Ricebean Network

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FOSRIN

Food Security through Ricebean Research in India and Nepal

Report 4: Indigenous knowledge of ricebean in Nepal

Report on farmers' local knowledge associated with the production, utilization and diversity of ricebean (*Vigna umbellata)* in Nepal

Aditya Raj Khanal[1], Kamal Khadka[1], Indrahari Poudel[2,] Krishna Dev Joshi[3] and Philip Hollington[3]

[1]Local Initiatives for Biodiversity, Research and Development (LI-BIRD), Pokhara, Nepal
[2]Institute of Agriculture and Animal Sciences, Rampur, Chitwan, Nepal
[3]CAZS Natural Resources, College of Natural Sciences, Bangor University, Wales, UK

Executive Summary

This document contains information on farmers' indigenous knowledge and practices associated with the ricebean (*Vigna umbellata* (Thunb.) Ohwi and Ohashi, previously *Phaseolus calcaratus*) in potential ricebean growing areas of Nepal. Ricebean is a potentially valuable but underutilised multipurpose grain legume for farmers in the marginal hill areas of Nepal. It is a traditional crop that gives satisfactory grain yields even in marginal and adverse land, and farmers in some particular niche environments have grown it for many generations. Ricebean plays an important role in securing the food and nutritional security of farmers and their families in those areas.

Understanding farmers' practices and the underlying indigenous knowledge regarding the crop is useful to guide conservation and promotion strategies, particularly for traditional crops. As farmers have been cultivating ricebean for very many years, they have unique knowledge of it, and an assessment of this is a valuable prelude to its promotion. This study was carried out to assess and analyze this knowledge and the farmers' practices associated with the crop.

Potential districts for ricebean in Nepal were assessed in collaboration with district agricultural development offices (DADOs) and pocket areas within them identified using field visits and group discussions (GDs) with ricebean growers. From these pocket areas, the indigenous knowledge and practices associated with ricebean were assessed through direct observations and interaction with farmers. In-depth documentation of indigenous knowledge and analysis was done for Darbar Devisthan VDC and Simichaur VDC in Gulmi district; and Bhaluajor VDC and Pakarbas VDC in Ramechhap district in Nepal. In Ramechhap, documentation was done by a Master's student from the Institute of Agriculture and Animal Sciences (IAAS), Nepal, who was commissioned by LI-BIRD to study indigenous knowledge related to ricebean in Nepal. Initially, fifteen and eighteen knowledgeable farmers were selected as key informants in Gulmi and Ramechhap respectively. Then, knowledge associated with the production, utilisation and diversity of ricebean was documented through repeated interactions and interviews with the key informants. Finally, the compiled knowledge was validated through GDs with randomly selected farmers in each of the VDCs in both districts.

Farmers have their own knowledge regarding ricebean and they adopt different methods to cultivate, produce and use it. Ricebean is known by different local names, such as *Masyang, Jhilunge*, *Gurous, Ghore and Rata Mas* in different parts of Nepal. Farmers generally grow ricebean in marginal areas with low or no inputs. It is used as food, fodder and green manure. To enrich soil fertility, some farmers rotate ricebean around their pieces of lands. Farmers reported the very high diversity of ricebean landraces and use maturity period, grain size and grain colour to name them. Ricebean is used mainly for whole grain soup. However, it is also used to prepare different recipes, for example *batuk, furaula, kwati, khichadi* and vegetable curry. Most farmers prefer bold (large) seeded varieties but these also have the negative trait of late maturity and, as a result, farmers have to forgo the next crop in the cycle. The success of ricebean production depends upon the weather in the growing season. If continuous rainfall

occurs during flowering, production is greatly reduced due to the formation of chaffy pods locally known as *pani kosa*. Farmers confirmed that despite the multiple uses of the crop, it was not widely cultivated and the area grown was declining

It is anticipated that this document on the indigenous technical knowledge associated with ricebean, its cultivation and diversity will be of great value to researchers, extension workers and policy makers. In addition, documentation of the indigenous knowledge associated with ricebean will assist further research. Incorporation of farmers' knowledge in scientific activities is essential for traditional crops, to enhance their status, to develop farmers' preferred varieties, to guide dissemination activities and to highlight their value to consumers and farmers alike.

Series Editor: PA Hollington

For more information or further copies of this report, please contact:

Dr Philip Hollington, CAZS Natural Resources, College of Natural Sciences, Bangor University, Bangor LL57 2UW, Wales, UK.

Email: p.a.hollington@bangor.ac.uk

Website: www.ricebean.org

or

Dr Krishna Joshi, CAZS Natural Resources, South Asia Office, c/o CIMMYT, P.O. Box 5186, Singh Durbar Plaza Marg, Bhadrakali, Kathmandu, Nepal

Email: kdjoshi@mos.com.np

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Contents

1. General introduction

1.1 Introduction: the ricebean crop

Ricebean (*Vigna umbellata* (Thunb.) Ohwi and Ohashi, previously *Phaseolus calcaratus*) is a fairly short-lived warm season annual vine legume which is little known, little researched and little exploited. The centre of diversity, and presumably the origin, of ricebean is in the Indo-China region. It is thought to be derived from the wild species *V. umbellata* var. *gracilis,* found naturally from southern China through the north of Vietnam, Laos and Thailand into Burma and India, and with which is thought to be cross-fertile (Tomooka *et al*, 1991). In South Asia, ricebean is regarded as an underutilized crop, grown in Western, Northern and Eastern India and Nepal (Fery, 1991).

Ricebean is grown as an intercrop or a mixed crop with maize (*Zea mays*), and as a sole crop on a very limited area in the uplands in Nepal. It is often cultivated on the edges of the terraces, rice bunds, and sloping marginal to sub-marginal lands, particularly in the mid hills. It is also grown at the base of the hills (1000 to 1200 m) during the rainy season after planting rice (Lohani, 1980). Ricebean is most widely grown as an intercrop, particularly of maize, throughout Indo-China and extending into southern China, India and Burma. It is an important component of the local dryland farming system, being rich in protein (17.8 to 25.2%), calcium, iron and phosphorus (Mal & Joshi, 1991).

There are many types and varieties of ricebean available**.** Seed colour ranges from ivory to greenish ivory, red, violet, and black (Chatterjee & Dana, 1997). Farmers in Nepal grow ricebean mainly for use as a dried pulse. However it is also important as a fodder, a green manure and a vegetable crop.

Ricebean can be grown on a wide range of soil types, including heavy paddy (rice) soils, although maximum yields require a fertile loam (Kay, 1979). It cannot withstand waterlogged conditions (National Academy of Science, 1979). In general, it is adapted to similar environments to cowpeas. Ricebean is susceptible to frost, but tolerates high temperatures, and is best grown where temperature averages 18-30° C and where rainfall as 1,000-1,500 mm per annum (Duke, 1981; Kay, 1979). As a short day legume, flowering is only initiated when days are short, with a daylength threshold of less than 12 hours (Kay, 1979). It has rapid establishment, is pest resistant, and has the potential to produce large amounts of nutritious animal fodder and high quality grain (Gautam *et al*, 2007).

Millions of people in Nepal and other countries in South Asia suffer from protein-calorie under-nutrition. There is a high frequency of low birth-weight children caused by protein and micro-nutrient deficiencies. Ricebean is a rich source of protein, amino acids, vitamins and minerals. Thus, it can play a vital role in combating silent hunger of millions of under-nourished people making the family diet more balanced.

1.2 Grain legume diversity in Nepal

Grain legumes occupy about 10.3% of the total cultivated land of Nepal (Neupane, 2002). In order of importance, they are lentil (*Lens culinaris*), chickpea (*Cicer arietinum*) and grasspea (*Lathyrus sativus*) in winter, and black gram (*Vigna mungo*), pigeonpea (*Cajanus cajan*) and soyabean (*Glycine max*) in summer. Lentil alone occupies more than 59% of the total area under grain legumes (CBS, 2006). *Phaseolus* bean, ricebean, horsegram (*Macrotyloma uniflorum*), and field peas (*Pisum sativum*) cover a smaller area, but are important in specific pockets as cash generating crops for poor and marginal farmers (Neupane, 2002). There are no figures available for the total area and production of ricebean in Nepal as it is simply regarded as one of several minor legumes. However, ricebean, field pea, cowpea, broad bean (*Vicia faba*), *Phaseolus* and mung beans (*V. radiata*) together occupy a total of 28,113 ha, producing 24,324 t with an average yield of 865 kg ha^{-1} (CBS, 2006). The major and minor legumes generally cultivated as food crops in different ecological regions of Nepal are presented in Table 1.2.1

Table 1.2.1: The major and minor legumes generally cultivated as food crops in Nepal

Ecological region	Major legumes	Minor legumes
Terai and inner *terai* (dry and humid sub-tropics)	Lentil (*Lens culinaris*) Chickpea (*Cicer arietinum)* Black gram (*Vigna mungo*) Grasspea (*Lathyrus sativus)* Pigeonpea (*Cajanus cajan*)	Mung bean (*Vigna radiata*) Field pea (*Pisum sativum*) Horsegram (*Macrotyloma uniflorum*) Common bean (*Phaseolus vulgaris)* Ricebean (*Vigna umbellata)* Broad bean (*Vicia faba)*
Hills and valleys (humid-subtropics and temperate)	Soybean (*Glycine max)* Black gram (*Vigna mungo*) Cowpea (*Vigna sinensis)* Groundnut (*Arachis hypogea*)	

Source: Rajbhandari, 1988

1.3 Grain legume research in the Nepal Government system

In Nepal, legume research began in 1972 at the Agronomy Division of the Nepal Agriculture Research Council (NARC), Khumaltar and at Parwanipur Agriculture Station in Bara District. However, this was limited to a small number of the major crops: chickpea, lentil, soybean, black gram and mungbean. Parwarnipur Agriculture Station coordinated the work on chickpea and lentil improvement, while the Agronomy Division, Khumaltar, coordinated work on soybean, black gram and mungbean. The main emphasis was on the identification and development of high yielding varieties of these crops, followed by the agronomic, entomological and pathological aspects of their management.

The National Grain Legume Improvement Program (NGLIP) was initiated in 1985 in Rampur, Chitwan, to focus on integrated approaches to grain legume improvement (Rajbhandari, 1988). Since 1990, NGLIP has been part of NARC, as the National Grain Legume Research Program (NGLRP). Its mandate is the development of improved varieties of grain legumes adapted to different agro-climatic condition in the country.

1.4 Research on ricebean in Nepal

The NGLRP is the sole government organization responsible for grain legume research in Nepal, but has concentrated on the major legumes and only a few of the minor ones, and research on ricebean is not a priority. As a result, there are no improved varieties in the country, and no scientific production technology has yet been recommended. The Plant Genetic Resources unit of NARC maintains a collection of some 300 accessions from various parts of Nepal (Gautam *et al*, 2007). Since 2006, the European Commission funded project "Food security through ricebean research in India and Nepal" (FOSRIN), coordinated by CAZS Natural Resources, Bangor University, UK, has been implemented jointly in Nepal by Local Initiatives for Biodiversity Research and Development (LI-BIRD) and NARC. The project also involves cooperation with a number of other international research organizations and Universities

1.5 Farmers' local knowledge

1.5.1 Concept, use and definition of local knowledge

Farmers' knowledge has been most commonly and widely discussed using the term 'indigenous knowledge' (Brokensha *et al*, 1980; Warren *et al*, 1989; Warren, 1991; Thapa *et al*, 1995), a label that some major institutions working on the subject have adopted (see Warren *et al*, 1995; CBNRM, 1998). However, the great diversity of disciplines in both the natural and the social sciences involved, as well as the value judgements of individual investigators, has led to the concept being described and discussed using various terms (Table 1.5.1).

Table 1.5.1: Terms used for local knowledge

Term	Reference
Ethno science	Barker, 1977; Knight, 1980
Ethno ecology	Conklin,1954; Frake,1962; Brosius *et al*, 1986; Muller-Boker, 1991
People's science	Richards, 1985
Folk knowledge	Berlin, 1973; Bellon & Taylor, 1993
Rural people's knowledge	Chambers, 1983; Bebbington *et al*, 1993
Traditional knowledge	Zurick, 1990; Bocco, 1991
Indigenous technical knowledge	Howes, 1980; Sharland, 1989; Mathais-Mundi *et al*, 1990; Fairhead, 1990
Indigenous ecological knowledge	Posey, 1983; Walker *et al*, 1991
Local technical knowledge	Warner, 1991

Sinclair & Walker (1999) argue that while these definitions may often be useful, they seriously constrain how local knowledge can be gathered and used. Synthesizing from case studies in Nepal, Sri Lanka and Kenya, and drawing on the work of Berlin (1992), and Fairhead & Leach (1994), they established that although the way local knowledge is acquired and transformed into decisions depends on the cultural context, knowledge is distinguishable from other aspects of a person's, or a community's, culture. They proposed a 'utilitarian' approach to the definition and use of local knowledge in research and development, defining knowledge as 'the outcome, independently of the interpreter, of the interpretation of data, that can be articulated and communicated', and local knowledge as 'locally derived understanding which is based on experiences and real world observation' (Shrestha, 2003).

1.5.2 Issues of combining local and scientific knowledge

The central tenet of Participatory Technology Development (PTD) is to facilitate and support farmer experimentation by combining farmers' local knowledge and methods with advances in scientific knowledge and methods (Havorkort *et al*, 1991). The synergy created through the joint learning process, in which researchers and farmers work together to generate new solutions, can encourage farmers' to experiment but at the same time requires them to learn new skills, and the researchers to enable such processes (Huijsma & Budelman, 1996). Despite a growing interest and emphasis on local knowledge, its use in research and development has been constrained by a lack of appropriate methods for storage, analysis, synthesis and interpretation of the qualitative knowledge held by farmers (Walker *et al*, 1995; Sinclair & Walker, 1999). Nevertheless, it is of the utmost importance to assess the local knowledge of farmers and combine it with scientific techniques. Understanding farmers' practices and the underlying local knowledge regarding them, is useful to guide the conservation and promotion strategy for any indigenous crop. As farmers have been cultivating ricebean for many generations, they have unique practical knowledge of the crop, and an assessment of this is an essential prelude to the promotion of this underutilized crop. Thus, the objectives of the study were:

- To document farmers' practices and knowledge associated with the cultivation and use of ricebean
- To carry out an in-depth analysis of farmers' local knowledge in production, utilization and diversity of ricebean from selected study areas.

2. Methodology

Information on farmers' practices and knowledge about ricebean was collected from different areas in Nepal. Information about cultivation, diversity, use and associated practices was obtained through visits and group discussions, together with seed sample collection. An in-depth assessment of farmers' knowledge was carried out in two selected areas: Gulmi and Ramechhap districts. Documentation of local knowledge from the Ramechhap area was carried out by a postgraduate student of the Institute of Agriculture and Animal Sciences (IAAS) Chitwan as a part of his thesis work.

2.1 Framework for finding pocket areas of ricebean for systematic study

The area under ricebean in each district of Nepal was assessed earlier in the project (Gautam *et al*, 2007) while assessing its national distribution. Districts were categorized as high, medium or low in terms of the area covered by the crop. During sampling, information from the collection sites concerning ricebean diversity and the location itself were also gathered. Based on this, and on accessibility, two districts, Gulmi and Ramechhap were selected for the in-depth documentation and analysis of local knowledge. Collaborating with District Agricultural Development Offices (DADOs), Darbar Devisthan Village Development Committee[1] (VDC) in Gulmi and three VDCs viz. Ramechhap, Bhaluajor and Pakarbas, in Ramechhap district were

[1] A Village Development Committee (VDC) is the smallest political unit in Nepal

identified. In order to generate a broad understanding of the domain and to provide a coherent and complete knowledge base, the project team interacted with the local communities through group discussions, mass meetings and informal talks with local farmers. The framework for identifying the pocket areas of ricebean is shown in Figure 2.1.1.

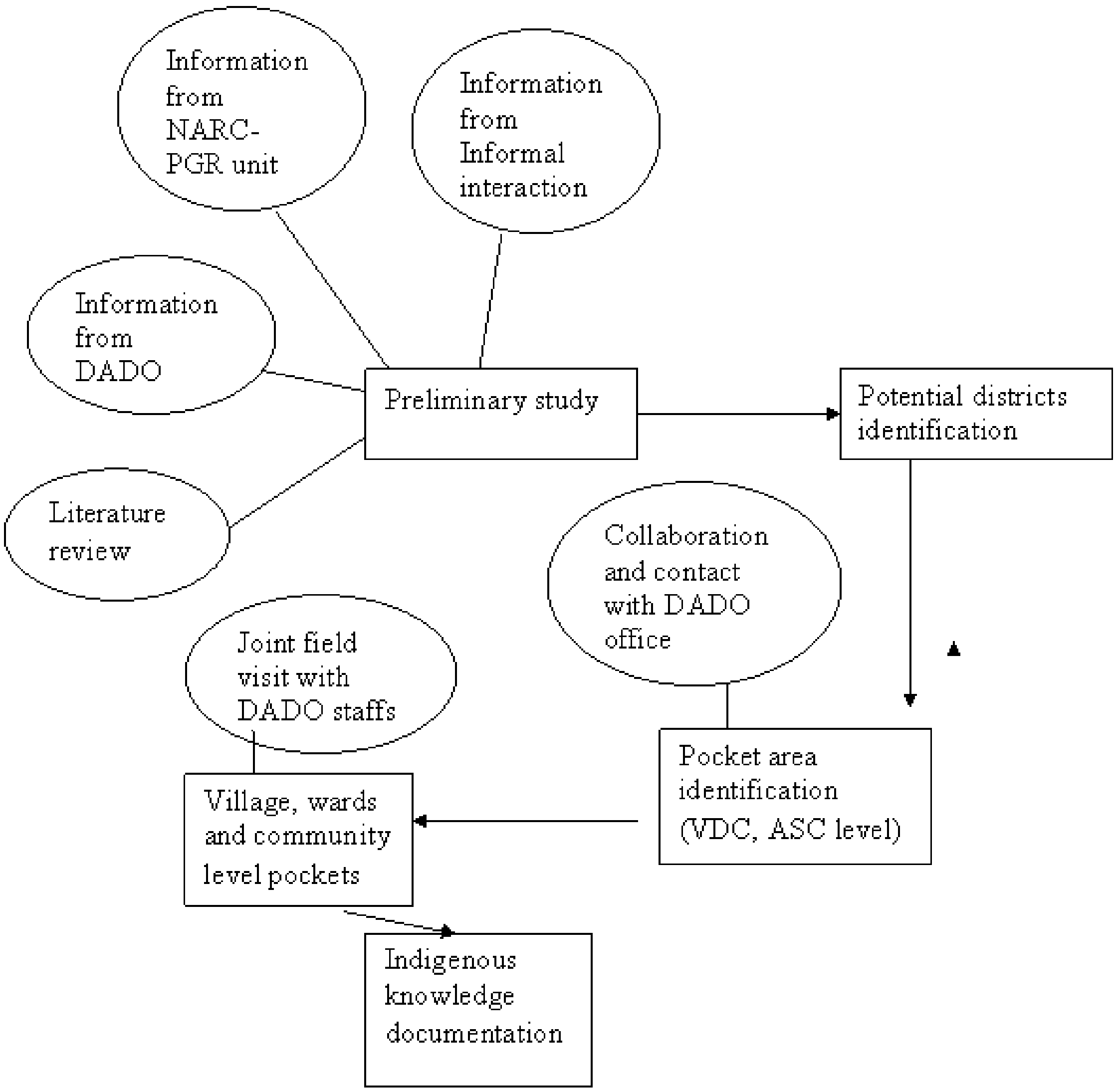

Fig 2.1.1: The process of identifying pocket areas of ricebean for systematic study

2.2 Knowledge elicitation strategy

Informal visits and interaction with existing farmers' groups during sample collections undertaken as part of other project activities were carried out to familiarize the researchers with the source community and help them gain a broader understanding of the knowledge held. Then, group discussions based on a checklist were held with male and female farmers. The focus group discussions helped in refining the research questions, identifying key informants and guiding the knowledge acquisition strategy. The team interacted repeatedly with the key informants through semi-structured interviews. The knowledge and information gathered were validated through more group discussions with randomly selected farmers in the area.

2.3 Selection of key informants

Altogether 15 key informants were selected from Darbar Devisthan VDC, Gulmi, and 18 from Ramechhap, Bhaluajor and Pakarbas VDCs in Ramechhap district. These represented farmers from different altitudes within the respective VDCs, and details are shown in Table 2.3.1.

Table 2.3.1: Details of the key informants selected for knowledge documentation in Gulmi and Ramechhap district

District	Gender		Altitude (m asl)		Ethnicity		
	M†	F	600-1000	1000-1600	BCK	MGN	KDS
Gulmi	7	8	4	11	8	4	3
Ramechhap	10	8	9	9	7	6	5

†M = Male, F = Female, BCK= Brahmin, Chhetri and Khatri; MGN = Magar, Gurung and Newar; KDS= Kami, Damai and Sarki.

2.4 Strategy for knowledge acquisition

The strategy adopted for knowledge acquisition involved an iterative cycle of designing checklists and interviews. Research questions were formulated, on the basis of which the checklist was designed and each key informant was interviewed. The interviews were recorded, transcribed at the end of each day and the transcripts maintained as written records. The knowledge transcripts were then reviewed to identify another set of checklists, and the cycle was repeated until further questioning did not alter the representation indicating that a comprehensive acquisition of knowledge had been created.

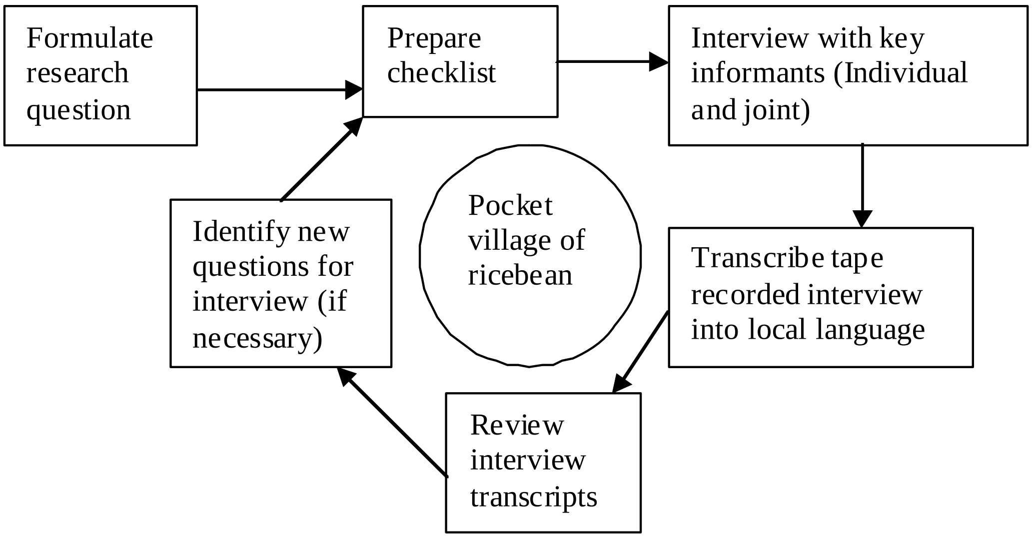

Fig 2.3: Sequence of activities constituting the knowledge acquisition strategy

3. Details of the study areas

The sites are in the mid hill range of Nepal, at altitudes from 400 to 2000 m asl (Table 3.1, Figure 3.1). Farmers have only a small area of *khet*[2] and most of their land is

[2] *Khet* – irrigated land where rice is cultivated

rainfed sloping *bari*[3] lands. Ricebean has been cultivated in the area for many years. The initial assessment in collaboration with the DADO office showed that Gulmi had 130 ha of ricebean and Ramechhap 300 ha (Gautam *et al*, 2007).

Table 3.1: Geographical features of the selected sites

District	Selected VDCs	Physiographic characters Altitude (masl)	Latitude	Longitude	Geographical aspect
Gulmi	Darbar Devisthan	600-1500	$28^0$00.12N	$83^0$19.93E	
Ramechhap	Ramechhap	600 to 2000	27°19'60N	86°4' 60 E	South facing
	Bhaluwajor	600 to 2000			North facing
	Pakarbas	600 to 2000			North-east facing

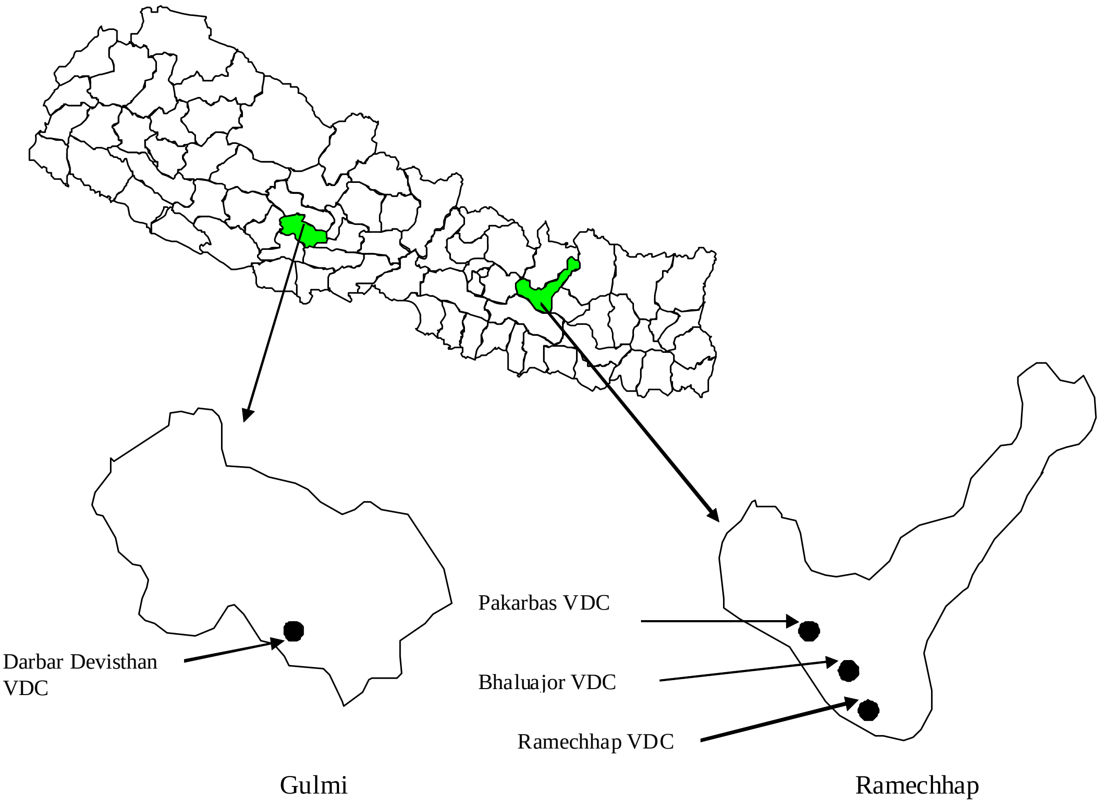

Fig 3.1: Sites for knowledge documentation

4. Findings

4.1 Ricebean: historical perspective

Ricebean is a long established crop in both districts. This is because as well as providing food, fodder and green manure it is associated with a number of cultural

[3] *Bari* – Rainfed upland with big terrace risers

and religious aspects of local society. Farmers believe that ricebean was probably introduced at the same time as maize began to be grown in the area, although there is uncertainty as to how long ago this was. At that time, farmers would plant ricebean in marginal areas to increase soil fertility without providing fertilizers. The farmers regard ricebean as a traditional and ancient crop.

All cultivated varieties of ricebean in Nepal are landraces which have disseminated from one village to another and from generation to generation through an informal distribution system, with farmers solely responsible for management and seed supply.

4.2 Local names for ricebean

Ricebean is known by different local names in different areas of Nepal. It is popularly known as *Jhilunge* or *Jhilinge* in Gulmi and its neighbouring districts. In Ramechhap is it known as *Masyang* or *Ghore Mas*.

4.3 Production productivity trends and underlying reasons

Over the last ten years, no new varieties have been introduced into either study area, some of the traditional varieties have been lost, and the area of ricebean grown, and its productivity, are decreasing. According to the farmers, ricebean production used to be measured in terms of *muri*[4] per farmer, but is now down to *pathi* and even *mana* in some areas. The main reasons are said to be:

- In the past farmers cultivated ricebean over a large area of their main *bari* land, but the area is now limited to field margins and corners as a result of greater priority being given to other crops.
- The increased prevalence of nuclear families leads to land fragmentation and families give priority to the main crop on such lands, resulting in decreased areas of some traditional and minor crops.
- Due to its relatively long duration, ricebean prevents farmers adopting the current trend for growing three crops in a year.
- The ready availability of attractively packaged newer legumes and pulses, perceived to be better, in local markets leads to decreased consumption of traditional crops like ricebean.
- Disaffection of young people with agriculture, and the migration of economically active members of the family for work, leads to fewer people being engaged in farm activities. The remaining family members focus on the main crop and avoid intercropping as it needs additional effort, so decreasing the area and production of traditional and minor crops.

Farmers reveal that the productivity of ricebean has also declined from levels in the past. The knowledge behind this is listed below:

- The productivity of many legumes, including ricebean, has decreased with the use of chemical fertilizers, and in particular with the application of urea to maize. This results in luxuriant vegetative growth, but low flowering and fruiting in intercropped legumes.

[4] *Mana*, *pathi* and *muri* are local units for measurement of food grains. 1 *muri* = 20 *pathi*; 1 *pathi* = 8 *mana*; 1 *mana* of ricebean is about 0.4 kg.

- According to the farmers, ricebean is drought tolerant. Even so, their experience is that, in cases of severe drought, production is reduced significantly.
- In the past, only one or two crops were cultivated per year, but this has now risen to three or even four in some cases. Farmers believe that, as a result, the overall fertility status of the cultivable land has decreased due to exhaustion.

4.4 Farmers' soil classification (types and properties) and associated knowledge

4.4.1 Farmers' classification of soil in the area

<u>Based on colour</u>

- *Rato mato* (red soil): This soil has moderate fertility and the crop grows well provided a good moisture status is maintained.
- *Kalo mato* (black soil): This is the most fertile soil. It is more porous and friable, and needs less irrigation.
- *Fusro mato* (yellowish dry soil): This is yellowish coloured soil and is less fertile.
- *Kamero mato* (creamy soil): This soil is white to creamy in colour and is also less fertile. It is also used to paint the walls of houses in rural areas.

<u>Based on soil properties</u>

- *Sano mato* (small soil) is shallow with more pebbles and stones in it. Even without a great deal of care in cultivation, tillage and manuring, such soil yields well. Farmers pay little attention to the crop on this soil, which is generally found on the borders and corners of the main *bari* land and in dry *khar baries* (grass lands).
- *Thulo mato* (big soil) is deep with fewer pebbles and stones. It requires more inputs and tillage, but gives higher yields.
- *Gagreto (*pebble or small stone mixed soil) is moderately fertile.

4.4.2 Underlying knowledge of soil and its implications for ricebean

- In *rato mato* (red soil), the roots can go deep. Provided there is irrigation or timely rainfall, such soils give good yields of every crop. *Rato mato* is compact when it is dry. It holds water for longer and has good depth.
- Black soil is the most fertile soil. Ricebean yields are low in such soils: although the vegetative growth of the vine is higher there is less flowering and fruiting.
- Ricebean grows well in a variety of soil. Gravel mixed red soil (*Rato Gagreto mato*) is best, followed by slightly black soil, which allows roots to go deep even under low moisture conditions.
- In *Sano mato,* ricebean is generally cultivated with few inputs and little attention is given to the crop.

4.5 Knowledge associated with ricebean-growing lands

Farmers cultivate ricebean in marginal lands, usually on dry hills and on southern or eastern facing slopes. The associated knowledge is:

- Medium to low fertile land is more suited to ricebean than land with high fertility status. Fertile soils lead to luxuriant vegetative growth and higher green biomass rather than flowers, so plants yield more in dry, marginal and hilly areas than in the plains. Ricebean yield is higher in red soil than in black soil.
- Ricebean does not require much soil depth. The crop can be cultivated in unproductive corners or margins of land.
- As ricebean is considered drought resistant, farmers in marginal and drought-prone areas cultivate it.
- The crop does better in dry hilly areas than on the shady sides of the same hills and farmers belief is that ricebean makes the soil of such areas more porous.
- Damp and shady areas where rainwater residues or dew are not directly exposed to intense sunlight are called *Ripyan* or *Tapken.* These areas are not suitable for ricebean grain production as vegetative growth tends to be high, and more *Pani Kosa* (chaffy pods) are produced. These turgid and thick pods are also called *Bose Kosa* (fatty pods), as their inner surfaces bear a thick and moist fat-like substance.

In the Ramechhap area, ricebean is cultivated from 500 m (foot of the hill) to 1800-1900 m (top of the hills). The hills rise from river basins and they remain dry for most of the year round. A typical Ramechhap landscape is shown in Fig 4.5.1.

Fig 4.5.1: Rough sketch of typical ricebean growing land (dry hills raised from river basins) in Ramechhap

4.6 Diversity of ricebean landraces and underlying knowledge

4.6.1 Farmers' basis for naming landraces

Farmers consider seed colour, maturity and seed size when naming landraces. Names include *Thulo* (big), *Mailo* or *madhyam* (medium) and *Sano* (small) in terms of seed size; *Rato* (red), *Seto* (white), *Pahelo* (yellow), or *Kalo* (black) in terms of colour and *Bhadaure* (early) *or madhyam* (medium) *and dhila* (late) in terms of maturity.

4.6.2 Landrace diversity in the study areas

Based on their own descriptors, farmers have reported high diversity in ricebean landraces. Days to maturity, seed coat colour and grain size are the major traits used by farmers for identifying and naming landraces, and based upon these the following landraces types are reported in the study area (Table 4.6.1).

Table 4.1: Diversity of ricebean landraces in the two study areas

Study area	Ricebean landrace	Colour	Size	Maturity
Gulmi	*Bhadaure sano*	Light green to yellowish	Small	Early
	Rato Jhilunge	Red	Medium	Medium
	Seto Thulo Jhilunge	White to yellowish	Big	Late
	Chhirkemirke Thulo	Grey mottled	Big	Late
	Chhirkemike Madhyam	Grey mottled	Medium	Medium
Ramechhap	*Sano Seto Masyang*	White to yellowish	Small	Early
	Pahelo Masyang /Pahenli	Yellow	Medium	Medium
	Singare/ Ghorle/ Bage/ Chirkemirke Masyang	Grey mottled	Big	Late
	Rato Masyang	Red	Medium	Medium
	Kalo Masyang	Black	Medium	Medium

4.6.3 Farmers' classification of landraces on the basis of maturity

Farmers classify ricebean landraces into three broad categories in terms of maturity period.

<u>Early types:</u>

Early landraces are called *Bhadaure* as their harvest time is around the last week of *bhadau*[5]– the second or third week of September. They are planted alongside and at the same time as maize, or broadcast just after the maize seedlings have emerged. These landraces have small grains and low biomass. They have smaller vines than other types and do not need strong stakes for support. They are also grown as an intercrop with maize as the small vines do not need strong stakes for support. There is less diversity within this category. Fewer farmers cultivate them and they are the least productive of the three types of ricebean. Most farmers regard them as inferior in taste. Their colour varies from yellowish white to brown and black. Early black (*kalo sano*) is found mainly in lower altitude regions (*Bensi* areas), while yellowish white and brown types are grown at higher altitudes (1000-1400 m).

<u>Medium types:</u>

Planting time for these is usually during the second earthing up of maize, between the last week of May and the middle of June, but the exact time depends on the moisture status of the soil and on rainfall. Harvesting time differs slightly with altitude, but is generally from the third week of October to the first week of November. Colour ranges from yellow, red, purple, brown, or cream to grey mottled. Farmers report

[5] *Bhadau*: a month in the Nepali calendar

greater diversity within this category, and generally prefer earlier harvesting types to ensure the successful subsequent planting of *Tori* or oilseed rape (*Brassica* spp.).

Late types:
Late maturing landraces are planted at the same time as the medium maturity types, but their longer duration means that harvesting continues up to the first week of December. They have larger grains and longer pods, and farmers prefer them for home consumption as a food crop, although they also have a luxuriant growth habit and higher fodder yield. These types require strong stakes for support, but yield more than others, particularly if planted in sunny and more fertile lands. The seed colour of these types is yellow, grey mottled, white, black and light green. Although they have good yield and quality, fewer farmers cultivate them due to their late maturity.

Plate 4.1: Ricebean diversity in seed colour and size

4.6.4 Knowledge associated with landraces

- *Bhadaure* landraces are resistant to chaffy pods (*pani kosa*), so are not affected by rainfall during flowering. However, they are inferior in taste and have small grains, they are least grown by farmers.
- *Sano seto masyang*, *Pahelo masyang* / *Pahenli* are grown in lower altitudes, in *Bensi* (river basins) areas. They have small, non-twining, vines, small grains and early maturity. They are best suited for growing on rice bunds and yield best with sole cropping.
- *Ghorle / Thulo / Bage masyang* have indeterminate vines with luxuriant growth habit and late maturity. They are grown at higher altitudes (1000-1800 m) and yield best in an intercropping system with maize.

- In extremely dry and marginal areas, small seeded and early- to late-maturing landraces such as *Sano Seto masyang*, *Pahelo masyang* / *Pahenli*, *Rato masyang*, *Chirkemirke Sano* yield better than the big seeded late maturing landraces.
- In more fertile soil, large-seeded, late-maturing landraces and those with luxuriant growth habit yield more. As a result, some farmers also plant small-seeded early- to mid-maturing landraces in the field margins and corners where there is shallow soil and low fertility, while the more fertile land is allocated to large-seeded types.
- Farmers say that mixing ricebean with different colours and seed sizes has been a common practice for a long time. They believe that mixing different seeds of the same maturity group minimizes risks, as in adverse conditions at least one type should perform well, and there is no substantial loss in production.

4.7 Cropping patterns adapted for ricebean in different parts of Nepal

Farmers grow ricebean in different cropping systems in Nepal, under a range of different cropping systems. Those in the study areas are discussed briefly below.

4.7.1 Mixed or intercropping with maize in bari lands

This is the most dominant cropping system for ricebean in Nepal generally, as well as in the study sites. Ricebean seeds, usually indeterminate types, are usually broadcast with maize seeds or are planted in-between the maize plants. In both cases, the maize stalk acts as a stake for the ricebean vine. The planting time of ricebean differs with the altitude and the type of landraces. Some farmers adjust the planting time so that its twining habit does not affect the yield potential of the maize crop. Early maturing landraces are planted at the same time as maize, while mid and late maturity types are generally planted after the first or second earthing up of maize. For intercropping with maize, farmers prefer medium maturing landraces with optimum vine growth.

In certain areas, farmers grow ricebean in the borders of their main *bari* land. This is more common in the areas where finger millet is cultivated as relay crop with maize.

Plate 4.2: Ricebean cultivation in an intercropping system with maize; as an intercrop in the main *bari* land (left) and on the bunds of the *bari* land (right).

4.7.2 On rice bunds and margins of the bari lands

Ricebean is also cultivated on rice bunds particularly in the mid and far western regions of Nepal. Farmers grow determinate ricebean on rice bunds and thus no stakes are required. The indeterminate types are guided along the slopes of the *bari* lands when they attain certain vegetative growth.

4.7.3 Sole cropping in home gardens or uplands

Some farmers grow ricebean as a sole crop in their home gardens and on small pieces of land around the homestead entirely for consumption within the family. In this case, the crop is provided with stakes. Farmers use the immature green seeds as a fresh vegetable. Landraces with long pods and bold grains are generally cultivated for this purpose.

Plate 4.3: Ricebean cultivation on rice bunds (left) and as sole crop in home gardens (right).

4.8 Cultivation practices of ricebean and underlying knowledge

4.8.1 Cultivation practices adopted by farmers

Planting time and method

Farmers commonly adopt one of two planting methods; dibbling or broadcasting. Broadcasting requires a high seed rate which leads to a greater initial plant population, which is then reduced to the optimum population by thinning. This has advantages in terms of providing additional fodder for livestock. The planting method also depends on the soil moisture status. Broadcast sowing is common where there is adequate soil moisture and friable soil. Seed is broadcast sown after ploughing, or digging up the maize, while in dry conditions two or three seeds per hill are dibbled. Seed rate differs according to the planting method, farming system and practices. Table 4.8.1 shows the seed rate reported by farmers when mixed cropping or intercropping with maize in *bari* lands.

Table 4.8.1 Comparison of broadcasting and dibbling for ricebean establishment

Planting method	Seed rate (local units) *mana* / *hall*[6]	Seed rate (kg / *Ropani*[7])	Seed rate (kg / ha)
Broadcasting	10 – 12	1.8 – 2.2	35.5 – 43.4
Dibbling	8 – 10	1.4 – 1.8	27.6 – 35.5

<u>Intercultural operations</u>

- Weeding: Ricebean does not need much care. One or two weedings, usually at the vegetative growth stage are practiced.
- Staking: Staking is needed for indeterminate varieties. Late maturing landraces have luxuriant growth which needs strong stakes. When intercropped with maize, the maize plant acts as a stake, while for sole cropping and in home gardens farmers provide stakes to the ricebean plants.
- Training/ pruning/ trimming: When the maize cob is mature, the tip of the dried maize plant is cut off just above the cob and the remaining stalk is retained as a stake for the ricebean. Some farmers even decapitate the ricebean vine so that the maize stalk is tall and strong enough to support the ricebean plant.
- Harvesting: Early landraces mature with maize and are harvested during the maize harvest. Mid maturing landraces generally mature from the last week of October to the first week of November, while late types remain standing until mid November.

At the time of maturity, the ricebean vine dries and the pod colour changes from green to brown. In indeterminate types there is no synchronization of the maturity of the upper and the lower pods, and so pods are picked over as they mature, necessitating two three more harvests. This is also practiced in late maturing landraces although most farmers harvest the whole vine when more than 60% of the pods are mature.

<u>Post harvest operations</u>

- **Threshing:** After harvesting, the vines and their pods are dried in the sun for two to three days, and are threshed by beating the vines with sticks. Farmers usually thresh ricebean twice, as all the grains are not completely removed in the first threshing. When all the grains are removed from the vines, the residue is utilized as fodder for animals.
- **Grain storage**: After harvesting ricebean, farmers dry the ricebean grains in the sunlight for at least two to three days. Well dried grains are then stored in wooden boxes, mud pots or sacks. Farmers report that ricebean seeds are less susceptible to post harvest pests if properly dried.

[6] *Hall* is a local land measurement unit, 1 hall of *bari* land = 2.35 ropani = 1192 m^2
[7] *Ropani* is a local land measurement unit, 1 *ropani* = 507 m^2

- **Seed selection**: Standard seed selection practices are uncommon. Generally, farmers prefer to keep seed from the first threshing, particularly bold grains identified by eye.
- **Grading**: Grading ricebean seeds based on colour or size is also uncommon. However, farmers do keep the seeds of early, mid and late maturing landraces separately.

4.8.2 Farmers' local knowledge associated with cultivation practices

- As ricebean needs warm temperature and adequate sunlight during flowering and pod formation the crop is cultivated only in summer.
- If it rains continuously during flowering period (generally in September), then the yield greatly decreases due to the formation of chaffy pods (*Pani Kosa)*.
- Shaking the ricebean vines in the morning or during the rain must be avoided as it may result into swelling in the nodes leading to vine breakage.
- Intercropping ricebean does not affect maize production. After the maize harvest, the maize stems are left standing as a stake for indeterminate vines.
- If indeterminate landraces are grown without staking then the vine may rot after contact with the soil. In this case, there is also the chance of attack by rodents or by saprophytic fungi. As a result, indeterminate ricebean landraces yield more in an intercropping system with maize than in sole cropping without staking.
- Ricebean vines decapitated at the time of maize maturity yield more, as this allows the vine to generate lateral branches.
- The first week of *Jestha* (third week of May) is the best time to plant ricebean. In an intercropping system, if ricebean is planted later than that then the maize canopy may suppress its growth through shading.
- In semi-determinate types and for the landraces cultivated on rice bunds such as *Sano Seto* and *Pahenli Masyang,* plants are trained to make them spread along the bunds. This should be done when the plant reaches its maximum vegetative growth, and if not done then the yield is lower.
- Manures and fertilizers are not usually applied to ricebean. If planted in soil with high fertility status, vegetative growth is luxuriant, but pod and seed set is poor. There is a greater problem of chaffy pods (*pani kosa)* in highly fertile soil.

Knowledge associated with chaffy pods (*pani kosa)*:

- Pods which do not develop seeds are called chaffy pods (*pani kosa)*, a condition in which a creamy white thick moist layer is developed on the inner surface of the pods, leading to the formation of fatty pods (*bose kosa)*.
- The problem of chaffy pods is greater on north-facing aspects and is least in southern and eastern aspects because south and east facing slopes are sunny and dry.

- The landraces cultivated at higher elevations (more than 1000m asl) such as *Ghorle Masyang* have a greater problem with chaffy pods than those lower down.

Knowledge associated with shattering

- Shattering loss is least in semi-determinate types such as *Sano Seto*.
- Harvesting is carried out in the morning hours to avoid loss due to shattering.

4.9 Knowledge associated with seed and seed management

Most farmers estimate the amount of seed they need for the next season, and they usually maintain ricebean for seed separately immediately after harvesting and drying the seed. Some farmers keep it in wooden boxes, while others put the seeds in earthen pots and sacks. Farmers' local knowledge associated with seed and seed management is as follows:

- Ricebean grains from vines cultivated on north-facing slopes are not suited for seed. They generally get wrinkled while drying and also have a greater chance of pest attack in storage.
- The grains from the first threshing are best for seed purposes.
- Ricebean grains need at least 3-4 days sun drying before storage. Properly dried seeds get less insect-pest infestation.
- In comparison to other legumes such as cowpea, chickpea and common pea, ricebean seeds have a lower level of insect pest attack during storage.
- *Timur (*Sichuan pepper) - *Xanthoxylum spp.), titepati* (*Artemesia* spp.*)*, or *neem* (*Azadirachta indica*) treatment on seed storage minimizes pest infestation.
- Seed stored in earthen pods get lower rates of pest attack because they are air and moisture resistant.
- Ricebean can be stored for one year for use as seed, but if stored for longer has low germination.

Knowledge associated with hard seed coat/ hard seeds

- Some legume seeds (not restricted toricebean) do not imbibe water properly and do not soften when cooked or soaked. These seeds are locally called *daino seeds* (hard seeds).
- In comparison to common pea, cowpea and *Gahate simi*, ricebean has a lower *daino* problem.
- The older the seed, the greater the problem of hard seededness.
- The amount of *daino* seed does not differ between landraces. The problem cannot be identified before soaking or cooking.

- Some farmers believe that if rainfall occurs during harvest, then there is a greater chance of hard seed coat development.

4.10 Consumption and use of ricebean and associated local knowledge

In Nepal, ricebean is used both for food and for fodder. In addition, it is also used as a deterrent to enrich the soil fertility.

4.10.1 Ricebean recipes

The main use of ricebean in Nepal is for human food, as a dried grain, although in some areas farmers also use the green seeds as vegetables. In most cases people mix ricebean with potato and other vegetables and sometimes even with mutton for a better taste. Farmers prepare a number of different food items from ricebean.

Whole / milled grain as soup (*dal*):

'*Dal-Bhat-Tarkari'* (legume soup, steamed rice and vegetables) is the main staple in most parts of Nepal. *Dal*, a major component of this meal, is a soup of legumes prepared after pressure cooking or cooking in a traditional manner. Farmers say that this is the main use of ricebean. Most legumes are split before cooking as *dal*, but in ricebean whole grains are used to prepare soup (*dal*). *Dal* is taken with cooked rice or *rotis* (chapattis) as the main food item in the area.


Plate 4.4: Ricebean recipes; soup (*dal*) with cooked rice (left) and snacks with wheat chapattis and leafy vegetables (right).

Boiled whole grain as snacks:

The practice of eating boiled or pressure-cooked ricebean grains as snacks is also common. It can also be taken with other snacks items such as puffed rice, beaten rice and wheat bread.

Biramla:

Biramla is one of the common ricebean snacks. The method of preparation differs around Nepal. Some people prepare it by mixing boiled ricebean grains with spices, while the others soak the whole grains overnight, fry them in oil and add spices as desired.

Batuk roti and *furaula:*

To prepare *batuk roti and furaula,* ricebean grains soaked overnight are ground and made into a paste which is mixed with salt, ginger and other spices. These are formed into small ring shapes and deep fried in oil to produce *batuk roti. Furaula* are the same as *batuk* but are round and smaller. They are occasionally prepared for feasts and festivals.

Plate 4.5: Ricebean recipes: *biramla* (left) and *batuk roti* (right).

Masaura (nuggets):

Usually *masaura* (nuggets) are prepared from blackgram flour in Nepal. However, farmers also prepare nuggets from ricebean flour. The flour is mixed with taro petioles or corms, and soaked to make a paste. The paste is formed into small pieces and left to dry in sunlight. Nuggets are used as a vegetable, especially during periods of scarcity.

Farmers' underlying knowledge associated with the food value of ricebean

- Soup (*dal*) made from the *Bhadaure* landrace is not tasty because it has small grains and has a strange taste, locally called *Chhokrailo*. Landraces such as *Chirkemirke Thulo, Chirkemirke Mailo, Seto Thulo, Seto Sano* and *Rato Masyang* make a good flavoured *dal*.
- Landraces with bold seed such as *Seto Thulo* (big white), *Chirkemirke Thulo* (big grey mottled), and *Ghorle* are best suited for *batuk*.
- For *biramla* and snacks, bold grain landraces are good and preferred by farmers.
- Ricebean is a nutritious grain legume, but sometimes creates digestive problems. It is the best pulse for those who carry out physical work. Consumption of ricebean is less among children and older people.
- One year old ricebean grain can be cooked easily, but older grain has poor cooking quality.

Farmers' classification of pulses as cold and hot

- Farmers have their own classification and concept of pulses as hot (*garmi*) and cold (*sardi*) *dal* and they say this might a have different result on human health. For example, horsegram, lentil and cowpea are considered to be *garmi dal* and are preferred during the winter months, whereas blackgram and ricebean are regarded as *sardi dal* and preferred in summer months.

- These days farmers have begun to mix split ricebean with other split legumes like lentil and cowpea.
- Being a cold *dal* does not mean that it is liable to cause common colds or influenza. Despite this, cold *dal* is generally not given to lactating mothers for the first two or three months as it is considered to induce coldness, gastritis or other uneasiness to new born babies or mothers.
- Some farmers say that freshly harvested ricebean has a substantial cold effect. Thus, there is a tradition to consume ricebean only after storing it for at least one or two months.
- In addition to foods, farmers also ascribe the *Sardi and Garmi* concept to people. For people with a hot body (*garmi),* ricebean consumption is advantageous as it acts as a medicine. On the other hand, for people who are cold sensitive (*sardi*), ricebean consumption is disadvantageous.

4.10.2 Cultural and medicinal value of ricebean

Along with its ethnic diversity, Nepal presents great diversity in the food habits of the people. A wide variety of foods is consumed, particularly during festivals and on special occasions. Festivals in Nepal begin with religion and end as a social event. There are more than 50 major festivals each year and although most are religious some have historical significance, and others are seasonal celebrations. Beans are attached to the cultural and religious aspects of Nepalese society and have a distinct value in some festivals. Thus, ricebean as a legume has its own cultural importance.

Ricebean is the main component of festival dishes like '*kwati*' (soup prepared from a whole grain mixture of nine grain legumes) and *khichadi* (split legumes, especially blackgram or ricebean, mixed with rice and cooked together and eaten as a special dish in the Nepalese month of *magh* (January)). '*Kwati'* is prepared during the *Janai Purnima* festival. Although it is traditionally eaten by the Newar community, these days it has been adopted by other communities too. Beside these, ricebean is used as *dal* in social gatherings and feasts, and among some ethnic communities; *batuk* is used as a souvenir for relatives and guests.

Farmers state that some legumes cannot be offered to the gods. These are called '*jutho*' or '*asan dal*' (not sacred) and are not used in ritual activities. Ricebean is regarded as a sacred *dal,* and is used as an offering to the gods in a number of ritual activities.

4.10.3 Fodder use of ricebean and underlying knowledge

Farmers use ricebean vines and pod husks as livestock fodder. Grain residues from threshing and winnowing are also regarded as a nutritious feed.

- *Kusaouro* (dried residue from threshing and winnowing of ricebean) is nutritious to feed farm animals. Dried vine and leaves are more appropriate during dry seasons.

- Farmers indicate that cattle and buffaloes highly prefer green fodder of ricebean.
- Farmers reveal that dairy animals yield more if green ricebean fodder is fed to them. However, they believe that fresh green fodder has some cold effect and so it is not given to animals in early lactation (around 15-30 days after delivery).

4.10.4 Ricebean cultivation to enrich soil fertility and farmers' local knowledge

Some farmers cultivate ricebean just to enrich soil fertility. In some areas, it is grown in rotation with other crops to improve the fertility status of cultivated land. It results in porous and friable soil. Farmers' knowledge associated with this is noted below:

- Ricebean roots are thicker than those of other legumes. Thus, they play a much greater role to make soil porous than do cowpea, black gram, lentil or chickpea.
- The leaves of ricebean fall after senescence making the soil black and fertile.
- It is easier to dig and plough soils where ricebean has been grown previously. As a result, growing it in marginal and exhausted land is common among the farmers.

5. Conclusion

Ricebean is an ancient and traditional indigenous crop, but although it has been grown for generations its area and production are declining. It is a potentially valuable multipurpose (grain, fodder and green manure) crop for farmers in marginal hill areas of Nepal. As a rainfed crop with good grain yields even in marginal and adverse lands it is important for the food and nutritional security of farmers in such areas. Identifying farmer preferred traits and landraces, or developing such varieties, are crucial to promote it. Farmers, with their unique knowledge of ricebean production, utilization and diversity, are the main source of information and documentation of the indigenous and local knowledge associated with ricebean will help further research, in particular to enhance its status and to develop farmer-preferred varieties. Formal representation of the indigenous knowledge associated with ricebean is necessary for further research.

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7. Appendices

Appendix 1: List of farmers participating in the various group discussions

Focus group discussion and key informants selection, Darbar Devisthan VDC, Gulmi, 2007		
1. Tikaram Khanal 2. Rishiram Panthi 3. Dilli Raj Panthi 4. Rikh Bahadur Karki 5. Resham K.C. 6. Chhatra Bahadur Khanal 7. Hira Panthi 8. Goma Panthi 9. Manju Khatri	10. Parbati B.K. 11. Mangala Devi Khatri 12. Sita Devi Nepali 13. Parbati Sunar 14. Sita Panthi 15. Laxmi Panthi 16. Topkala Aryal 17. Kamala Khatri	18. Bal Bhadra Poudel 19. Chet Man Singh Khatri 20. Sita Gyawali 21. Prem Bahadur Karki 22. Laxman Karki 23. Bhim Bahadur Aryal 24. Manikala Gyawali 25. Laxman Aryal 26. Dam Kumari Karki
In-depth knowledge documentation and analysis, Gulmi		
1. Dilli Raj Panthi 2. Tej Narayan aryal 3. Sita Gyawali 4. Laxmi Aryal 5. Mangala Devi khatri 6. Shiva Kala Subedi	7. Top Bahadur Thapa 8. Prithivi Bahadur Karki 9. Sita Nepali 10. Santi Devi Nepali 11. Gir Bahadur Tohota	12. Jit Bahadur Kuwar, Magar 13. Harka Bahadur Shahi 14. Rukmini Magar 15. Man Kumai Magar 16. Hum Bahadur Magar 17. Gokarna Bahadur Nepali
In-depth knowledge documentation and analysis in 3 VDCs of Ramechhap		
Ramechhap VDC 1. Saroj Lama 2. Shambhu Thapa 3. Narayan Babu Shrestha 4. Bishnu Kumari Shrestha 5. Jit Maya B.K. 6. Iman Singh Kasai	Bhaluajor VDC 7. Prem Bahadur Kasai 8. Indira Kasai 9. Amar Bahadur Thapa 10. Namati Thapa 11. Bhakta Maya Shrestha 12. Krishna Bahadur Shrestha	Pakarbas VDC 13. Tikaram Koirala 14. Hem Bahadur Khadka 15. Balaram Karki 16. Manmaya Magar 17. Hira Kumari Tamang 18. Rosita Nepali
Focus group discussion to validate the documented knowledge, Gulmi, 2008		
1. Jit Bahadur Thapa 2. Rikhiram Panthi 3. Prithivi Bahadur Karki 4. Laxman Aryal	5. Hari Prasad Gyawali 6. Dhana maya Karki 7. Laxima aryal 8. Sita Gyawali	9. Chet Man Singh Khatri 10. Tika Bahadur Khatri

Appendix 2: Research questions used in documenting local knowledge

Key research questions:

1. **General information:** information on geographical location, altitude, distance from district centre, major ethnic groups, source of livelihood, climate, land types, cropping pattern of rice bean growing pocket areas.
2. **Crop information:** major crops and legumes growing on the area, preference ranking of commonly growing legumes.
3. **Cultivation practice of rice bean:** information on major production domains (sole, inter cropping or on bunds of rice), cultivation practices adopted by farmers (planting time and method, planting distance, intercultural operations, harvesting time and method and so on) -domain wise
4. Description of **rice bean growing lands,** most preferred land, soil type and aspect for rice bean.
5. **Rice bean diversity:** commonly growing landraces, positive and negative traits of commonly growing landraces, farmers' preferred landraces and traits in the area.
6. **Historical perspective:** rice bean production and productivity trend, reasons for decrease / increase in production and productivity, loss/introduction of landraces in the area.
7. **Important uses and recipes of rice bean**: preferred traits and landraces for particular use, local use methods, cultural and medicinal value.
8. Information on **fodder value of rice bean:** contribution of rice bean as fodder for animal, farmers' methods of using and parts of use.
9. Farmers' knowledge regarding **long term storage, storage methods for seed and grain, seed selection practices, methods of threshing** and problems associated.
10. **Major problems in cultivation** of rice bean.
11. **Farmers' suggestions to add value to the crop.**
12. Is there any difference in preference of rice bean **food items by age group**?
13. Farmers' knowledge about **hardy / dormant seeds,** how they are handled? Is there any practice to treat hardy seeds/ hard seed coats?
14. Farmers local knowledge regarding **"non seed bearing pods" (*pani kosa*).** When and how these are formed? Most susceptible landraces, Impact on yield; are there any cultural methods to minimize this problem?
15. Farmers' **basis of naming local landraces**.