2003. Likewise, landraces growers decreased to 31.8 from 67.8% in five years despite implementation of on-farm conservation programme and total area occupied by rice landraces decreased to 3.4 from 16.67 % during the same period of time (Table 3).

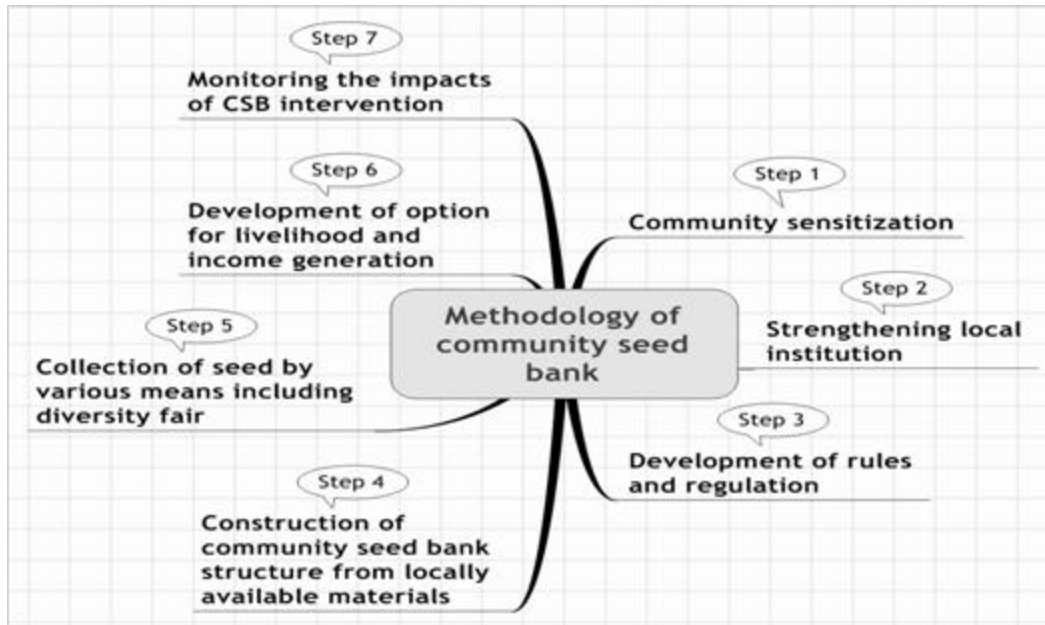


Figure 1: Methodology of CSB implementation (Shrestha et al., 2006)

Table 3: Number of farmers and area of rice landraces in different time periods

Year and type of study	Number		% of grower		% of area occupied by	
	LRs	MVs	LRs	MVs	LRs	MVs
Baseline 1998 (n=202 HHs)	33	20	67.8	-	16.67	83.3
CBR 2003 (n=349 HHs)	14	26	31.8	-	3.4	96.6

Note: - LRs: Landraces, MVs: Modern varieties, HHs: Households, CBR: Community Biodiversity Register, Source: Adapted and modified from Rana et al., 2000.

The CSB is leading to sustainable local seed security by supporting community seed demands and improving farmers' access to quality seeds thereby promoting conservation of local crop diversity on-farm. After the establishment of CSB, the number of landraces and overall diversity in the village has been increased and seed has become abundant and accessible. Results showed that farmers have received seed of 11 to 23 rice landraces in the last three years (Table 5). The options for the farmers of Kachorwa have been increased for marginal growing environments, which was limited before. Until now, seeds of 54 landraces of rice, 5 of sponge gourd, 2 of pigeon pea and 2 of finger millet have been collected, conserved (Table 4) and regenerated continuously for seed increase. Out of 54 rice landraces, 12 were short duration types, which tend to have drought tolerant characters, 15 were aromatic, fine and good eating quality types and 27 were suitable to be grown in swampy lands. The CSB has employed different on-farm seed conservation strategies, i) providing seed to the farmers following the traditional loan system, ii) maintaining diversity blocks of each crop and landrace and iii) keeping remnant stock to avoid risk of loss from natural disasters.

Table 4: Status of local seeds conserved at CSB.

S.N.	Crop	Number of additional landraces collected each year			
		2003	2004	2005	Total
1.	Rice	19	18	17	54
2.	Finger millet	2	-	-	2
3.	Sponge gourd	5	-	-	5
4.	Pigeon pea	2	-	-	2
Total		28	18	17	63

Increase access to genetic materials and supports rural livelihood

National genebanks try to conserve under-utilized landraces but its centralized management makes the access to seeds by farmers very difficult. Furthermore, being an *ex situ* practice, landraces preserved in national genebanks for a long time might no longer be well adapted to the original growing conditions. The project used CSB as a contact point to access local seed and associated knowledge. In the CSB, the members have collected a number of local crop germplasms with important information and associated knowledge using CBR database. Collected seeds are stored, regenerated or multiplied and distributed to fulfil seed requirements of farmers for their diverse agro ecology and promote on-farm conservation. It is important to note that the CSB collects seed grown by farmers so that the seed lot go through both human and natural selection. It is locally maintained and managed providing easy access to and control over planting materials for farmers, allowing traditional seed exchange and knowledge, and enhancing sustainable management of local resources. It has given greater priority of seed access for women group members and resource poor farmers who are not able to save or purchase seeds due to small land holding. Well-being status of users and seed in and out flow mechanisms were also categorized and discussed. Since the establishment of CSB, number of users and volume of seed transaction have been increased. In 2003, 40 farmers used CSB source, while the number were 87 in 2005. Preliminary results showed that 38-43% of poor farmers have received seed of 11 to 23 landraces in last three years (Table 5). The total number of seed bank source user has also increased to 87 from 40 and seed quantity to 197.2 from 86.7 kg in between 2003 to 2005 (Table 5).

Table 5: Recipients of seed from CSB by socioeconomic categories.

Year	Number of farmers of different socio-economic category				Number of landraces	Seed Qty. (Kg)
	Rich	Medium	Poor	Total		
2005	17(20%)	37 (42%)	33 (38%)	87	23	197.2
2004	6 (17%)	14 (40%)	15 (43%)	35	13	69.3
2003	5 (12%)	19 (48%)	16 (40%)	40	11	86.75

(Source: Seed distribution records from CSB, Kachorwa, Bara)

Incentives to the users and their perceptions

Perceived benefits and incentives of having CSB in the community were studied through individual household survey among users. A group discussion with nine members (3 female and 6 male) of CSB was organized to outline the social, economic and environmental benefits. A brief interview with 33% households among users of 2005 was conducted to understand their perspective and trace-out effectiveness of CSB for on-farm conservation of agro-biodiversity and its incentives to the farmers. The study revealed that the community members have benefited socially and economically from CSB. Among surveyed households, 86% accepted that the CSB promoted social interaction and increased cohesiveness through various meeting, training and other regular activities. It is also revealed 48% among interviewed households saved seed for subsequent year and 28% distributed the seed to neighbours and relatives. The CSB provides seed to the group and community members on traditional loan system and on minimum cost basis for outside community. Due to the activity of CSB, 70% reported that their interest towards local crop landraces conservation has been increased and 52% agreed that the CSB helped to strengthen local seed supply system. There were two reasons of using CSB for seed source; first, unavailability of seed from other sources such as neighbours and relatives (reported by 76%) and second, better quality seed from CSB as compared to their own source (reported by 24%). There were no formal institutions dealing with local seeds. Most of the marginal farmers tend to have marginal lands where landraces suit better than improved varieties. The CSB not only provided easy access to seed (62%) for their variable marginal growing environment but also knowledge (24%) and credit (14%) in low interest from community biodiversity management fund for income generation and conservation (Table 6). Thus, the CSB provided social, economic and ecological benefits to support their livelihood of the poor farmers and women group members.

Table 6: Benefits of CSB as perceived by users

Benefits	% of response (n=29 HHs)
Socioeconomic benefits	
-promote social interaction and increase cohesiveness	86
-increased interest for local crop landraces conservation	70
-create opportunities to strengthen local seed system	52
-seed saved for subsequent year	48
-seed distributed to other farmers/neighbors	28
Reasons of taking seed from CSB	
-unavailability of seed from other sources	76
-better quality seed from CSB	24
Access	
-easy availability of quality seed	62
- easy availability of quality seed and knowledge	24
- easy availability of seed and credit	14

HHs: Households

Community empowerment for on-farm conservation of agricultural biodiversity

CSB is an integral part of community-led agricultural biodiversity conservation approach. This practice was useful to strengthen the capacity of the Kachorwa community to manage and exchange on-farm local diversity through their own resources and knowledge base systems. They have documented and maintained CBR of rice, sponge gourd, pigeon pea and finger millet through which the extent and distribution of landrace diversity is analyzed, traditional and local knowledge are documented and seed production and distribution of rare and endangered landraces are planned. Awareness created by *in situ* conservation project encouraged CBR members to establish seed bank in a systematic way to counter the loss of landraces, by collecting seed of local landraces, regeneration, distribution, rules setting and overall management of the seed bank (Figure 2). Agriculture Development and Conservation Society (ADCS³), implementing CSB mobilizes the women groups, nodal farmers and farmers for collecting seed, regeneration and organize the diversity fairs. ADCS continuously maintains diversity blocks of all crop landraces collected at CSB, which are used to produce adequate quantities of seed for distribution. Seed cleaning, drying, storage in traditional seed storage structure is conducted by the members of ADCS on both wage and volunteer basis. Germination test is conducted before distributing the seed and only seed with adequate level of germination is distributed.

ADCS has established a community biodiversity management fund of NPRs 75000.0 with 33% community contribution in cash and credits are provided to those farmers who are willing to conserve landraces. The CSB has resulted in increased social cohesiveness as it has been managed through community group actions. With the increase in biodiversity, the community in Kachorwa internalized the value of biodiversity. The initiative has increased the capacity of community to conserve and use agro-biodiversity on-farm and empowered them to maintain and use their own agricultural biodiversity.

CONCLUSION

CSB is an innovative farmer-led on-farm seed conservation approach, which serves for both conserving the local crop landraces as well as providing seed security to the farming community thereby increasing access to genetic materials. This approach is emerging as a potential option of on-farm conservation in areas where speedy erosion of plant genetic resources is in progress. The CSB addresses all concerns of healthy seed system and contributes to the continuity of the evolutionary processes and adapt in their local habitats, which increased the stability and resilience of the community agro-ecosystem. This study has furthermore, provided a knowledge

³ ADCS is a community based organization established by a group of farmers of Kachorwa village to conduct various community development activities including CSB for sustainable local seed security and promote on-farm conservation.

base and modality for grassroots strengthening to conserve agro-biodiversity and to scale up the approach in other areas.

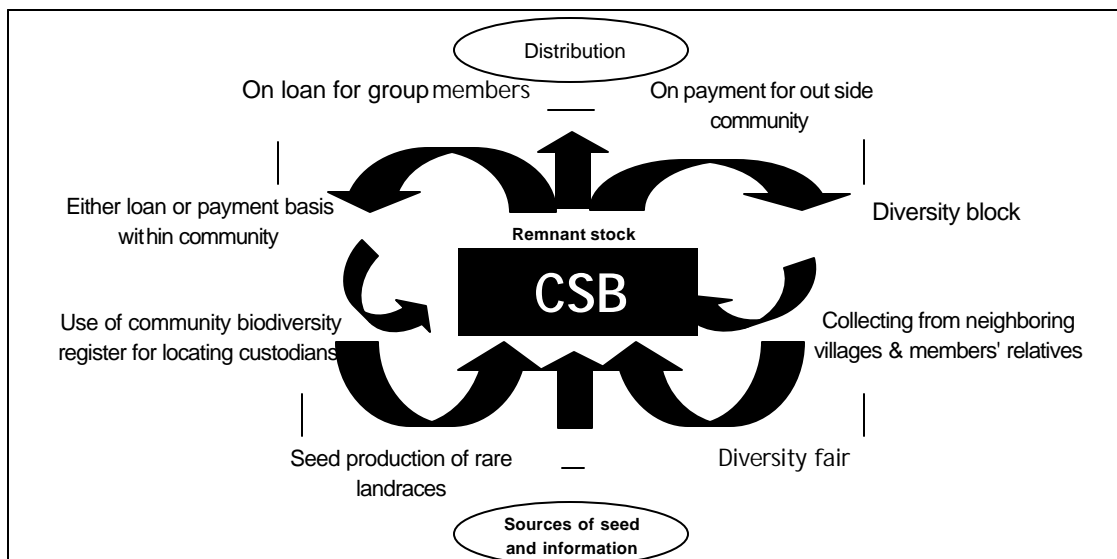


Figure 2: Seed management systems of CSB

This can be managed locally through empowering members of community with minimum external financial and technical support and integrating it with other development activities using community biodiversity management approach. Creation of knowledge base and community empowerment are the driving force for the success of CSB. However, collaboration among plant breeding programme, agriculture research and development agencies and CSB still has to be developed. Such linkages can make the CSBing more dynamic with feasibility of systematic introduction of new diversity that can integrate with the existing agricultural biodiversity instead of replacing it.

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