Farmers' access to quality and diverse seed in Nepal: Implications for seed sector development

Introduction

Nepal is facing similar problems as many developing countries regarding its agricultural development: low agricultural productivity, lack of easy access to inputs, low mechanization, old agricultural technologies, high rates of economic migration of men (and thus feminisation of agricultural production) and an inadequate enabling policy environment are some of the major constraints to agricultural production. Further, low uptake of improved plant varieties and low access and availability of improved and quality seed limit improvements in crop production. These factors, the increasing population as well as the high sensitivity to climate risks largely contribute to Nepal's position as one of the most food-insecure countries in Asia and one of the poorest countries in the world (IFPRI 2012; Krishnamurthy et al. 2013).

Seed security is a prerequisite for food security of small-holder farmers. In the case of Nepal, the timely and sufficient supply of quality seed of high yielding varieties has the potential to increase crop yields by about 15-25% (Gauchan et al. 2014). Despite numerous efforts to improve the seed systems in Nepal, the country is still facing many challenges in its seed sector development. Rice is the most important staple crop and finger millet is the fourth most important food crop in terms of area coverage in the country. Despite being considered a neglected and underutilised species, finger millet is particularly important in subsistence-based farming systems in the middle mountains of Nepal due its nutritional value and suitability for growing on dry soils with low fertility (Bhandari et al. 2004).

This study analyses rice and finger millet seed systems in Nepal, particularly Ghanpokhara, Lamjung and compares them with the seed systems found in other parts of the country. It presents factors that influence seed availability and accessibility for rice and finger millet along the continuum of seed systems from formal to informal. Elements that may limit or facilitate smallholder farmers' access to quality seed, which is adapted to their environmental and socio-economic conditions, are highlighted. The preferences of farmers in remote areas of Nepal are of particular interest, especially in relation to crop varieties, seed sources and seed quality. These and other elements emphasised in this policy brief must be taken into consideration when defining public policy interventions aimed at extending formal systems of seed production and commercialization to areas where production of and access to seed have always relied on informal mechanisms. This policy brief is based on research (Master Thesis) which took place under the umbrella of two different projects funded by the Swiss Agency for Development and Cooperation (SDC) and the Global Environment Facility (GEF), coordinated by Bioversity International and implemented by the Nepal Agricultural Research Council (NARC) and Local Initiatives for Biodiversity, Research and Development (LI-BIRD).

Research methods

To generate information about the actors involved in seed systems in Nepal and the connections between them, a review of literature and secondary data, key informant and expert interviews, value chain analyses and market mapping were conducted. The research focused on a particular area, namely Ghanpokhara, a Village Development Committee in Lamjung District, in the Gandaki Zone of the Western Region of Nepal. In depth face to face interviews with household members were conducted covering 40 households in addition to a seed network analysis in the study communities. The interviews focused on two major crops, rice and finger millet, which are important crops in the study area, covering lower to middle mountain landscapes. For this brief, the case of Ghanpokhara was compared with seed systems in Jumla (high-hill), Kaski (mid-hill) and Bara (low-lands).

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Research context and study area

Due to its diverse landscape – both in altitude (850–6983 masl.) and in coverage (forests, rangeland, settlements and agricultural cultivation), dispersed human settlements, and varying climatic conditions, Ghanpokhara is representative of remote areas of Nepal populated mainly by the indigenous Gurung community, who practice traditional mountain agriculture (Figure 1). The average farm size is 0.70 hectare of land which is similar to the national average. Agriculture is the main source of household income, followed by remittances received from family members working elsewhere or abroad. A small number of households depend on local non-farm employment. In Ghanpokhara, 94% of the households grow rice and 58% of the households grow finger millet in small terraced farms in the undulating landscape (Gurung et al. 2016).

Figure 1: Landscape in Ghanpokhara, Lamjung.

Findings

The actors

Nepal's national seed system involves four different types of players: public institutions, the private sector, international collaborators and farmer communities (Sah 2014, Gauchan et al. 2014) (Figure 2).

Figure 2: Actors in Nepal´s national seed system (adapted from Sah 2014; Gauchan et al. 2014).

MoAD: Ministry of Agricultural Development, NARC: Nepal Agricultural Research Council, NAS; National Seed Company, NSC: National Seed Board, DoA: Department of Agriculture, DADO: District Agricultural Development Office, SQCC: Seed Quality Control Centre, SEAN: Seed Entrepreneurs' Association of Nepal, CBSP: Community Based Seed Production

The presence and weight of each actor varies considerably across crops and territories. In districts of the Terai (plain region) such as Bara and Chitwan, and for crops like rice, wheat and maize, the involvement of actors from the public sector and seed enterprises is greater than in mountainous areas. Seed services facilitated by the District Agricultural Development Offices (DADO's) are present in most districts, but in some of them, these services do not reach remote villages (Paudel et al. 2013).

Seed sources and farmers' access to seed

Overall, nearly 90% of the seed that is used in Nepal for cultivating rice comes from informal farmer-based seed systems (Gauchan et al. 2014; MoAD 2013), who control production and supply. Even in Bara, where a large proportion of farms are in proximity of research stations, seed enterprises and local seed dealers, 96% of farmers acquire rice seed from informal sources, including their own harvest. This situation is illustrated in Table 1, which presents the proportion of farmers that get their rice seed from formal and informal sources in three different sites in Nepal.

Table 1: Rice seed sources for farmers in three sites of Nepal in % (adapted from Gauchan et al. 2003)

Source	Ghan-pokhara	Jumla	Kaski	Bara
Informal system	100	100	98	96
Own seed retention	55 (11 farmers out of 20)	79	44	32
Neighbours	45* (9 farmers out of 20)	11	46	40
Relatives	0	8	8	8
Others	0	2	0	14
Formal System	0	0	2	4
Data source	Own data	Gauchan et al. (2003)		

** no regular exchange of seed*

In Ghanpokhara, 100% of finger millet and rice seed comes from farmers themselves, as they are not connected to any of the other stakeholder groups depicted in Figure 2. This however does not seem to affect availability of seed, as all interviewed households (40) stated that they usually have access to sufficient quantity of seed for the following season from their own local sources. All 40 farmers primarily use their own seed, with some (15) also exchanging seed with friends and relatives every 1-5 years and some (6) less than every 5 years.

Compared to other documented seed systems in Nepal (e.g. in Jumla, Kaski and Bara districts, by Baniya et al. 2005), farmers in Ghanpokhara are not used to exchanging seed with each other. Several factors can explain this:

- Asking for seed from other farmers is perceived negatively and interpreted as being a 'bad' farmer.
- It makes little sense to exchange seed if everyone has the same varieties with no evident differences in seed quality.
- Agro-climatic conditions within the area of Ghanpokhara prevent the exchange of seed between the higher and lower altitude. For example, cold tolerant rice varieties from higher altitudes don't perform well in lower altitudes.
- Social barriers between different casts exclude certain ethnic groups from community activities[1], including those that facilitate seed exchange among farmers. Similar social dynamics among ethnic and social groups have been found in other countries (Almekinders and Louwaars 1999, 53; Sperling and Cooper 2003).

Isolation of farming communities from external sources of seed cannot always be explained by the lack of infrastructures (e.g. roads) or by the geographical distance to the seed sources. In fact, in the case of Ghanpokhara, seed and food markets can be found close to the study site. Among the factors that hinder or at least do not foster farmers' exposure to other seed sources, we can highlight the following:

- Farmers are reluctant to use different seed and varieties. They trust their own varieties which they have grown, selected and stored themselves and which seem to grow well in the region. In past experiences, newly introduced varieties have not performed well in the local ecological conditions.
- Varietal adaptation capacity and the quality of newly introduced seed might be different from what farmers wish for or are familiar with.
- Due to dispersed and isolated human settlement, the local seed network is narrow, limiting the accessibility of farmers to quality and appropriate planting materials.
- The price of good quality seed is not necessarily a limiting factor for farmers, but unless farmers are sure about the better quality of the seed provided by external sources, they will probably not be willing to pay for seed when they can produce it themselves.
- The presence of extension services is poor and irregular, and this limits the flow of knowledge and technology among research organizations and farmers.
- There are very few development projects working on cold tolerant rice, finger millet and other underutilised crops, such as amaranth, buckwheat, rice bean, etc. Even if these crops are important for farmers' food and nutrition security, seed actors have virtually no new seed to offer to farmers.

Varietal diversity

A study by Gauchan et al. (2003) reveals that high intra-specific diversity exists for rice and finger millet in the mid-hills as well as in the high-hills, as represented in Table 2.

Farmers in Ghanpokhara grow and maintain large numbers of crop varieties. They grow only traditional varieties (landraces) of finger millet and rice, which is similar to findings of a previous study in the high mountain site of Jumla (Gauchan et al. 2003). Farmers in Bara and Kaski also grow modern varieties of rice but, similar to Ghanpokhara (Lamjung) and Jumla, landraces are the predominant varieties for finger millet in these sites. This is because local landraces are most adapted and suitable in remote mountainous landscapes, where farmers have limited options for well adapted improved varieties in these harsh environments.

Table 2: Number of rice and finger millet (FM) varieties grown across ecosites (adapted from Gauchan et al. 2003)

	Masl	Rainfall (MM)	Total no of varieties		Of which landraces		Of which modern varieties (MVs)		Data source
			Rice	FM	Rice	FM	Rice	FM	
Jumla	2240-3000	866	17	12	17	12	0	0	Gauchan et al. 2003
Kaski	600-1200	3979	68	24	63	24	5	0	
Bara	55-100	1515	53	5	33	5	20	0	
Lamjung (Ghanpokhara)	900-2500	2143	24	14	24	14	0	0	Own data

[1] More prevelant in Dalit community.

During millennia of crossing and selection, Nepalese farmers have generated hundreds of varieties of rice and finger millet based on their response to biotic and abiotic stresses, their adaptability to preferred agronomic methods and cooking practices, the quality of their organoleptic characteristics like taste and colour, or their use during religious festivities or for social events. In general, traditional varieties show a richer allelic diversity when compared to modern varieties. Intensive selection for particular traits by modern breeding has led to the simplification of the genetic composition of modern varieties, making them less adaptable to changing environmental conditions (Tura et al. 2010; Ben Hassen et al. 2017; Singh et al. 2016; Ceccarelli 1996). In the last decades, many improved varieties of rice have been released and distributed through formal channels. The adoption of improved varieties has been high in several districts. For example, in Bara, 83% of the land dedicated to rice is cultivated with modern varieties. However, traditional varieties continue to play an important role in all regions of Nepal. Some landraces of rice (Thulo/Sano Madhise in Begnas site in Kaski; Lalka Basmati in Kachorwa site in Bara) have been found as competitive as modern varieties (Mansuli or Sabetri) in terms of productivity, whereas in marginal, remote areas (Mansara and Kathe Gurdi in Begnas; Bhati in Kachorwa) local traditional varieties are the only option available to farmers (Gauchan et al. 2003). In Ghanpokhara as well as in Jumla, rice landraces cover 100% of the land and are as such of particular importance for food security in the region.

The continuum of seed systems

The findings show that four different seed systems can still be identified in Nepal: Ghanpokhara represents the informal – own seed system, where farmers still rely on the most basic or unspecialized seed sources for rice and finger millet, i.e. their own farms or those of their neighbours; Kaski has been classified as informal – local seed system, where seed from cooperatives or neighbouring villages can be found; Bara is an example for an intermediary seed system, where seed of dealers and industry play a role in addition to farmers' own seed and truthfully labelled seed (TLS) / certified seed can be found; no district in Nepal fully represents the formal system, but a tendency can be found in the Terai region for certain crops with predominantly certified seed, sourced from NARC and the seed industry. This confirms the conclusions of a growing body of literature on seed systems: there is a continuum of seed systems in developing countries and seed production and supply is not clearly polarized between formal and informal structures. Table 3 presents the qualitative and semi-quantitative characteristics of these four systems.

Table 3: Selected characteristics of seed systems along the continuum of seed systems, an original concept defined in the present study

	Seed system designation Locations in Nepal of the seed systems (examples)	***Informal – own seed*** Ghanpokhara, Lamjung	***Informal – local seed*** Begnas, Kaski	***Intermediary*** Kachorwa, Bara	***Formal*** Certain crops and certain areas in Nepal (mainly within Terai region) (*)
Qualitative characteristics	***Seed source***	Own retention, limited exchange with neighbours or relatives	Own retention, neighbour farmers, relatives, seed cooperatives, including from neighbouring villages	Own retention, neighbours' relatives, seed cooperatives, seed dealers, seed industry	NARC and seed industry (directly or through seed dealers)
	Seed certification	Not certified	Not certified	Not certified, truthfully labelled seed, certified.	Certified
Semi-quantitative characteristics	***Legal framework, regulations, rules applied***	0 little/no contact with this system	+ little contact with legal framework	+++ applied partly	++++ very strict application of rules
	Market integration (for crops and seed)	+	++	+++	++++
	Access to new seed and new varieties	+	++	++(+)	+++(+)
	Varietal richness (number of landraces and varieties grown in the region)	++ medium number of different varieties found, intercropping practiced	++++ high number of varieties found, mostly landraces, intercropping practiced	+++ high number of varieties found, about half of rice varieties are landraces, half MVs, intercropping practiced	+
	Expected allelic diversity (Genetic diversity within varieties)	+++(+)	+++(+)	++(+)	+

Scale: ++++ = high/numerous, +++ = medium, ++ = little/few, + = low/very few, 0 = none (explanations added where relevant)
** No district in Nepal represents the formal system to 100%, but a tendency can be found in the Terai region*

A series of trade-offs along the continuum of seed systems occurs in Nepal: places where all seed supply is subject to official regulation show low levels of varietal richness when compared to all other types of seed systems, mainly due to economic constraints; at the same time, agricultural systems which rely entirely on informal seed sources, present lower levels of varietal diversity than those in which farmers acquire seed also from formal suppliers. In addition, these agricultural systems are more exposed to risks derived from the lack of quality control and market integration.

Discussion and recommendations

As stated by a number of actors in other contexts (including Louwaars and de Boeuf 2012), our study shows that informal - local seed systems and intermediary seed systems better respond to Nepalese farmers' needs for diverse and quality seed, compared to completely formal or completely informal systems. This study also supports the fact that intermediary systems show a more balanced set of trade-offs than purely formal or purely informal systems. The local seed networks of the farmers are more developed in the intermediary seed system, where farmers can exchange and access diverse seed from different sources. In purely informal seed systems, as observed in Ghanpokhara, the local seed network is not able to adequately supply seed and the access to new seed from external sources is absent or very limited since market integration is very low due to remoteness and subsistence farming systems.

A well performing seed system must ensure farmers' access to new seed of good quality, but without making farmers dependent on certain suppliers, inputs and rigidly certified quality. Such a system must also allow crop diversity to circulate among actors in the seed value chain, in the form of modern, traditional and farmers' improved varieties, so that genetic diversity is not put at risk and farmers can choose from a range of locally adapted germplasm. Therefore, public policy interventions (in the form of laws, regulations and public investments) should target both the informal and formal elements of seed systems and their integration. Good examples are:

- The adoption of TLS for seed quality assurance in Nepal is a good example of a public policy intervention oriented to promote intermediary seed systems, with about two-thirds of seed actors in Nepal already adopting TLS, while 30% of them only adopted the certification system (Gauchan et al. 2016).
- Another example would be the simplification of procedures for the registration of traditional varieties in the national register of commercial varieties.

However, further efforts need to be made to effectively implement these public policies, particularly by channelling public support to individual farmers and farmers' communities and their linkages to diverse seed suppliers, who are involved in seed production and commercialization.

An important aspect to be taken into consideration when defining public policy interventions and development projects in Nepal is that, despite the growing importance of formal and intermediary seed systems, in many districts of Nepal, farmers will continue to rely mostly on their own seed for a number of years, as evidenced by our study in Ghanpokhara. Thus, measures oriented to increase the specialization of seed producers and suppliers should be coupled with mechanisms that support farmers in producing their own seed with better quality. This will require external support and linkage for mobilization and building capacity of seed producers, linked with formal sector agencies. In the case of Ghanpokhara (Lamjung), both the formal and the informal aspects of the seed system can be improved:

- Extension services have the potential to better inform and supply farmers with well performing varieties coming from formal research and development. They can also help to integrate the product from such isolated areas into local and national markets.
- More resources can be made available to increase farmers' capacities to produce, select and store seed, particularly for their own traditional varieties.
- Establishing and promoting community seed banks is one of the best options to enhance access to diverse adapted varieties to local communities by strengthening the local seed system of Ghanpokhara (Lamjung). Considering this, the GEF UNEP local project in Nepal is already working in this direction.
- Furthermore, the organisation of farmer groups for seed production could be facilitated in order to ensure that farmers can meet their own needs for seed locally, especially in the case of their preferred local varieties. Local NGO's and local level governments, including Village Development Committees and District Governments, can play an important role in supporting the development of these organizations.

In this way, the seed system could transform into something between Kaski (informal – local seed) and Bara (intermediary) seed systems; a situation, which seems to be more balanced and less risky for farmers in terms of seed security, seed quality and seed diversity. This will require quality improvement in seed production and supply in informal seed systems and diversification of sources of seed supply in formal seed systems, as well as fostering sustained linkages between them.

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