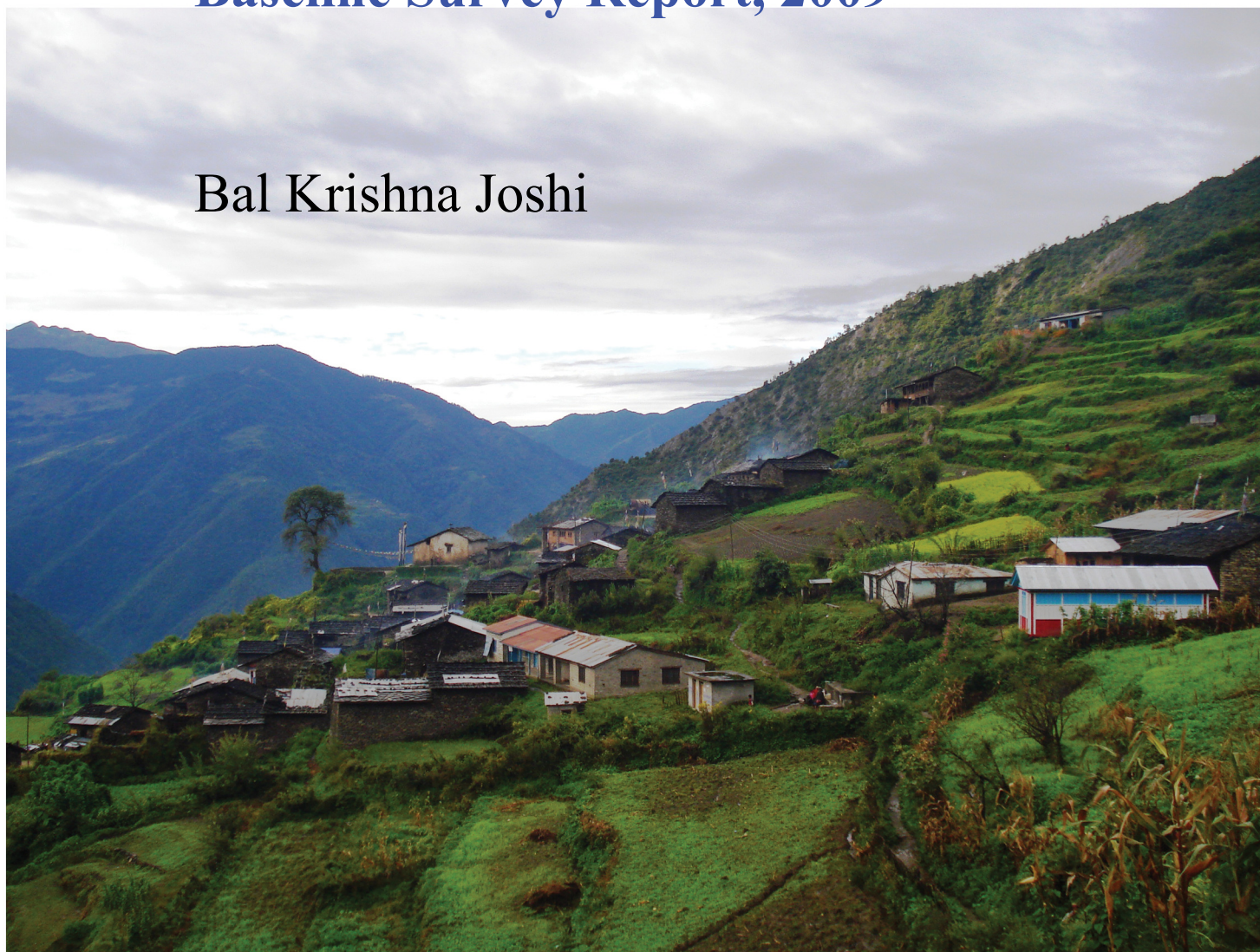


Agro-ecology, Socio-economy and Crop Diversity in the Working Areas of RACE-Nepal, Rasuwa

Baseline Survey Report, 2009

Bal Krishna Joshi



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Bal Krishna Joshi
Plant Breeder
Kathmandu, Nepal
Email: joshibalak@yahoo.com

URL: <http://sites.google.com/site/jafgaubase>



RACE-Nepal
Dhunche-7 Rasuwa
Tel: 010 540116, 010 670006
Email: racenepal@ntc.net.np, racenepal@yahoo.com
Web site: www.uscnepal.org/racenepal

USC-Canada Asia
Chundeви, Maharajgunj
Kathmandu, Nepal
Tel: 01-4721152
Fax: 01-4727758
Email: uscasia@wlink.com.np
Web site : www.uscasia.org

USC-Canada
56 Sparks Street Suite 705
Ottawa, Canada, K1P 5B1
Tel: 613 234 6827
Fax: 613 234 6842
Email: info@usc-canada.org
Web site: <http://usc-canada.org>

RACE-Nepal (Action for Community Empowerment and Resilience)

Partner organization of USC-Canada working in the Rasuwa district from 2000 and its mission is to improve the living standard of community by better managing agricultural biodiversity and other local resources.

USC-Canada Asia

Regional organization, formerly USC-Canada Nepal, working in Nepal since 1977 for the promotion of sustainable human development and social justice.

USC-Canada

Founded by Dr Lotta Hitschmanova in 1945 as the Unitarian Service Committee of Canada and working in Africa, Asia and Central America to help themselves by building capacity at the individual and national levels. USCC promotes vibrant family farms, strong rural communities and healthy ecosystems around the world applying the principles of Right, Resilience and Respect.

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RACE-Nepal (Action for Community Empowerment and Resilience)

Dhunchhe-7 Rasuwa

Tel: 010 540116, 010 670006

Email: racenepal@ntc.net.np, racenepal@yahoo.com

Web site: www.uscasia.org/racenepal

+

USC-Canada Asia

Chundeви, Maharajgunj

Kathmandu, Nepal

Tel: 01-4721152

Fax: 01-4727758

Email: uscasia@wlink.com.np

Web site : www.uscasia.org

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Cover page photo: Village and farm land in Thuman (Courtesy Murari P. Lamichhane)

FOREWORD

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INTRODUCTION

Agricultural biodiversity (Agro-biodiversity) is the basis of life in many districts of Nepal including Rasuwa. Rasuwa is considered one of the biodiversity rich districts. From the very ancient time, farmers are maintaining, conserving and utilizing agro-biodiversity. However, farmers have not been able to harvest more benefit from the existing crop diversity and they usually look for other high yielding varieties and/ or other business. Crop landraces are less competitive even though they might have a very specific trait and many developmental organizations including governmental are always giving emphasis to so called high yielding varieties (HYV), which ultimately replace the local valuable crop diversity. Therefore, value addition is an urgent need for the continued cultivation of local crop diversity, and development of site specific and household specific varieties should get priority. To make the local gene pool more competitive, Landrace Enhancement and Conservation (LEC) program is an effective way as seen in local Cauliflower of Dalchowki-Lalitpur. Information on the status of crop landraces is the prerequisite for initiating landraces improvement and conservation, in addition to other agro-biodiversity management programs, therefore, this survey program is designed.

RASUWA DISTRICT

Literally Rasuwa means pasture land for sheep and Chyangra (Hill goat). Rasuwa district is located at high Himalaya of Bagmati zone. The headquarter, Dhunche is located at 1950 m altitude and 119 km far from Kathmandu. Rasuwa district is consisted of 18 VDCs with altitude range of 314 m to 7134 m. Its total area is 151,200 ha (1519.31 m²) and Langtang National Park covers about 30% of total land (Figure 1) and agro-ecologically it is divided into two groups, High Hill and Mid Hill. Total population in the district is 43906 consisting of 22552 male and 21354 female with the population rate of 1.8%. Tamang is the dominant cast after Brahmin and Gurung. Minimum rainfall is generally observed in Push, which is 3.3 mm in the district and maximum in Bhadra (650.1 mm). On an average, the lowest temperature is 1.2°C and the highest temperature is 42°C. Due to prevailing of all types climates ie tropical, subtropical and temperate, biodiversity is rich in this district from where 345 bird species, 58 butterfly species, 40 fish species, 46 Estandhari species and 11 Uvaychar and Gharsane 11 are reported.

Agriculture is the backbone for economy in this district. 84.1% of the active populations are engaged in agriculture. Cultivable land is 11.21% of which Khet area is 1277 ha and Bari is 15678 ha. Among the total 6448 HHs, 16 are landless and average land holding is 0.91 ha. Landslides cause many damages every year. Due to soil erosion productivity is decreased each year however, productivity is increased each year in rice and bean. Potato is the most important crop in the district after maize and rice. Varieties available in the district are reported in Table 1.

Table 1. Crop area and production of selected species for baseline survey in Rasuwa district

Crop	Area, ha	Production, t	Variety
Rice	1277	2785	Chomrong, Machapuchhre-3, Mansuli, Radha-7, Radha-4, Taichung, Radha-32, Khumal-4, Sabitri, Bhunte Masino, CH-45
Maize	2365	4470	Rampur Composite, Rampur Yellow, Kakani Yellow, Ganesh-1, Arun-2, Local, Mankamana-1
Buckwheat	25	20	Local

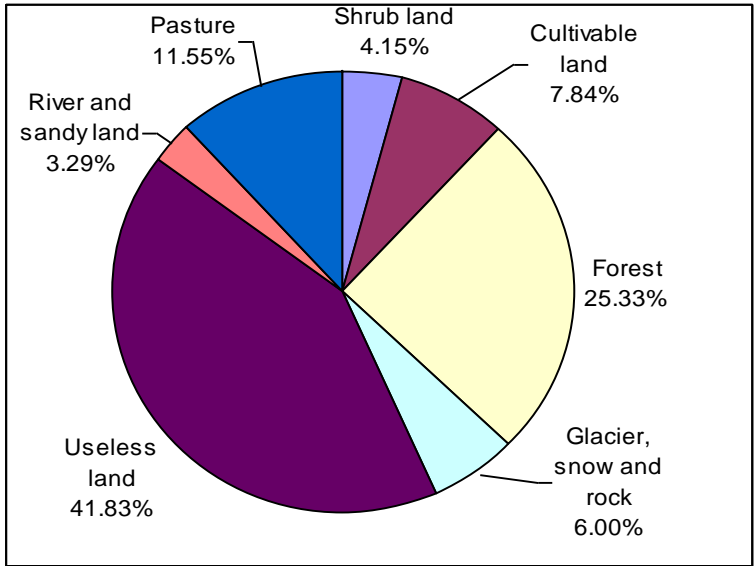
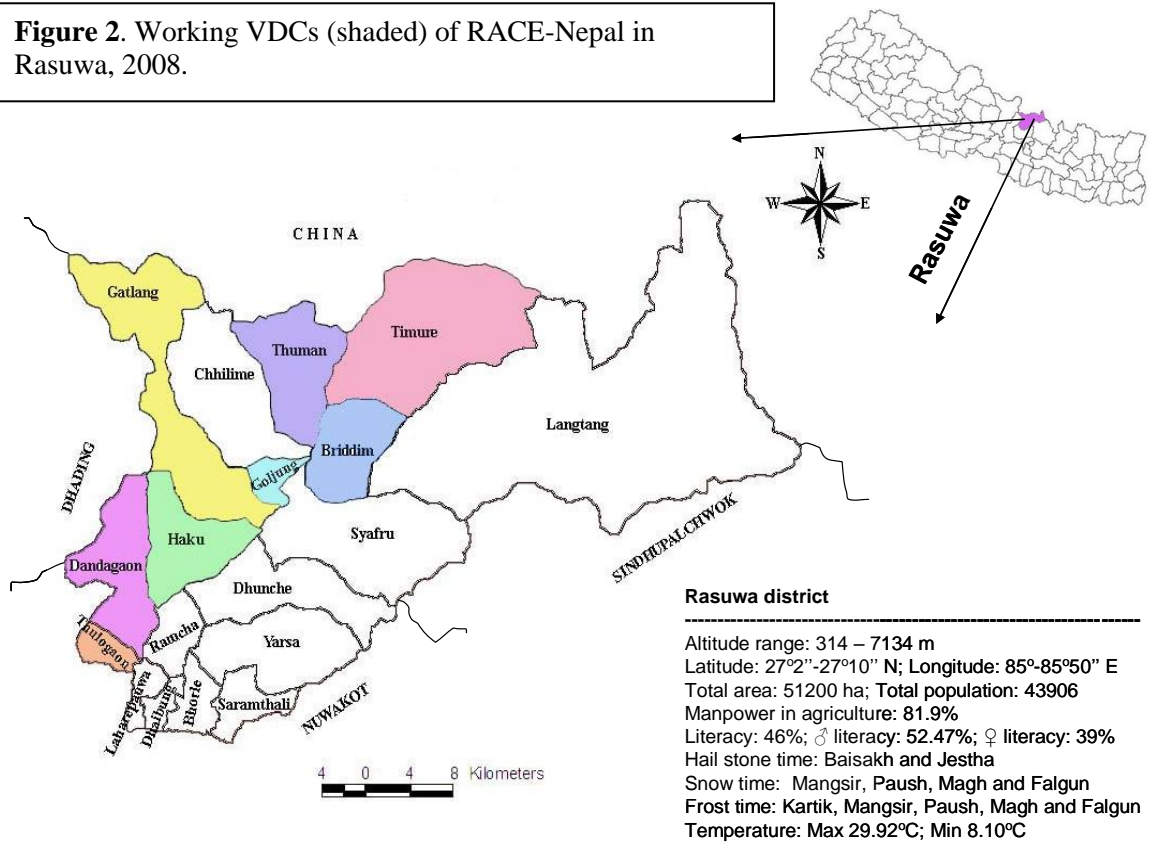


Figure 1. Land use pattern in Rasuwa district.

WORKING AREAS OF RACE-NEPAL

After the successful implementation of Integrated Community Development Project (ICDP) in Lalitpur, USC-Canada-Nepal started RACE-Nepal (formerly Rural Civil-Society Empowerment Program, RCEP) in Rasuwa from 2000. Community needs-based activities have been effectively and efficiently implemented under this program. Its mission is to improve the living standard of community by better managing agricultural biodiversity and other local resources. Its working areas are needy and less attentive areas where Government and other organisations have not reached. The target beneficiaries include poor, Dalit, disadvantage and underprivileged groups. Agrobiodiversity is the main working sector. RACE-Nepal follows ecological and diverse agriculture system. It has already initiated many activities related to agrobiodiversity management.

Figure 2. Working VDCs (shaded) of RACE-Nepal in Rasuwa, 2008.



Among 18 VDCs of Rasuwa district, RACE-Nepal is working in 8 VDCs. Initially it has been working on 6 VDCs namely Gatlang, Thuman, Timure, Briddim, Goljung and Haku. Later its working areas are expanded to other two VDCs ie Dandagaon and Thulogaon (). The population status of these 8 VDCs is given in Figure 3. Most of the land is sloppy even though, agriculture is the mainstay of life. Agricultural land of 8 VDCs are given in Figure 4. Total food deficit was 1350 tone based on 201 kg /year/person.

Findings of Baseline Report (USCCN, 2001)

USCCN (2001) reported that 66.3% of active people are engaged in agriculture in these 6 VDCs. Baseline reports of two VDCs, Dandagaon and Thulogaon are not available. Average land per HH is 16 Ropani and 43.9% HHs are able to meet their family needs of food from their farm. Among the total households, 72% used seeds maintained by themselves, 24% borrowed from neighbors and 5% from local market. 75.8% HHs did not change seed (until new seed is available). Most of areas could not be cultivated year round mainly due to cold temperature and sloppiness. Land generally left uncultivated for abut 3 to 6 motnhs. 44.8% HHs use chemical fertilizers. Majority of farmers reported that use of chemical fertilizer and pesticides increase hardening of soil, increase diseases, decrease of production and reduction of biodiversity. 52.1% HHs followed single cropping pattern.

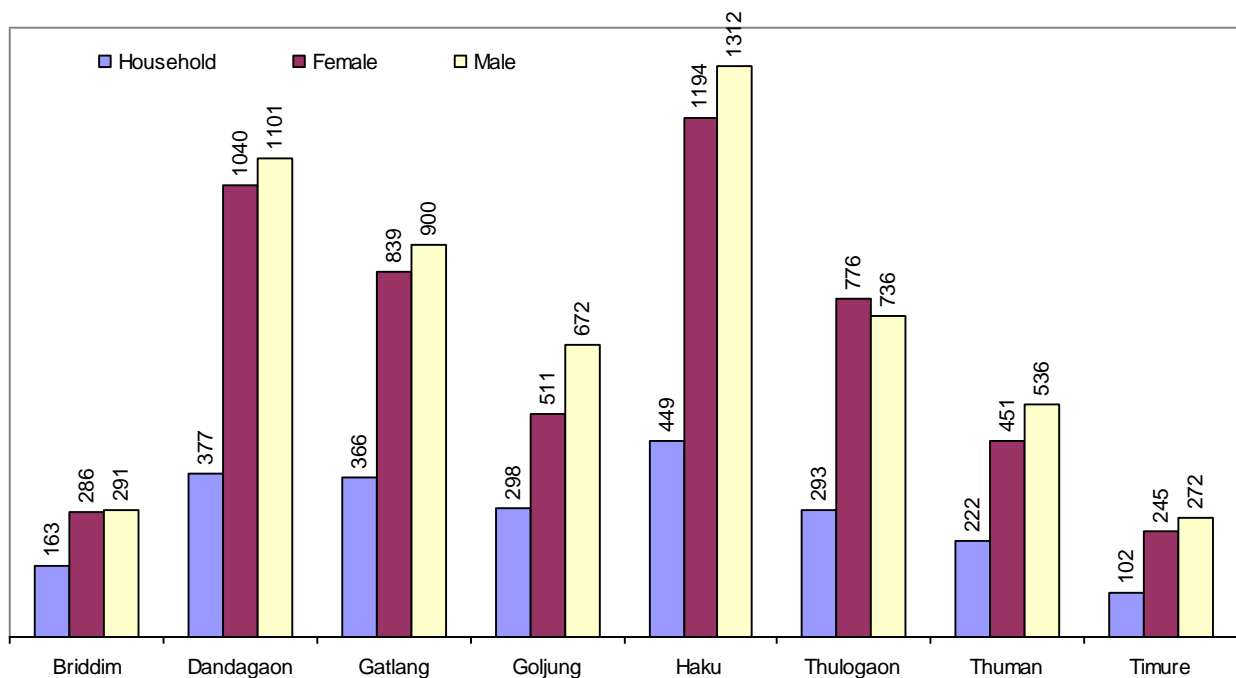


Figure 3. Number of household and population in working areas of RACE-Nepal, Rasuwa, 2008.

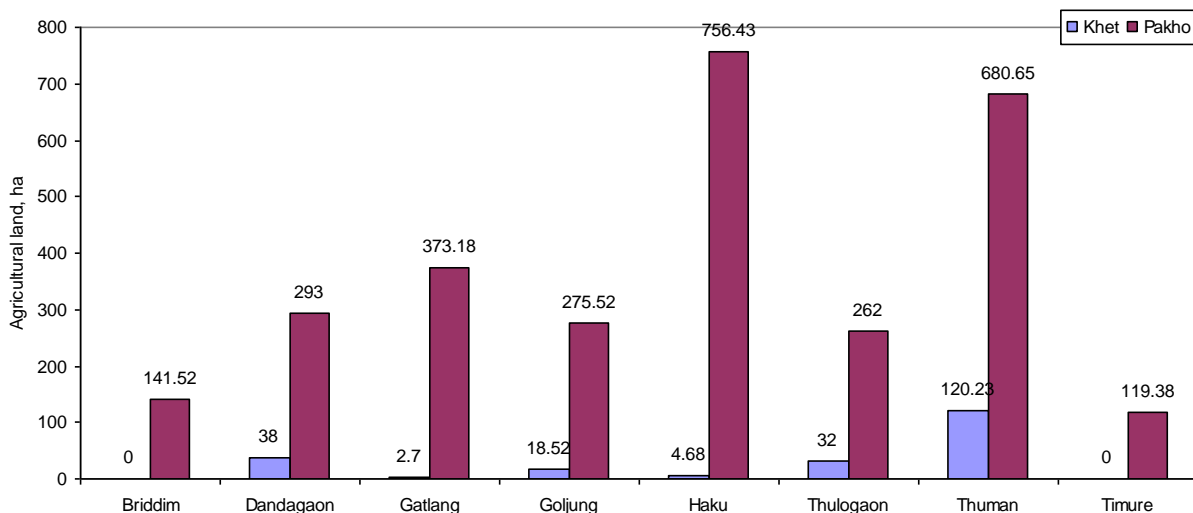


Figure 4. Agricultural land (ha) in working areas of RACE-Nepal, Rasuwa.

Agro-biodiversity Status

Species richness of these 8 VDCs is reported in Figure 5. This number of species need to verify. Existing agro-biodiversity of four crop species are listed below in

Table 2. Followings are the land type found in this area.

Khet: Bagar, Gairi Khet, Sim Khet, Khola Khet, Kanle Khet, Tari Khet

Bari: Ghar Bari, Ghod Bari, Khoria, Gaira Bari, Danda Bari, Lek Bari, Khar Bari, Dadyan Bari, Pata Bari, Pakho Bari, Kanle Bari

NARC has released 215 varieties of 45 crop species for cultivation. Among them, followings are the common cultivars in the working areas of RACE-Nepal.

Maize: Rampur Composite, Ganesh-2, Mankamana-1, Mankamana-3, Ganesh-1, Deuti

Rice: Khumal-4, Radha-12, Khumal-11

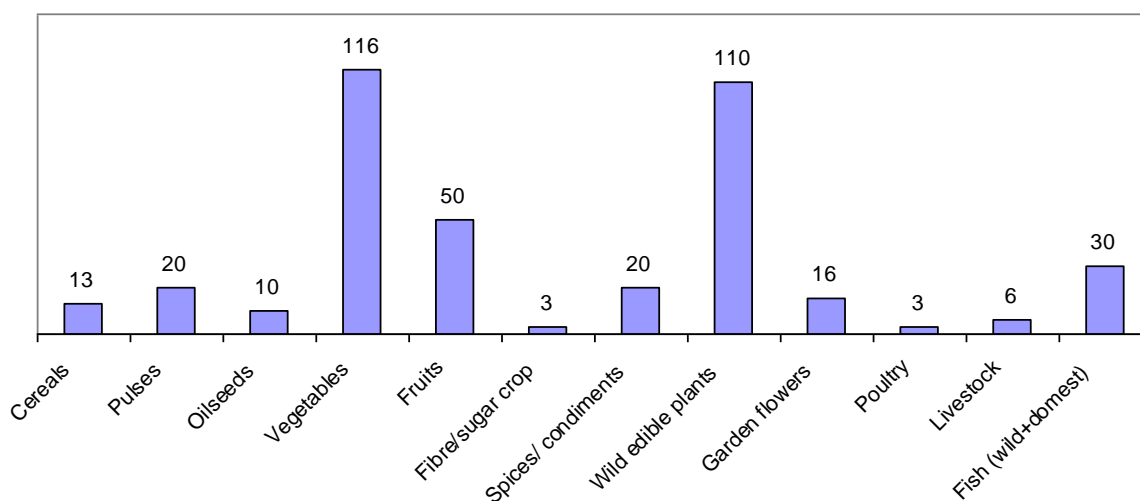


Figure 5. Number of species found in working areas of RACE-Nepal, Rasuwa.

Table 2. Crop species and their landraces found in working areas of RACE-Nepal, Rasuwa

SN	Common name	Nepali name	Landraces/varieties
	Rice	Dhan	Khumal-4, Anpjutthe, Taichung (shattering type), Taichung (non shattering type), Sirke, Kanchan, Khumal-9, BG, Seto BG, Radha-7, Radha-9, Radha-11, Himali, Samundraphinj, Patale, Bhen Marshi, Siyali, Marshi, Anga, Sidali, Chaite-4, Tadmara, Chote, Ghaiya, Ekle, Pokhrela
	Maize/ corn	Makai	Rampur-2, Arun, Rampur-5, Seto, Murali, Thakre, Papele,
	Flint Corn	Pahenli Makai	Nuppa, Silide, Kasali, Thumse, Asare, Korche, Pajung, Bikase
	Dent Corn	Dante Makai	Seto
	Pop Corn	Murali Makai	
	Sweet Corn	Guliyo Makai	
	Pod Corn	Kali Makai	
	Common buckwheat	Mithe Phapar	
	Tartary buckwheat	Tite Phapar	
	Bean	Simi	Seto, Kalo, Rato, Razma, Chirbire, Ghiu Simi, Tamra, Makai Simi, Bhakkhre Simi
	Sword Bean	Tarware Simi	
	Hyacinth Bean	Hiunde Simi	
	Velvet Bean	Kause Simi	
	Field Bean	Asare Simi	
	Winged Bean	Pate Simi	Pate Sano, Pate Thulo
	Broad Bean	Bakula Simi	

Most of farmers agreed that, due to the introduction of new species or varieties especially through the developmental organizations, local varieties were lost (Joshi 2008). Marshi Dhan is lost from the local area. Some of endangered landraces/ species are Mithe buckwheat, Tite buckwheat, Anp Jutthe Dhan, Sinali Dhan, Pajung Thaniya and Local maize. Farmers are more interested on landraces and eager to improve them, so that their landraces could be competitive.

HOW TO MEASURE ON-FARM DIVERSITY

Landraces play a pivotal role in folk community. Diverse landraces are under cultivation in traditional farming systems and they are maintained and managed by farmers for diversity of use values, indigenous beliefs and rituals and adaptive functions over space and time. Landraces constitutes a conspicuous source of variation and provide valuable genes and traits for crop improvement. A basic knowledge of genetic diversity is therefore essential for sustainable conservation and utilization of diversity of crop varieties. Farmers have a well-developed indigenous knowledge of the crops and crop varieties and they use traditional names to identify and distinguish landraces. Farmer's naming the landraces is therefore a starting point and it provides a basis for measuring the diversity on-farm, and no doubt diversity in names reflects diversity in utility, agro-morphological and adaptive traits of the named landraces. On measuring the diversity of landraces, there also account physical and social factors of the fields and farming communities. Various tools and techniques have been used aiming to measure the extent and level of diversity on-farm (Joshi et al 2007). Biodiversity is the variety and variability among living organisms and the ecological complexes in which they occur. The diversity may be structural ie genes, species, ecosystem and functional ie ecological and evolutionary processes.

The surveys have shown that much can be understood about landrace diversity structures on-farm. Surveying tools: diversity fairs, baseline survey, and participatory rural appraisals of diversity assessment have been used and revealed an extent of diversity of landraces with diversity of names,

utilities and their diverse local preparations. Diversity in naming varieties is therefore a valuable starting point and itself is a measure of diversity of the landraces that farmers use to identify and distinguish the named varieties. Farmer's indigenous knowledge of landraces is thus linked to extent, maintenance and management of crop diversity. The choice of a crop or landrace is first determined by adaptation to the agro-ecological domains and farm management practices under which the crop will be grown. Phenotypic features of the plants are next factors that are selected by farmers to meet their preferences or identification. Therefore, the farmer's naming of varieties, on farm characterization of landraces, characterization of landraces on diversity block, diversity assessment by physical (adaptation to agro-ecological conditions) and social factors of farming communities are some landrace diversity measuring tools used by farmers in their farms.

Approaches of agro-biodiversity measurement

1. Species richness
2. Variety richness (Number of farmer's named variety or farmer's unit diversity)
3. Landraces grouped under different use type
4. Landraces grouped under different morpho type
5. Landraces grouped suitable under different land type
6. Grouping landraces based on distribution in terms of area and household
7. Grouping landraces based on growing season
8. Average population size or field size of a specific landrace
9. Number of fields in which a landrace is grown
10. Simpson's index
11. Shannon- Weaver index
12. Measuring diversity using on farm agromorphological data: Standard error, coefficient of variation, frequency distribution, mean etc.
13. Measuring diversity using genetic data (isozymes and molecular markers): Allelic richness, frequency of allelic variants, level of heterozygosity, distinctiveness, Nei indices, Fisher indices etc.

RATIONALE

Main component of biodiversity is agricultural biodiversity, which is the basis of life. Agrobiodiversity must be managed properly for food security and sustaining the life. Nepal is rich in agrobiodiversity, but its value is underestimated. Due to which, introduction of genetic resources always remain in top priority. There is one Nepali proverb 'Najiko Thirtha Hela', mean, Nepalese people neglect locally available resources. This proverb is really applicable even in the agrobiodiversity. This affects profoundly to lose the local genetic resources. Agrobiodiversity management (conservation, enhancement and utilization) is now considered one of the most important activities by government and non government organizations. For better managing this diversity, modern sciences should be combined with local skill, knowledge and techniques.

Due to the great variation in farming land and farmers' needs, farmers have maintained different kinds of crop landraces. Site specific and house hold specific landraces are being created and maintained over the years and locations. However, landraces are relatively poor in performance and response less to high inputs mainly due to the degraded environments. Modern varieties are called high yielding varieties and different line agencies support the farmers for adopting these varieties. These leads to loss of localized genotypes and many organizations now concern on conservation. Conservation through utilization is the effective and efficient way of conserving landraces. Farmers always consider the economic yield of any cultivated crop species. Therefore, for the continuation of evolution in the cultivated crop species, localized landraces should be competitive. Genetic and non-genetic approaches help to economize the agricultural products. Genetic improvement is the best method for the continuation of landraces. Different factors contribute for the management of crop diversity and factors directly related to diversity should be understood for better managing the diversity.

Information on the agro-ecology where the landraces are grown, socio-economy of the farmers who grow the landraces and landraces that sustain the life of farming communities is prerequisite for initiating agro-biodiversity management including value addition program.

OBJECTIVES

The prime objective of this baseline survey on crop diversity, agro-ecology and socio-economy in the working areas of RACE-Nepal was to collect information and develop a basis for implementing Landrace Enhancement and Conservation (LEC) program. Followings are the specific objectives.

- To develop basis for planning and implementing LEC program
- To document the status of landraces diversity of selected crop species, associated farmers' knowledge and management practices
- To develop guidelines for the development and implementation of future program
- To assess the factors shaping the crop diversity
- To list the preference and un-preferred traits of farmers of specific crop landrace
- To explore the farmers' access to markets, new technologies, external inputs and different institutes
- To help build the linkage between Gene Bank of Nepal Agricultural Research Council and RACE-Nepal, by developing red listing of crop landraces

METHODOLOGY

Several round of discussion had been made with RACE-Nepal and USCC-Asia for setting objectives and developing questionnaire. Step by step procedures adopted in this survey are depicted in Figure 6. After many round of discussion with RACE-Nepal, these steps were finalized.

Conceptualization and Questionnaire Development

Concept was developed after the preliminary discussion with Murari P. Lamichhane, Coordinator of RACE-Nepal, Rasuwa. Two documents, USCCN (2001) and Joshi (2008a) were consulted. This concept was circulated to RACE-Nepal, USCC-Asia and USC-Canada for further improvement. Introduction, objectives, methodology and expected outputs were included in the concept. Discussion meetings had been held several times with RACE-Nepal. Three sectors namely agro-ecology, socio-economy and crop diversity were chosen for collecting information from household survey (HHS). After finalization of the concept, questionnaire was drafted and circulated to above mentioned three organizations. Different literatures for example USCCN (2001), Rana et al (2000), Joshi (2008a), Joshi et al (2005a) and Joshi et al (2006) were consulted to develop the questionnaire. This questionnaire was refined during Orientation workshop and finalized after pre-testing. Questionnaire is given in Annex 8.

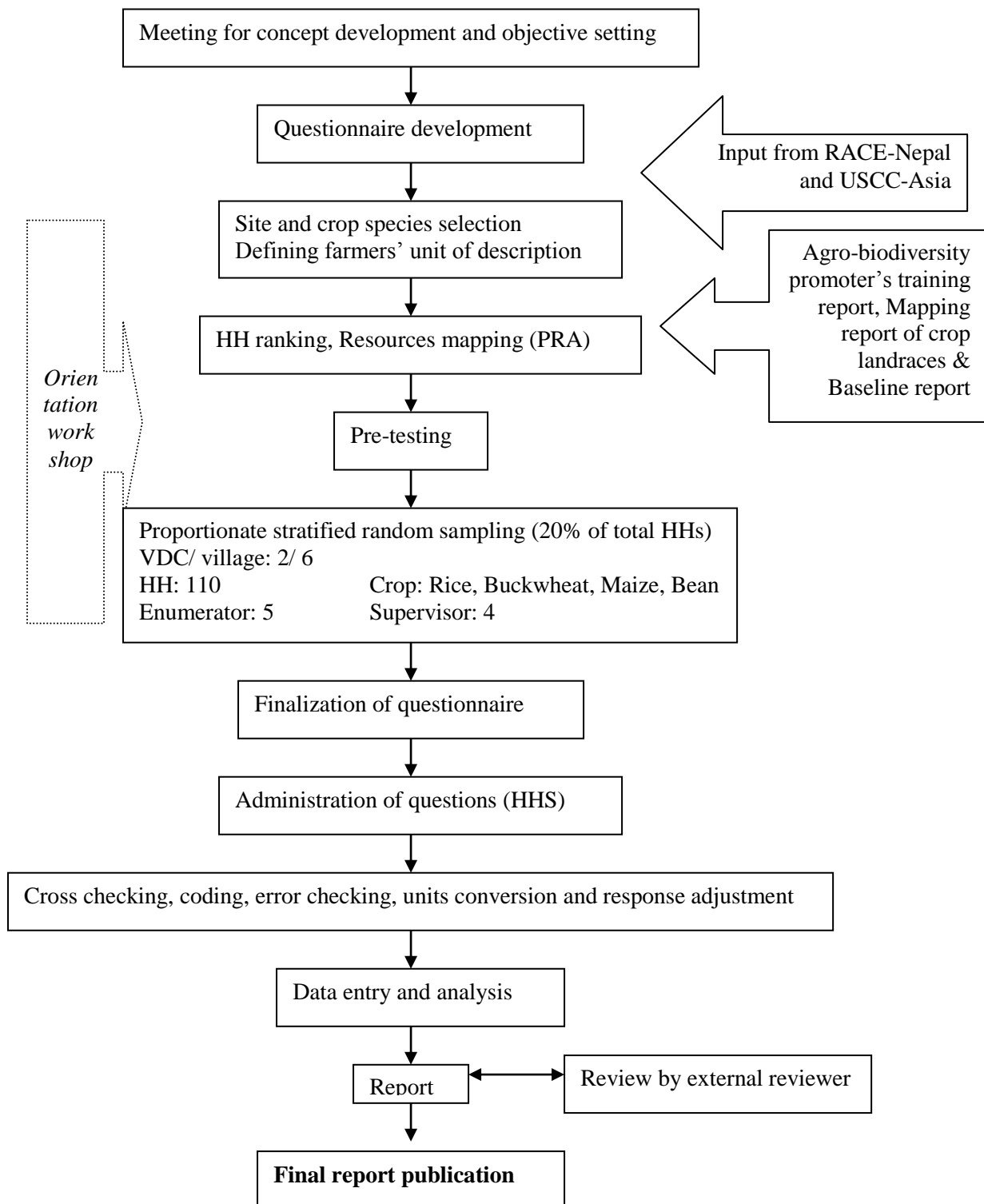


Figure 6. Detail methodology adopted for baseline survey (PRA, Participatory Rural Appraisal; HH, Household; HHS, Household Survey; HHs, Households).

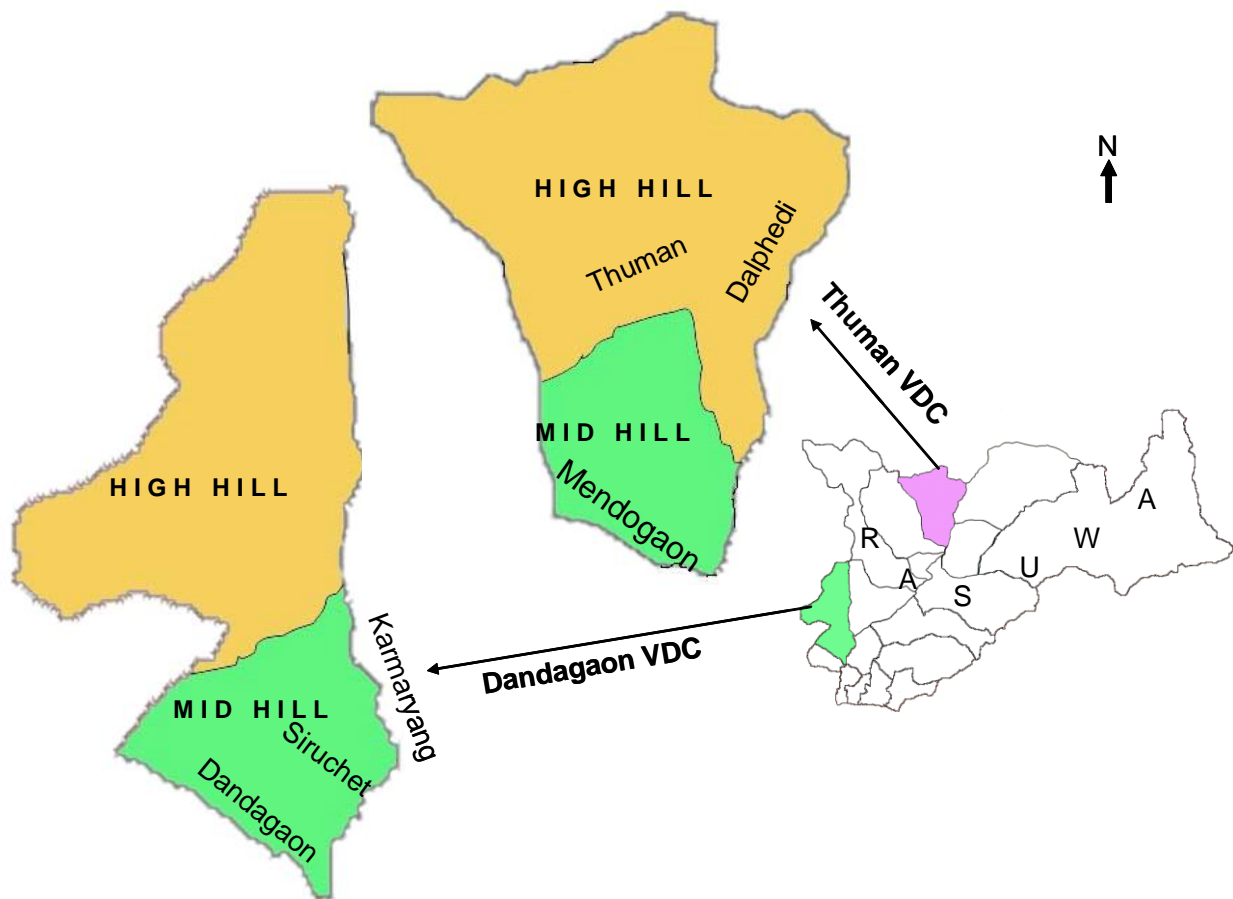


Figure 7. Surveyed VDCs for crop diversity in working areas of RACE-Nepal, Rasuwa.

Sites and Crop Species Selection

RACE-Nepal is working in 6 VDCs namely Gatlang, Thuman, Timure, Briddim Goljung and Haku since 2000. Later in 2007, two VDCs, Dandagaon and Thulogaon have been added. Based on the experiences of RACE-Nepal and its future plan, two VDCs were selected for survey on agro-ecology, socio-economy and crop diversity. These VDCs are Thuman and Dandagaon. Agroecologically, these VDCs have two zones (which is marked in the map by the participants of orientation workshop considering altitude, food habit, crop species, agriculture systems, settlement style and habit, etc), High Hill and Mid Hill. Each of these zones in each VDC was considered to include in the study. Within each VDC, 3 villages were selected based on the criteria given below. VDCs similar in climate, biodiversity and caste are excluded from the study. Farm lands of the excluded VDCs are located in other selected villages. In Dandagaon, all villages lies in Mid Hill but their farm lands are distribution in both High Hill and Mid Hill. Among four villages in Thuman VDC (Thuman, Nagthali, Dalphedi and Mendogaon), Nagthali was not included in the study. Similarly among eight villages in Dandagaon VDC (Karmaryang, Siruchet, Dandagaon, Diyale, Chipleti, Baddhaure, Katunje and Khadgu) only three village namely Karmaryang, Siruchet (including Chipleti and Baddhaure villages) and Dandagaon were selected. Four crop species (rice, buckwheat, maize and bean) were determined for survey. Site and crop species selection were based on the report of baseline survey (USSCN 2001), agrobiodiversity promoters' training report (Joshi 2008a) and mapping report of crop landraces (unpublished, consult Dilip and Murari for detail). Other bases of sites and crop species selection are given below based on the discussion with RACE-Nepal staff and workshop participants. Selected sites

and villages are given in Table 3. From this survey, landraces of 4 crop species were identified to take action for genetic improvement considering farmers' needs. Status of landraces of these crop species had been documented and endangered landraces were listed so that, initiatives will be taken to conserve these landraces either linking with Gene Bank of Nepal Agricultural Research Council (NARC), Kathmandu or implementing LEC program.

Basis of site and crop species selection

Due to limitation of resources and time, only two VDCs out of 8 VDCs and four crop species out of 33 cereals and pulses species were selected for this study. Following are the bases of sites and crop species selection.

A. Site selection bases

- Selected two VDCs are geographically representative of these working areas of RACE-Nepal. Both Mid Hill and High Hill zones belong in these VDCs.
- Crop and climate diversity are rich. Rice recommended to Tarai belt can also be cultivated.
- Farmers are very cooperative and have positive attitude towards the agricultural development.
- These areas are the focus areas of USCC-Asia and RACE-Nepal and farmers are poor.
- Dandagaon is newly selected VDC and Thuman is from the period of first intervention.

B. Crop species selection bases

- Local varietal richness of these species is high.
- Beans of these areas are very famous.
- Buckwheat is multipurpose crop and medicinally important however, its diversity is disappearing in faster rate.
- Buckwheat and bean are easy for cultivation.
- Endangered landraces are more in rice.
- Mode of reproduction is different.
- Market value is high even at local level.
- Bean also improve soil fertility status.

Orientation Workshop and Pre-Testing

Two day long residential orientation workshop was organized in Kakani-Nuwakot district from 22-23 March 2009 (9-10 Chaitra 2065). Details of this workshop are given in Table 4. Five enumerators from the local areas were hired for HHS. Enumerators were selected based on the experiences in agriculture, education and involvement in agrobiodiversity promoters' training organized by RACE-Nepal in 2008. They were the responsible for PRA to categorize HHs in Resource-rich, Resource-medium and Resource-poor groups and HHS to fill up the questionnaire. Four staff of RACE-Nepal had involved in this workshop and HHS. Person involved in this study and action plan are given in Annex 4. Two of them had been assigned to monitor the field during fill-up, to control error, to help enumerators and to support for collecting right information. We finalized and pre-tested the questionnaire, categorized the HHs and defined the local systems of agriculture during the workshop. Thorough discussion on questionnaire was done with the enumerators and staff. These enumerators are from the HH which were equally chance to include in the sample. Therefore the questionnaire was pre-tested among the enumerators and then finalized.

Table 3. Selected sites, sample size and distribution

S N	Agro- Eco-Zone	Village	Ward	Total HH, n				Sampled HH, n (20%)			
				Rich	Medium	Poor	Total	Rich	Medium	Poor	Total
Thuman VDC											
1.	High Hill	Thuman	1-7	0	124	36	160	0	25	7	32
2.		Dalphendi	9	0	10	21	31	0	2	4	6
3.	Mid Hill	Mendogaon	8	8	6	29	43	2	1	6	9
Dandagaon VDC											
4.	High Hill	-									
5.	Mid Hill	Karmaryang	8, 9	0	33	83	116	0	6	17	23
6.		Siruchet	7	4	43	33	80	1	9	7	17
7.		Dandagaon	1-3	12	24	77	113	2	5	16	23
Total				24	240	279	543	5	48	47	110

Table 4. Detail of orientation workshop

SN	Workshop contents
1.	General description of baseline survey (HH and landraces characterization and evaluation)
2.	Questionnaire discussion
3.	Site and crop species selection (Basis of selection)
4.	Listing land type, landraces, agro-eco-zones, irrigation types and defining farmers' unit of description
5.	Sampling strategy (Stratified, Proportionate and Random)
6.	Wealth ranking (PRA)
7.	Pre testing
8.	Finalization of questionnaire
9.	Field administration (HHS)
10.	Important issues: Local terms, photos, valid information (reliability of information), local units, local terms, how convince farmers, name not known, key informants, main respondents, time, seed samples, interview methods, error/ cross checking, letter to farmers

Wealth Ranking and Defining Farmers' Units of Description

For categorizing HH in Resource-rich, Resource-medium and Resource-poor groups, PRA was conducted in 6 villages of 2 VDCs. 11-44 key informants per village had been involved in PRA. During orientation workshop, general criteria were developed for ranking HHs in different strata (

Table 5). We came in consensus that food sufficiency is the best criteria and easy for house hold categorization. Only the farm products including livestock were considered in determining food sufficiency months. These criteria were also discussed with key informants. Enumerators ranked all the HHs through PRA in to resource rich, resource medium and resource poor groups. Key informants involved in the PRA are given in Annex 5. We grouped all HHs in different wealth strata because resources are one of the important factors influencing the crop diversity.

Possible local unit and terminology were listed, defined in orientation workshop and verified during survey (See Annex 2 and 3 for detail). Land type was listed mainly as Khet, Bari and Lek and irrigation systems as Kulo, Mul, Khola and Ghatkulo (Bhalpani).

Sampling Strategy and Sample Size

Proportionate stratified random sampling was adopted. Each VDC was divided in High Hill and Mid Hill zones. Within these zones villages were purposively selected. HHs from these selected VDCs were placed in Rich, Medium and Poor strata. Proportionate numbers of HHs from these strata were sampled. 20% of the total HHs in selected villages was sampled. From within each strata HHs were randomly drawn. Total and sampled HHs from 3 different strata are given in Table 3. HH and crop species are the sample units for characterization and evaluation. Crop species was purposively selected.

Table 5. Criteria used for categorizing HHs in Rich, Medium and Poor groups

SN	Resources	Wealth category		
		Rich	Medium	Poor
1.	Land holding, Ropani			
	Khet land	>15	5-15	<5
	Bari land	>20	10-20	<10
	Pakho Bari	>20	10-20	<10
2.	Private forest/ kitchen garden, Ropani	>2	1/2-2	<1/2
3.	Food sufficiency, month	>12	6-12	<6
4.	Fruit/ herb, Rs in a year	>5000	1000-5000	<1000
5.	Livestock, n			
	Buffalo/ Cow/ Chauri	>5	2-5	<2
	Goat/ Sheep	>10	5-10	<5
	Poultry	>15	5-15	<5
6.	Services, monthly income, Rs	>5000	1000-5000	<1000

Household Survey

Immediately after the orientation workshop, enumerators conducted PRA and started to fill up the questionnaire. Official letter to selected HHs (47 in Thuman VDC and 63 in Dandagaon VDC) was sent mentioning the objectives of the survey and requesting their cooperation. To collect the valid and detail information family members were asked to choose a respondent basically family member who is the decision maker in agriculture. We also requested to other members to add or supplement information. HHS approach was adopted and interview was the method applied to complete the questionnaire. Enumerators were regularly monitored in the field. A maximum of four HHs was interviewed in a day and thoroughly checked in a group in each day after completion of the interview.

Data Checking and Editing

Data were cross checked in the field and RACE-Nepal office. Telephonic conversation was held many times during questionnaire fill-up among survey expert, staff and enumerators. HH was revisited and interviewers contacted in case of unclear information. Local terms and units were defined and converted to appropriate units (area in Ropani, weight in kg) before entering the data. Some information was converted in code. Data were also checked during and after entering data in the computer. Responses were adjusted before analysis.

Data Entry and Analysis

Data were entered in the Excel software. Exploratory data analysis was done first to check the data point and nature of the data. For statistical analysis we considered two points, characterization and evaluation of 1. House hold and 2. Crop landraces. Possible statistical tools were selected based on Joshi et al (2005). Descriptive statistics were calculated on different parameters. Grouping of HHs and landraces was done following the multivariate techniques, namely cluster and principal component analysis considering both categorical and numerical variables. House hold diversity index (HHDI) was estimated using the Shannon -Weaver index (H') (Joshi et al 2007). Chi square and regression methods were also applied in addition to the estimation of correlation coefficients. Three software, NTSys, Minitab and SPSS were used for data analysis.

Facilitators and household survey



Facilitators involved in the survey



Evaluating pre test



One of the survey area



Thinking of traditional knowledge



Discussion with farmer , who is the bank of knowledge



Participatory Rural Appraisal

Figure 8. Facilitators and field survey activities

FINDINGS

Agroecology

Climate

Agroecologically these studied areas fall in two regions, Mid Hill and High Hill. Monthly weather conditions are given in Figure 9. Temperature is the main determinant factor to initiate the cultivation of land. Winter is generally in High Hill not suitable for growing crops. The temperature in the September was the highest and the lowest in the January. Rainfall from November to April is very low.

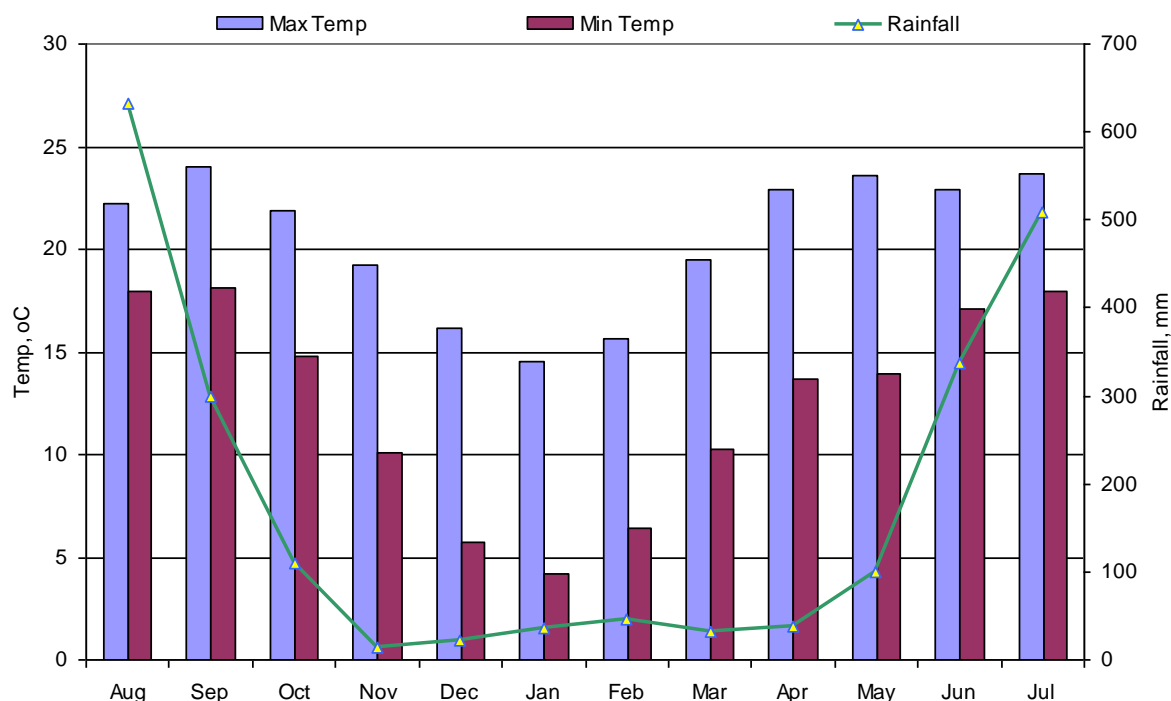


Figure 9. Monthly temperature and rainfall in Rasuwa district (average of 7 years, 1994-2000).

Soil fertility

Farmers' fields were grouped in High, Medium and Low fertility. All land types were grouped in to Khet, Bari and Lek. Most of the farmers have Khet and Bari land with Medium fertility both in Thuman and Dandagaon (Figure 10). Lek type of land is generally poor in fertility in both VDCs. Farmers generally classified the land based on the color and texture of soil.

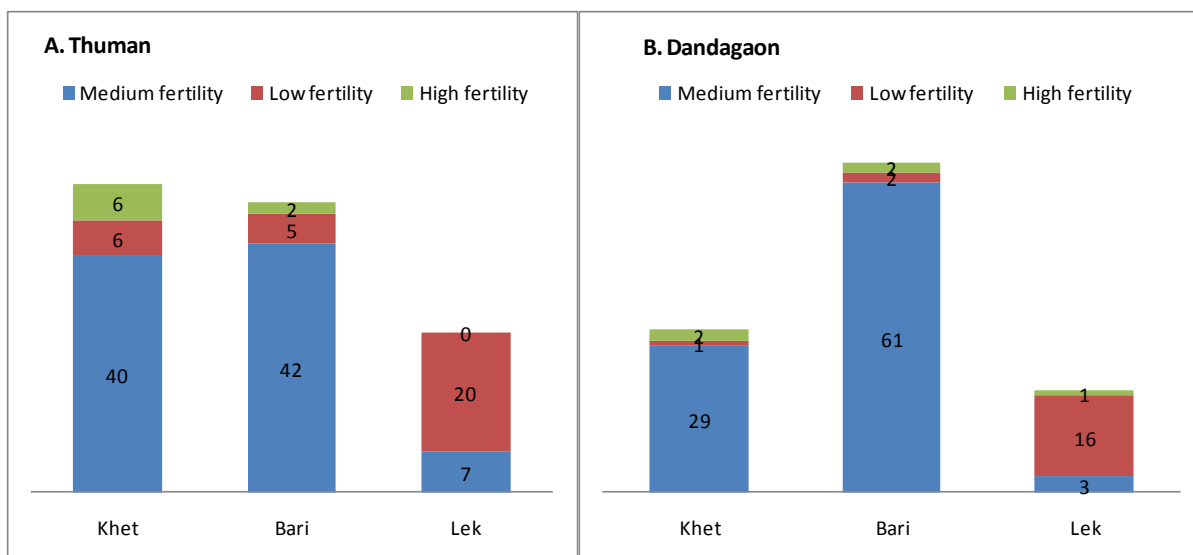


Figure 10. Number of farmers having different soil fertility status of their land.

Irrigation

Most the areas did not have access to irrigation. Among the four sources of irrigation (Kulo, Khola, Mul and Ghad Kulo), Kulo is the main source in both VDCs. In Dandagaon, Ghad Kulo is also important for fulfilling the requirement of irrigation. Khola is th second most important in both VDCs.

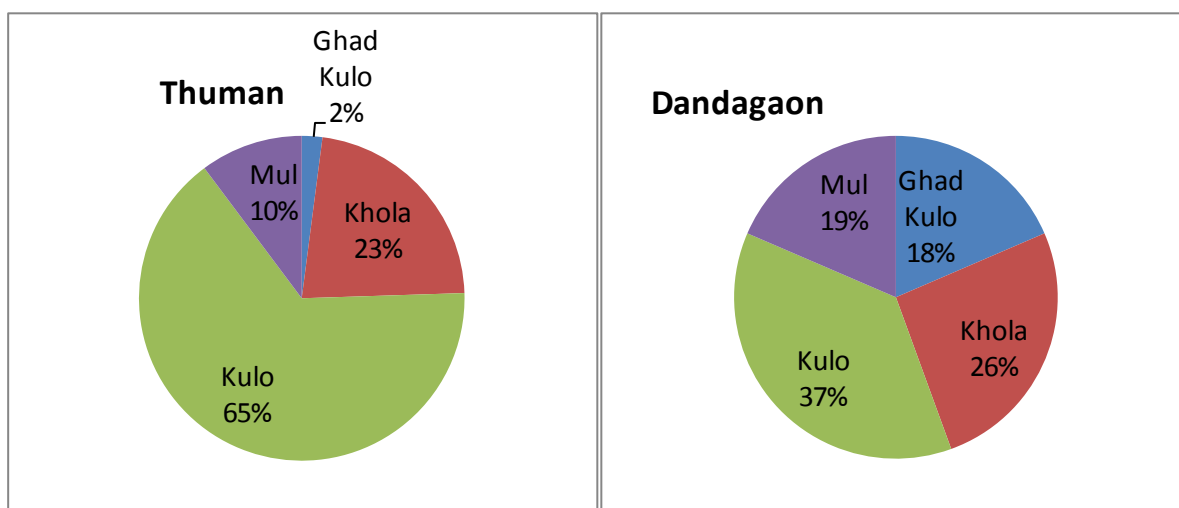


Figure 11. Percentage of different water sources for irrigating the field.

Cropping pattern and mix cropping

Details cropping pattern and mix cropping systems of Thuman and Dandagaon VDCs are given in Table 6 and 7. Rice based cropping is the dominant system in Khet and maize based system in Bari. In both VDCs cropping patterns are diverse. In Lek generally potato and barley are common to grow.in all villages legumes are grown together with other crop spcies. Farmes are well known in the importance of legumes to improve the soil fertility. Mix farming with different crop species is common mainly to the land near to house in all villages. Except rice, farmers are following mix farming in all crop species.

Table 6A. Cropping pattern in Thuman VDC

SN	Village	Cropping pattern		
		Khet	Bari	Lek
1.	Dalphedi	Rice	Maize-Wheat-Finger millet	Maize-Wheat-Finger millet
2.		Rice- Wheat	Maize – Barely/ Naked barley/ Wheat/ Finger millet	Potato/ Naked barley
3.			Potato / Bean	Maize – Barely/ Naked barley
4.				Maize
5.	Thuman	Rice	Maize – Wheat/ Barley/ Naked barley – Finger millet	Barely/ Naked barley/ Potato/ Bean
6.		Rice - Wheat	Maize – Wheat/ Barley/ Naked barley	Wheat/ Barley/ Chinese Tori
7.			Potato/ Bean	Potato – Radish
8.			Potato – Radish	
9.			Maize – Potato – Finger millet	
10.			Potato - Bean	
11.			Maize – Finger millet	
12.	Mendogaon	Rice	Maize – Finger millet/ Bean	Potato – Maize - Bean
13.			Rice/ Taro/ Maize	Maize – Finger millet
14.			Maize – Wheat/ Barley – Finger millet	

Slash (/) mean either one crop. In some cases, farmers plant second crop within the standing crop of first crop as a relay or inter cropping system.

Table 6B. Mix cropping system in Thuman VDC

SN	Village	Mix cropping		
		Khet	Bari	Lek
1.	Dalphedi	Rice+	Maize + Potato + Soybean	Maize+ Potato+ Pumpkin+ Soybean
2.		Soybean (black)	Maize + Soybean + Potato + Pumpkin	Maize + Potato
3.			Finger millet + Soybean	Maize + Potato +
4.			Maize + Potato + Bean	Pumpkin
5.	Thuman		Maize + Soybean + Pumpkin	Potato + Garlic
6.			Wheat/ Barely + Tori	
7.			Finger millet + Cowpea	
8.			Maize + Bean + Soybean + Pumpkin	
9.			Maize + Bean	
10.			Maize + Amaranths + Soybean + Pumpkin	
11.			Potato + Rayo + Pumpkin	
12.			Maize + Soybean + Potato + Pumpkin + Taro	
13.			Maize + Amaranths + Soybean	
14.			Maize + Potato + Pumpkin + Amaranths + Soybean	
15.			Potato + Bean	
16.			Maize + Soybean + Pumpkin + Potato	
17.			Potato + Garlic + Leafy vegetables	
18.	Mendogaon		Maize + Finger millet + Bean	
19.			Maize + Soybean + Pumpkin + Cucumber + Tomato + Potato	
20.			Maize + Bean + Finger millet----	
21.			Maize + Soybean + Pumpkin + Bean +	

SN	Village	Mix cropping		
		Khet	Bari	Lek
			Cucumber + Finger millet + Potato + Amaranths	
22.			Maize + Bean + Finger millet + Potato + Pumpkin	
23.			Maize + Soybean + Finger millet + Pumpkin	
24.			Maize + Bean + Pumpkin	

In some cases, these mix farming represents relay system or inter cropping. Latte = Mendo.

Table 7A. Cropping pattern in Dandagaon VDC

SN	Village	Cropping pattern		
		Khet	Bari	Lek
1.	Karmaryang		Maize- Finger millet/ Bean/ Potato	Barley/ Oat
2.				Wheat – Potato – Buckwheat
3.				Potato
4.				Wheat – Potato
5.	Dandagaon	Maize – Rice – Potato/ Wheat/ Tori	Maize – Finger millet/ Tori/ Potato/ Wheat	
6.		Maize – Potato	Maize - Tori	
7.		Rice - Potato	Finger millet – Tori	
8.		Rice – Tori		
9.		Maize – Rice		
10.	Siruchet	Maize - Rice	Maize – Finger millet/ Radish/ Bean/ Carrot/ Cauliflower/ Cabbage/ Rayo	Maize – Potato
11.		Rice - Potato		Maize - Bean
12.		Maize – Rice - Wheat		

Slash (/) mean either one crop. In some cases, farmers plant second crop within the standing crop of first crop as a relay system.

Table 7B. Mix cropping system in Dandagaon VDC

SN	Village	Mix cropping		
		Khet	Bari	Lek
1.	Karmaryang		Maize + Bean + Pumpkin + Potato	Wheat + Pea
2.			Finger millet + Soybean + Rice bean + Cow pea	
3.			Maize + Bean	
4.			Maize + Taro + Bean	
5.			Maize/ Finger millet + Bean + Potato	
6.			Maize + Bean + Pumpkin + Taro + Amaranths	
7.			Finger millet + Alas + Silam	
8.			Maize + Bean + Soybean + Pumpkin	
9.			Maize + Bean + Pumpkin + Taro	
10.			Maize + Soybean + Pumpkin + Taro	
11.			Maize + Bean + Pumpkin	
12.			Maize + Pumpkin	

SN	Village	Mix cropping		
		Khet	Bari	Lek
13.			Maize + Pumpkin + Taro	
14.			Finger millet + Silam	
15.	Dandagaon	Rice + Soybean + Black gram	Maize + Pumpkin + Bean	
16.		Maize + Pumpkin	Maize + Pumpkin + Cowpea + Rice bean + Sorghum (Junelo)	
17.		Maize + Bean + Pumpkin	Maize + Pumpkin + Cowpea + Rice bean + Sorghum (Junelo) +Taro	
18.		Rice + Soybean	Maize + Bean + Pumpkin + Soybean	
19.		Maize + Bean/ Cowpea/ Rice bean	Maize + Taro + Cowpea + Rice bean + Sorghum + Finger millet	
20.			Maize + Cowpea + Rice bean + Taro	
21.			Maize + Junelo/ Rice bean/ Cow pea	
22.			Maize + Taro + Sweet potato + Cowpea + Sorghum + Rice bean	
23.			Maize + Alas + Silam	
24.			Maize + Pumpkin + Bean + Taro	
25.			Finger millet + Alas	
26.			Maize + Pumpkin + Cowpea + Bean	
27.			Maize + Rice bean + Cowpea + Taro	
28.	Siruchet	Maize + Pumpkin + Buckwheat	Mazie + Pumpkin + Taro + Bean	Maize + Bean
29.		Maize + Bean + Pumpkin	Maize + Pumpkin + Taro + Bean + Buckwheat	
30.		Maize + Pumpkin	Maize + Rice bean + Cow pea	
31.		Rice + Soybean + Black gram	Maize + Pumpkin + Taro + Bean	
32.			Maize + Pumpkin + Bean	
33.			Mazie + Pumpkin + Taro	
34.			Maize + Amaranths	
35.			Maize + Pumpkin + Amaranths	
36.			Maize + Bean + Cowpea + Pumpkin + Rice bean + Cucumber	
37.			Mazie + Pumpkin + Taro + Cowpea + Rice bean	
38.			Maize + Pumpkin + Poato + Bean	
39.			Maize + Rice bean + Cowpea + Taro + Sweet potato	

In some cases, these mix farming represent relay system or inter cropping.

Socioeconomy

Economic status play important role on maintaining the crop diversity. Regression approach was used to know the roles of other different factors to economic staus. This regression equation is given in Box 1. In both VDCs, regression source is significant. Food sufficiency

has the highest regression coefficient in both VDCs. Food sufficiency is taken as the main criteria to group the household in different economic status. Therefore, its role is seemed most important. Agriculture training is contributed significantly to raise the economic status in Thuman VDCs, but any factors were not significant in Dandagaon.

Box 1. Regression analysis

A. The regression equation for economic status in Thuman VDC

Economic status = 4.54 + 0.0271 Landrace richness (0.38) - 0.225 Agro-Ecology (0.11) - 0.262 Sex (0.22) - 0.0040 Family size (0.90) - 0.0157 Parcel (0.60) - 0.0122 Land (0.36) + 0.090 Irrigation (0.57) + 0.00089 Livestock (0.89) - 0.288 Agriculture training (0.06) - 0.0327 Education (0.70) - 0.699 Food Sufficiency (0.00) + 0.053 Family type (0.66)

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	12	10.79894	0.89991	9.62	0.000
Residual Error	26	2.43183	0.09353		

B. The regression equation for economic status in Dandagaon VDC

Economic status = 3.98 - 0.0054 Landrace richness (0.69) - 0.024 Agro-Ecology (0.82) + 0.0429 Sex (0.29) - 0.0094 Education (0.755) - 0.955 Food Sufficiency (0.00) + 0.0244 Family type (0.58) + 0.00472 Family size (0.36) - 0.0099 Parcel (0.48) - 0.00572 Land (0.33) + 0.00155 Livestock (0.49) - 0.0478 Agri. Training (0.24)

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	11	20.0826	1.8257	107.09	0.000
Residual Error	49	0.8354	0.0170		

Settlement pattern

Caste and family size

Tamang dominate in both VDCs (Table 9). Withing Tamang there are many other subcaste and among them Ghale and Lopchan are relatively high in number. In both VDCs, female is low in number compare to male. Except Tamang, Lopchan and Paudel, all are from medium and poor group of economy.

Table 8. Total male and female population along with caste distibution

	Male	Female	Tamang	Baun	Gurung
Dandagaon	1101	1040	1469	323	255
Thuman	536	451	923		50

There is variation in family size with respect to economic status (Table 10) in Dandagaon, but average family size was approximately same in all economic groups in Thuman VDC. In all three category, Rich, Medium and Poor, average family size was higher in Dandagaon VDCs.

Table 9. Number of respondents with respect to their economic status and caste

<i>Thuman</i>				<i>Dandagaon</i>			
Caste	Rich	Medium	Poor	Caste	Rich	Medium	Poor
Dongba		2.1277		Brahmin		0.0003	6.3492
Ghale		2.1277	6.3830	Bulon		0.0003	
Lopchan		8.5106	2.1277	Dimdung			4.7619
Tamang	4.2553	44.6809	29.7872	Ghale			4.7619
				Ghising		0.0003	
				Gurung		0.0002	12.6984
				Lopchan	0.0005	0.0005	1.5873
				Mawa		0.0002	
				Paudel	0.0005	0.0002	1.5873
				Tamang	0.0005	0.0013	22.2222
				Thokra		0.0002	6.3492
				Yonjan			1.5873

Table 10. Family size in two VDCs

Status	<i>Thuman</i>			<i>Dandagaon</i>		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Rich	6	6	6.00	11.00	6	16
Medium	6.481481	3	12.00	8.10	2	25
Poor	6.166667	5	8.00	7.28	1	41

Education

In both VDCs, most of the respondents are illiterate (Table 11). One female respondent has of 10 class in Dandagaon VDC. Education is very important for agrobiodiversity management however, farmers said that after having higher education, they are not interested in farming.

Table 11. Education level of respondents

Education	<i>Thuman</i>				<i>Dandagaon</i>			
	Male	%	Female	%	Male	%	Female	%
Illiterate	6	12.77	22	46.81	10	15.87	18	28.57
Primary	13	27.66	4	8.51	10	15.87	20	31.75
6-10 class	1	2.13			1	1.59	3	4.76
≥ 10 class	1	2.13					1	1.59

Food sufficiency

Food sufficiency was considered main criteria to classify the household in three economic status. There are only 2 and 3 households with food sufficiency for more than 12 months in Thuman and Dandagaon VDC respectively (Table 12). Majority of the respondents are from the medium category that is households having food sufficiency for 6-12 months. Regression analysis was done for food sufficiency considering some other factors to determine their role. Landrace richness has positive and negative effects on food sufficiency in Thuman and Dandagaon VDCs respectively.

Table 12. Food sufficiency of surveyed household with respect to wealth category

Status	Thuman				Dandagaon							
	≤ 6 months	%	6-12 months	%	≥ 12 months	%	≤ 6 months	%	6-12 months	%	≥ 12 months	%
Rich					2	4.26					3	4.76
Medium			27	57.45			1	1.59	20	31.75		
Poor	17	36.17			1	2.13	39	61.90				

Box 2. Regression analysis

A. The regression equation for food sufficiency in Thuman VDC

Food Sufficiency = 4.81 + 0.0014 Landrace richness (0.96) - 0.143 Agro-Ecology (0.38) - 0.239 Sex (0.32) - 0.0041 Family size (0.91) + 0.0022 Parcel (0.94) - 0.0031 Land (0.84) + 0.046 Irrigation (0.79) + 0.00218 Livestock (0.78) - 0.248 Agriculture training (0.16) - 0.0149 Education (0.88) - 0.912 Economic status (0.00) - 0.099 Family type (0.48)

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	12	11.4924	0.9577	7.84	0.000
Residual Error	26	3.1743	0.1221		

B. The regression equation for food sufficiency in Dandagaon VDC

Food Sufficiency = 3.92 - 0.0021 Landrace richness (0.88) - 0.020 Agro-Ecology (0.85) + 0.0501 Sex (0.23) - 0.0088 Education (0.77) - 0.986 Economic status (0.00) + 0.0390 Family type (0.38) + 0.00262 Family size (0.62) - 0.0096 Parcel (0.50) - 0.00202 Land (0.74) + 0.00117 Livestock (0.61) - 0.0282 Agriculture training (0.54)

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	11	19.8913	1.8083	102.70	0.000
Residual Error	49	0.8628	0.0176		

Income sources

Livelihood sources of respondents household are presented in Figure 12. Agronomy was the primary source of livelihood for majority of respondents in both VDCs. And second primary source was livestock in both VDCs.

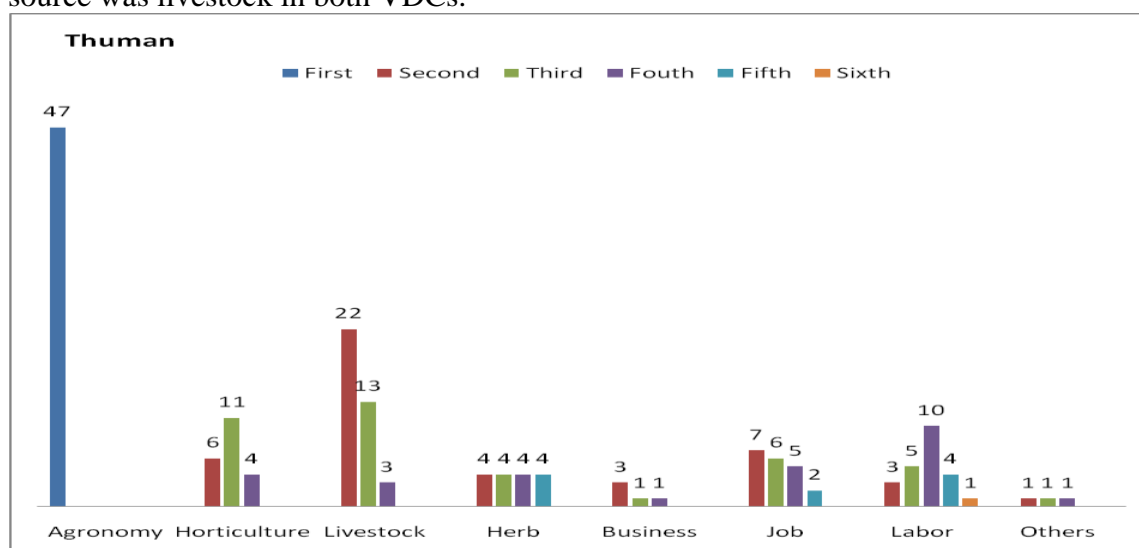


Figure 12A. Livelihood sources of household (in number) on priority basis in Thuman VDC

Farm Land Resources and Factors Association

Land type and use systems

Total land was grouped under Khet, Bari and Lek. Khet and Bari land were further sub-grouped under irrigated and unirrigated.

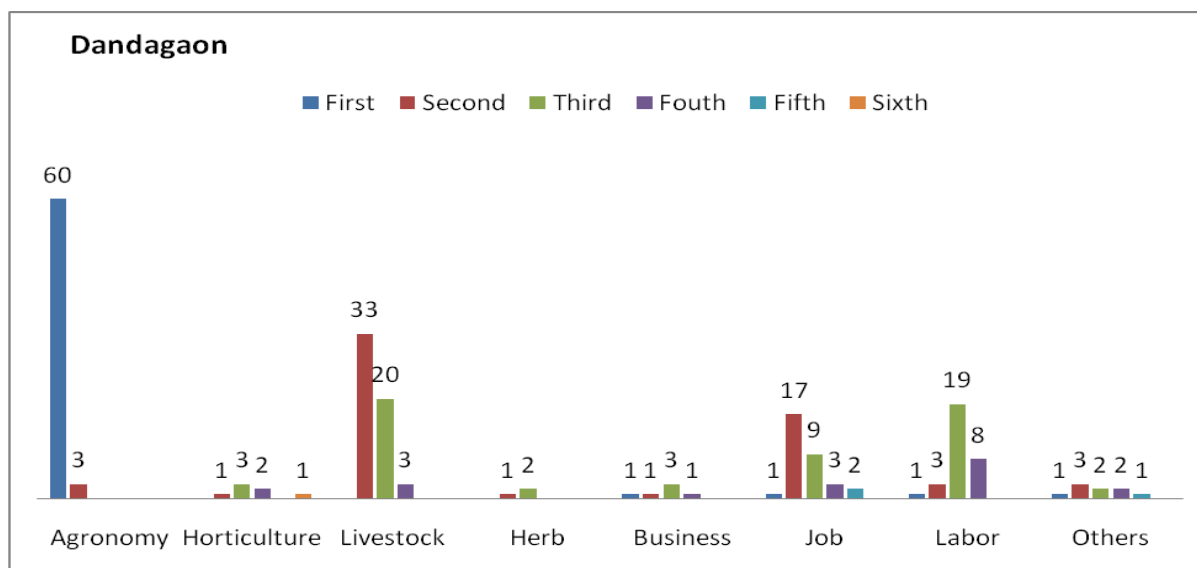


Figure 12A. Livelihood sources of household (in number) on priority basis in Dandagaon VDC

Table 13. Land distribution among wealth category in two VDCs

Land type	Rich				Medium				Poor			
	Mean	Min	Max	Sum	Mean	Min	Max	Sum	Mean	Min	Max	Sum
Thuman												
Unirrigated Khet	1.5	0	3	3	2.5	0	12	67.5	0.87	0	10.5	15.6
Irrigated Khet	1.5	0	3	3	3.17	0	21	85.5	1.25	0	6	22.5
Unirrigated Bari	3	0	6	6	10.89	0	84	294	1.64	0	6	29.52
Irrigated Bari	3	0	6	6	0.89	0	18	24	0	0	0	0
Lek	2.25	1.5	3	4.5	2.32	0	6	62.52	1.5	0	6	27
Dandagaon												
Unirrigated Khet	2	0	6	6	1.95	0	8	41	0.61	0	6	23.7
Irrigated Keht	2.67	2	4	8	0.19	0	2	4	0.36	0	6	14
Unirrigated Bari	5.67	3	8	17	4.72	1	12	99.2	3.08	0	18	120.04
Irrigated Bari	0.00	0	0	0	0.00	0	0	0	0.31	0	8	12
Lek	1.67	0	3	5	1.77	0	10	37.2	0.54	0	4	21

Land fragmentation

Number of parcel might be related with landraces diversity. Due to micro environmental variation, nich specific landraces might be evolved and maintained over the time. The number of parcel of Khet land type was higher in Dandagaon than in Thuman. Among the land type the number of parcel was higher in Bari land type.

Table 14. Number of household with parcel size

Parcel	Thuman			Dandagaon		
	Khet	Bari	Lek	Khet	Bari	Lek
One	19	12	17	20	28	16
Two	10	7	9	5	25	3
Three	8	5	2	2	6	
Four		5		4	2	
Five	1	4				
Six		3				
Seven		2				
Eight		2				

Table 15A. Correlation among different factors in Thuman VDC (Value just below the r is P value)

SN	Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Agro-Ecology														
2	Sex	-0.04													
		0.782													
3	Education	-0.3	-0.53												
		0.04	0												
4	Food Suff.	-0.17	-0.07	0.201											
		0.241	0.662	0.175											
5	Economic status	0.135	0.272	-0.27	-0.87										
		0.367	0.065	0.072	0										
6	Family type	0.237	0.121	-0.09	-0.3	0.247									
		0.108	0.417	0.545	0.041	0.094									
7	Family size	0.063	-0.19	0.211	0.033	-0.05	0.247								
		0.675	0.207	0.155	0.825	0.749	0.094								
8	Farm worker	0.424	-0.01	-0.05	0.088	-0.04	0.235	0.488							
		0.003	0.953	0.758	0.558	0.795	0.111	0.001							
9	Parcel	-0.07	-0.08	0.133	0.37	-0.38	0.077	0.056	-0.21						
		0.63	0.592	0.373	0.011	0.009	0.606	0.711	0.166						
10	Lant	-0.21	-0.25	0.277	0.303	-0.34	-0.06	0.34	-0.03	0.564					
		0.158	0.091	0.059	0.038	0.019	0.712	0.019	0.857	0					
11	Livestock	0.2	0.046	-0.07	0.094	-0.1	0.164	0.004	0.085	0.119	0.077				
		0.179	0.758	0.637	0.53	0.505	0.272	0.98	0.569	0.425	0.608				
12	Membership	-0.05	-0.12	-0.22	-0.08	0.015	0.043	-0.19	-0.09	-0.24	-0.21	0.067			
		0.733	0.423	0.131	0.606	0.921	0.776	0.19	0.56	0.106	0.16	0.655			
13	Agri. Training	-0.06	-0.07	0.103	-0.06	-0.05	-0.11	-0.27	-0.06	-0.19	-0.29	-0.05	0.164		
		0.7	0.651	0.49	0.692	0.766	0.469	0.071	0.713	0.204	0.045	0.725	0.27		
14	Government help	0.17	-0.14	0.08	0.092	-0.05	0.244	0.23	0.253	0.03	0.07	-0.09	0.051	-0.04	
		0.254	0.362	0.594	0.537	0.743	0.099	0.12	0.086	0.843	0.641	0.56	0.733	0.776	
15	Landraces	0.399	0.03	-0.02	-0.04	0.055	0.286	0.152	0.26	0.422	0.124	0.229	-0.35	-0.25	0.107
		0.005	0.843	0.921	0.78	0.714	0.051	0.308	0.078	0.003	0.407	0.122	0.016	0.089	0.476

Associating among different factors

Correlation output among different factors in two VDCs are given Table 15. Number of landraces has positive association with most the factors in Thuman. However, landrace richness has negative

association with almost half of the factors in Dandagaon. These factors relationship can be used to manage the crop diversity considering the coefficient values.

Table 15B. Correlation among different factors in Dandagaon VDC

SN	Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Agro-ecology														
2	Sex	0.256													
		0.043													
3	Education	0.047	0.109												
		0.718	0.404												
4	Food Suff.	0.129	0.039	0.05											
		0.315	0.764	0.701											
5	Economic status	-	0	-	-										
		0.133	0.064	0.977											
		0.299	1	0.626	0										
6	Family type	-	-	0.01	0.206	-									
		0.038	0.252			0.183									
		0.766	0.046	0.94	0.106	0.152									
7	Family size	0.071	-	0.044	0.149	-	0.519								
			0.093			0.131									
		0.579	0.468	0.735	0.242	0.306	0								
8	Farm worker	0.051	0.018	-	-	0.042	0.334	0.809							
				0.035	0.034										
		0.689	0.886	0.792	0.789	0.744	0.007	0							
9	Parcel	0.133	-	0.375	0.281	-	0.366	0.461	0.346						
			0.218			0.312									
		0.299	0.086	0.003	0.026	0.013	0.003	0	0.005						
10	Land	0.121	-	0.161	0.364	-	0.462	0.771	0.664	0.638					
			0.038			0.365									
		0.343	0.768	0.214	0.003	0.003	0	0	0	0					
11	Livestock	0.123	0.045	0.002	-	0.051	0.214	0.436	0.622	0.194	0.384				
					0.023										
		0.338	0.726	0.988	0.861	0.694	0.093	0	0	0.127	0.002				
12	Membership	0.059	-	-	-0.23	0.238	-	-	-	-0.208	-0.189	-			
			0.229	0.085			0.153	0.137	0.117			0.252			
		0.647	0.071	0.516	0.069	0.06	0.232	0.284	0.359	0.101	0.138	0.047			
13	Agri. Training	0.133	-	-	0.11	-	-	-	-	-0.04	-0.166	-	0.216		
			0.118	0.295		0.147	0.254	0.147	0.208			0.197			
		0.3	0.358	0.021	0.391	0.251	0.045	0.25	0.102	0.757	0.194	0.122	0.089		
14	Government help	-	-	-0.09	-	0.022	-	0.023	0.051	0.033	0.03	0.048	0.059	-	
		0.033	0.128		0.027		0.038							0.057	
		0.799	0.317	0.49	0.832	0.863	0.766	0.856	0.689	0.799	0.817	0.71	0.647	0.656	
15	Landraces	0.081	-	0.163	0.097	-	0.176	0.052	-	0.208	0.15	0.009	-0.028	-	0.016
			0.097			0.104			0.006					0.303	
		0.528	0.448	0.209	0.451	0.418	0.167	0.688	0.966	0.101	0.242	0.945	0.828	0.016	0.904

Livestock resources

Livestock was the second primary source of livelihoods in both VDCs. Buffalo was found in Thuman and sheep in Dandagaon. Common livestock were cow, goat and poultry in both VDCs. The number of livestock was varied with wealth category in both VDCs.

Table 16. Livestock resources in two VDCs

Status	Thuman					Dandagaon				
	Chauri	Cow	Goat	Sheep	Poultry	Cow	Buffalo	Goat	Poultry	
Rich	Mean		9	4		3	3	2.33	6	9
	Minimum		9	4		3	3	1	4	9
	Maximum		9	4		3	3	4	8	9
	Sum		9	4		3	3	7	12	9
Medium	Mean	1.25	5.24	11.60	7.33	6.08	2.11	2.33	6.75	3.58
	Minimum	1	1	3	3	2	1	1	1	1
	Maximum	2	18	29	10	15	4	4	16	10
	Sum	5	110	116	22	146	19	42	81	43
Poor	Mean		5.57	6.14	7.00	5.92	2.67	2.26	6.24	5.19
	Minimum		2	1	7	2	1	1	1	1
	Maximum		9	12	7	20	4	9	17	21
	Sum		78	43	7	77	24	77	156	140

Inputs in agriculture

Major sources of input are compost in both VDCs. However demands of chemical fertilizers are high. In all four crops, majority of the farmers did not use chemical fertilizers. Chemical fertilizers were used only for rice and maize in Thuman and for rice, maize and bean in Dandagaon. This is probably Dandagaon is near to market and has access to transportation system.

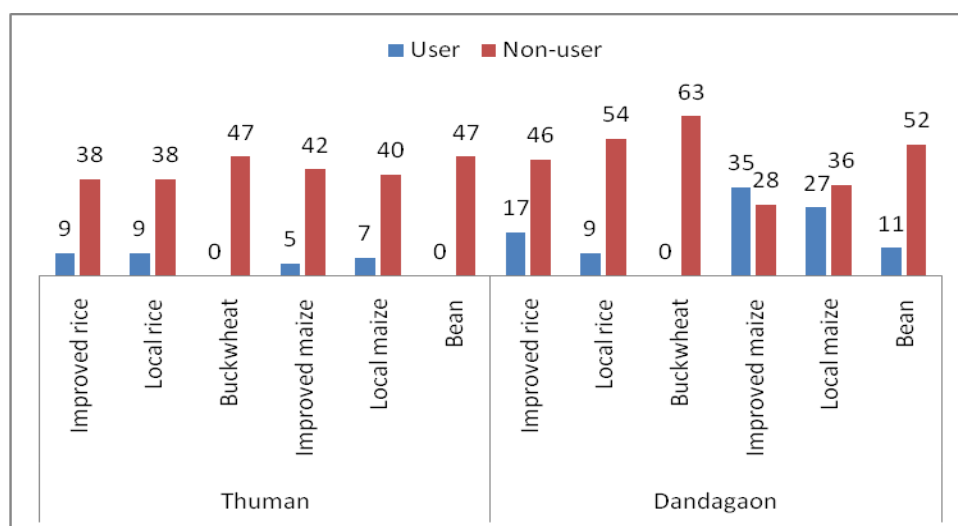


Figure 13. Number of household with respect to use of chemical fertilizers in their field

Pesticides

Any farmers did not report use of pesticides in any crops in both Thuman and Dandagaon.

Farmers' access to technology and information

Farmers' access to technology and information is very important for agriculture development. This is also related with the genetic erosion of local diversity. Majority of respondents said that they did not consult any of the service providers. Agricultrre office was the main source

of technology and information in Thuman VDC and TV/ radio was the main source in Dandagaon.

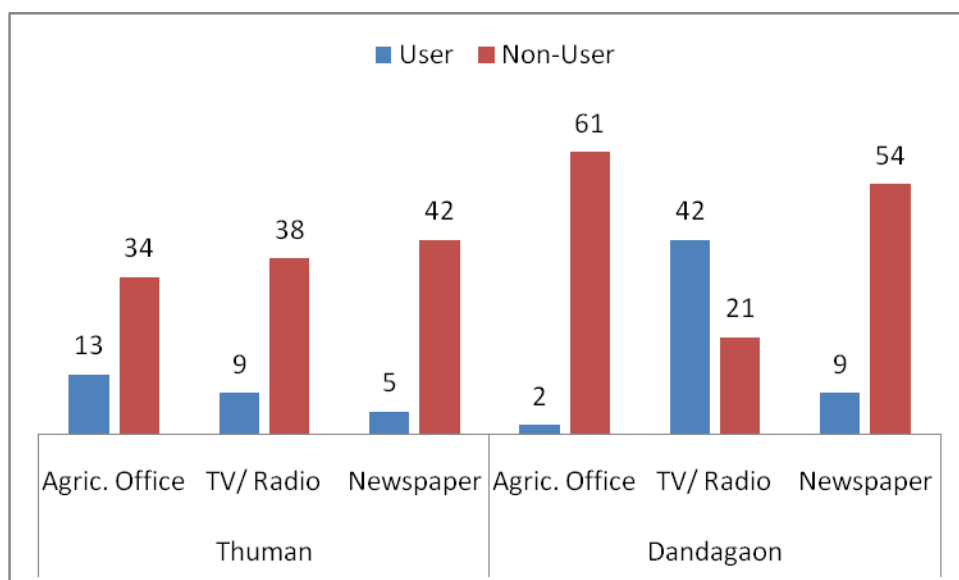


Figure 14. Number of respondents based on their access to technology

Household and crop landraces diversity

The total number of landraces maintained by the farmer were regressed with different factors. Major positive factors affecting the landrace richness were agriculture ecology, number of parcel, economic status and family type in Thuman. Agriculture training has negatively affected the number of landraces. This is because training is generally focused on monoculture and modern variety. One the two factors, agro-ecology and number of parcel had the positive impact on the landrace richness in Dandagaon.

Considering the different factors, all household were grouped. This helps to identify the most similar household and dissimilar household. Taking the two principal component, these household were plotted. Loading value of different factors for principal 1 to 3 are given in Table 17 and 18.

Box 3. Regression analysis

A. The regression equation for number of landraces in Thuman VDC

Number of landraces = 1.04 + 2.00 Agricultural Ecology (0.02) - 0.29 Sex (0.83) - 0.016 Family size (0.94) + 0.280 Parcel (0.13) - 0.0076 Land (0.93) - 1.42 Irrigation (0.15) + 0.0049 Livestock (0.91) - 0.67 Agriculture training (0.51) + 0.256 Education (0.64) + 0.04 Food Sufficiency (0.96) + 1.09 Economic status (0.38) + 0.494 Family type (0.53)

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	12	71.729	5.977	1.58	0.158
Residual Error	26	98.169	3.776		

B. The regression equation for number of landraces in Dandagaon VDC

Number of landraces = 5.35 + 1.23 Agro-Ecology (0.39) - 0.367 Sex (0.39) - 0.039 Education (0.9) - 0.22 Food Sufficiency (0.88) - 0.58 Economic status (0.69) + 0.008 Family type (0.98) - 0.0164 Family size (0.76) + 0.118 Parcel (0.41) - 0.0087 Land (0.88) - 0.0148 Livestock (0.53) - 1.23 Agri. Training (0.00)

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	11	24.385	2.217	1.22	0.302
Residual Error	49	89.385	1.824		

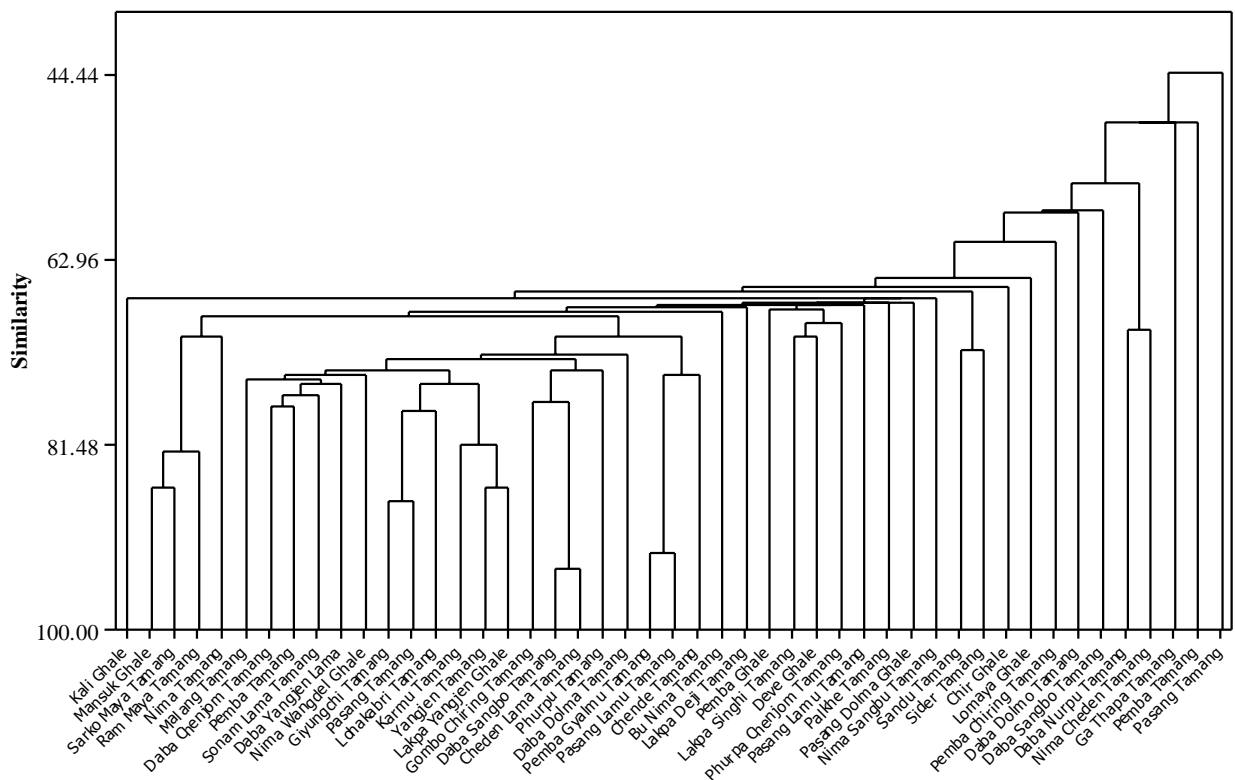


Figure 15. Clustering of households from Thuman VDC based on different factors

Table 17. Principal Component Analysis of different factors in Thuman VDC

Variable	PC1	PC2	PC3
Eigen value	3.449	2.665	1.648
Variation, %	21.6	16.7	10.3
Agro-Ecology	0.327	0.224	-0.364
Settlement	0.389	0.102	-0.421
Sex	0.211	-0.115	0.290
Education	-0.298	0.064	-0.127
Food Sufficiency	-0.369	-0.015	-0.331
Economic status	0.411	-0.022	0.332
Family type	0.178	0.176	0.159
Family size	-0.077	0.238	-0.260
Parcel	-0.280	0.322	0.281
Land	-0.346	0.193	0.046
Irrigation	0.072	0.075	-0.019
Rice	-0.017	0.403	0.404
Maize	0.020	0.479	0.052
Bean	0.207	0.451	-0.111
Chemical fertilizer	-0.129	0.244	-0.052
Livestock	0.047	0.179	-0.118

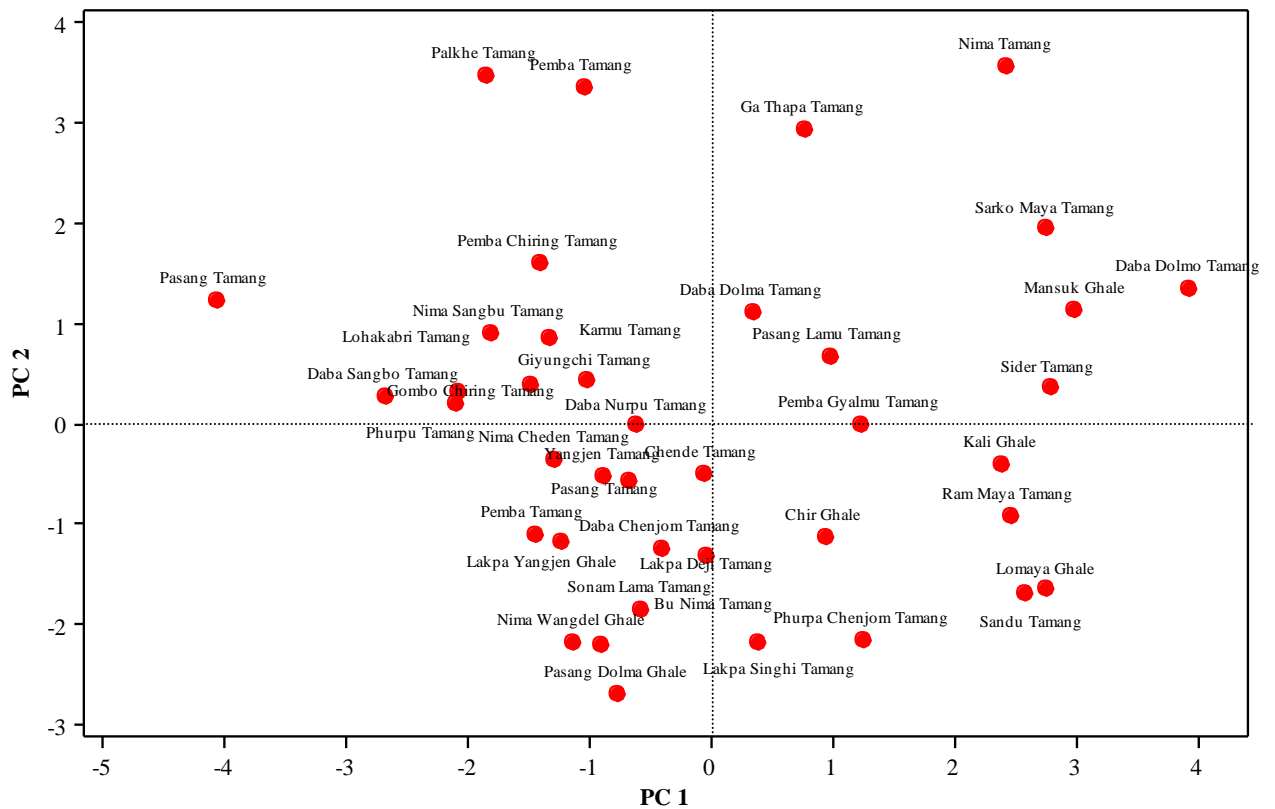


Figure 16. Plotting of surveyed household in Thuman VDC considering different factors

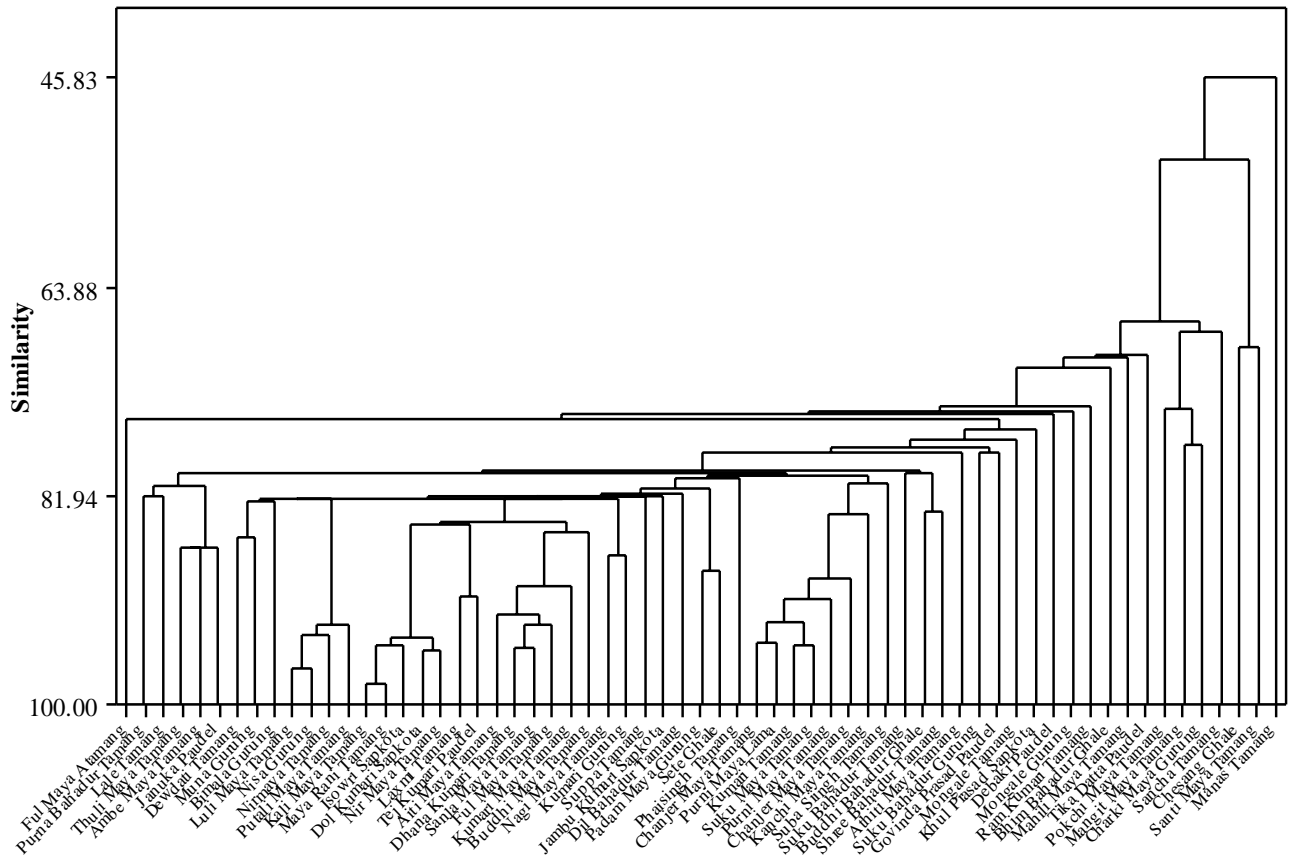


Figure 17. Clustering of household from Dandagaon VDC based on different factors

Table 18. Principal Component Analysis of different factors in Dandagaon VDC

Variable	PC1	PC2	PC3
Eigen value	3.865	1.846	1.763
Variation,%	24.2	11.5	11
Agro-Ecology	0.094	-0.015	-0.328
Settlement	0.144	0.078	-0.303
Sex	-0.070	0.020	-0.496
Education	0.114	0.174	-0.313
Food sufficiency	0.305	-0.538	-0.080
Economic status	-0.307	0.540	0.087
Family type	0.294	0.073	0.367
Family size	0.331	0.244	0.267
Parcel	0.386	0.112	-0.006
Land	0.426	0.127	0.095
Rice	0.284	-0.009	-0.247
Buckwheat	-0.027	-0.253	0.395
Maize	0.286	0.067	-0.022
Bean	-0.193	-0.016	0.097
Chemical fertilizer	-0.025	-0.307	0.020
Livestock	0.192	0.354	-0.010

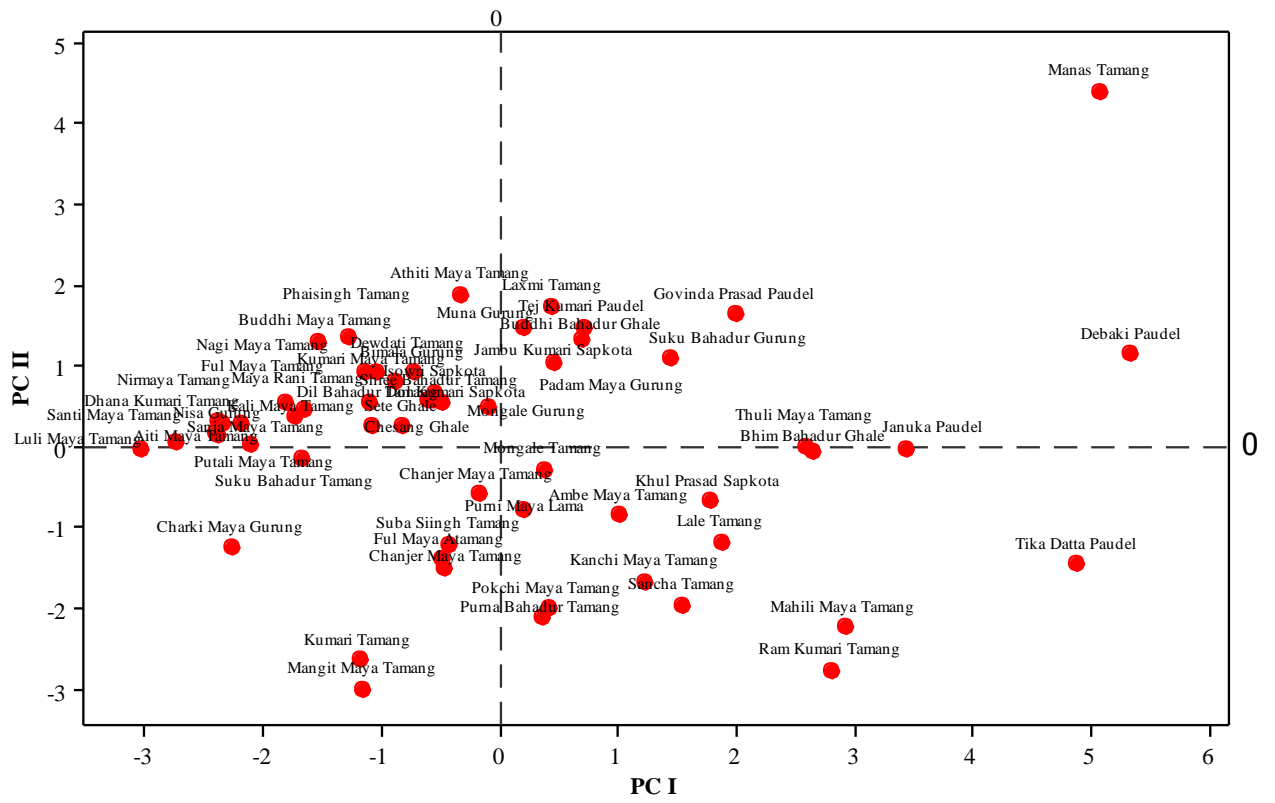


Figure 18. Plotting of surveyed household in Thuman VDC considering different factors

Status of main crop species

Productivity trends of four crop species are given in Table 19. These data were taken from the annual report of district agricultural development office. Productivity of all these crops was increased at the last year. But major factors that helped to increase the production was not known.

Table 19. Productivity of selected crop species over time

	054/55	055/56	056/57	057/58	Increased rate
Rice	1.7	1.7	1.7	1.75	0.015
Maize	1.6	1.6	1.6	1.65	0.015
buckwheat	0.8	0.8	0.7	0.85	0.005
Bean Ghee	8.714	8.733	9.29	11.1	
Bean Local	8	8	8	10	

Buckwheat

Only one landrace of mithe buckwheat was reported in Thuman. The number of household growing buckwheat was just 4. Both tite and mithe species of buckwheat are found in Dandago. There were 5 landraces with different names in Dandagaon. Farmers reported that the trend of area and production was same in Thuman VDC however, farmers reported both area and production were decreasing over the year in Dandagaon.

Area and productivity of each landraces of buckwheat are given in Table 20. In Dandagaon, Ghyabre Phapar was grown in more area and least area was allocated to Local Phapar. Productivity of Mithe Phapar was the highest in Dandagaon. Landraces specific information are given in Table 21. Similarly farmers practices and their traits of interest on buckwheat are given in Table 22.

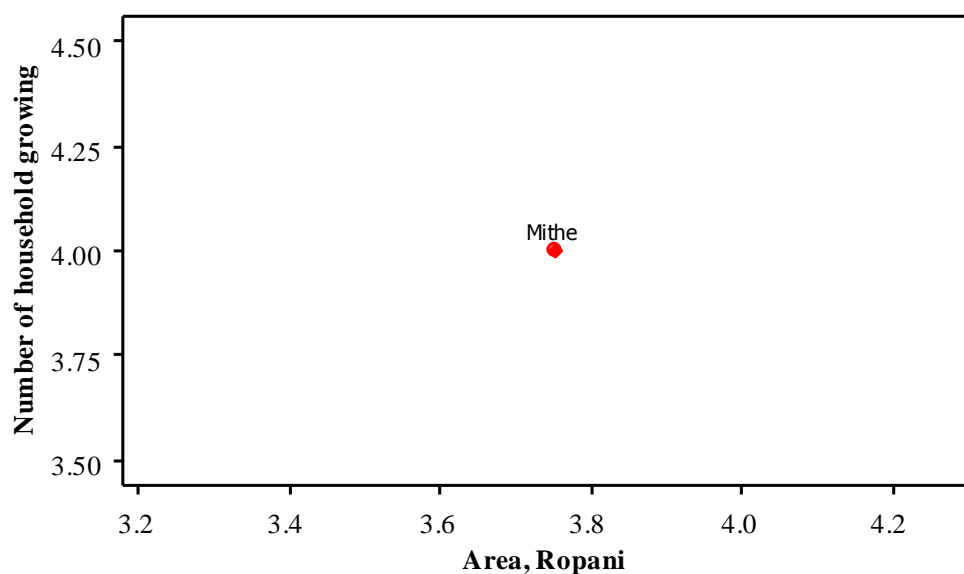


Figure 19A. Distribution of buckwheat landrace in Thuman VDC

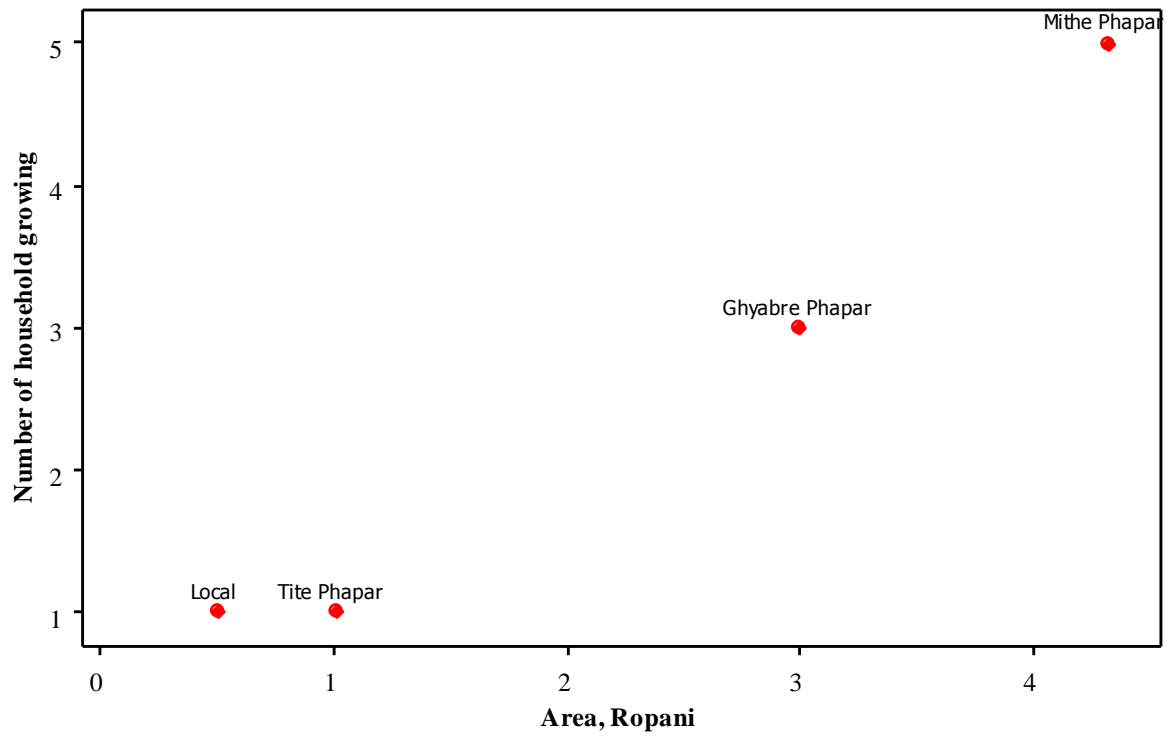


Figure 19B. Distribution of buckwheat landraces in Dandagaon VDC

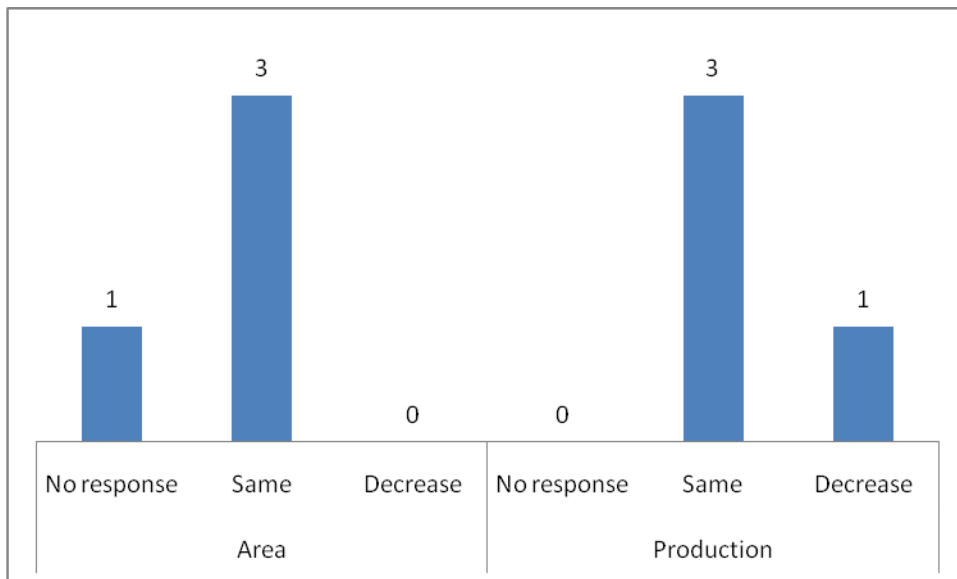


Figure 20. Number of respondents with respect to status of area and production of buckwheat landrace in Thuman VDC

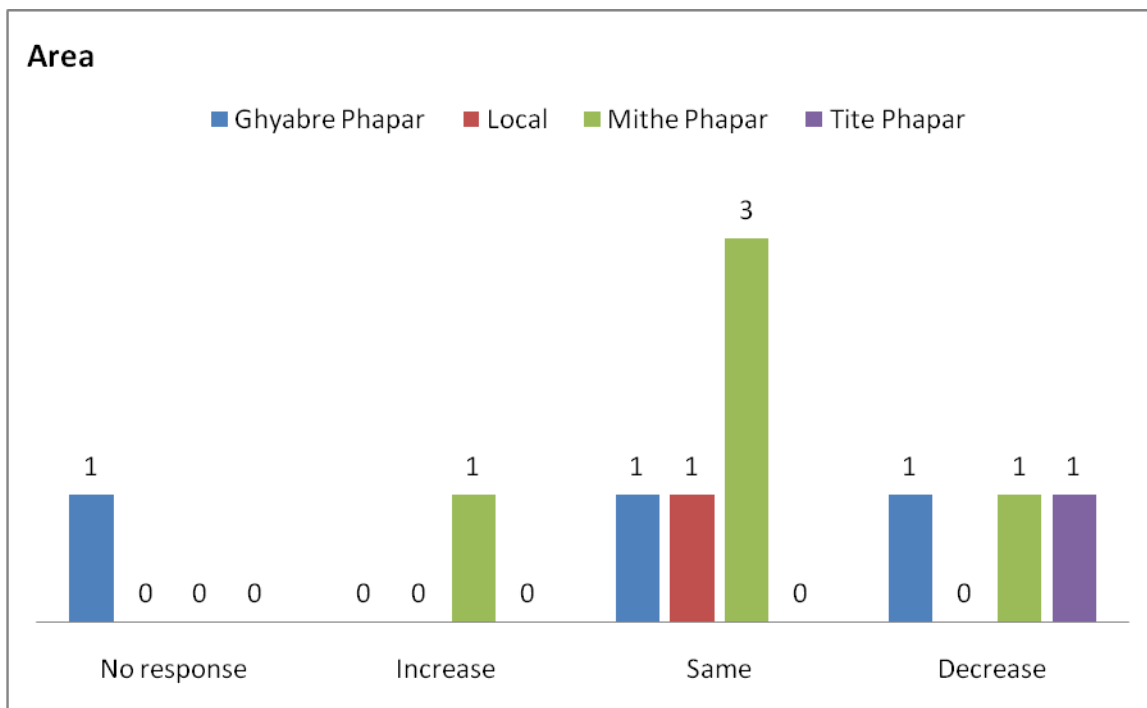


Figure 21A. Number of respondents with respect to status of area and production of buckwheat landrace over time in Dandagaon VDC

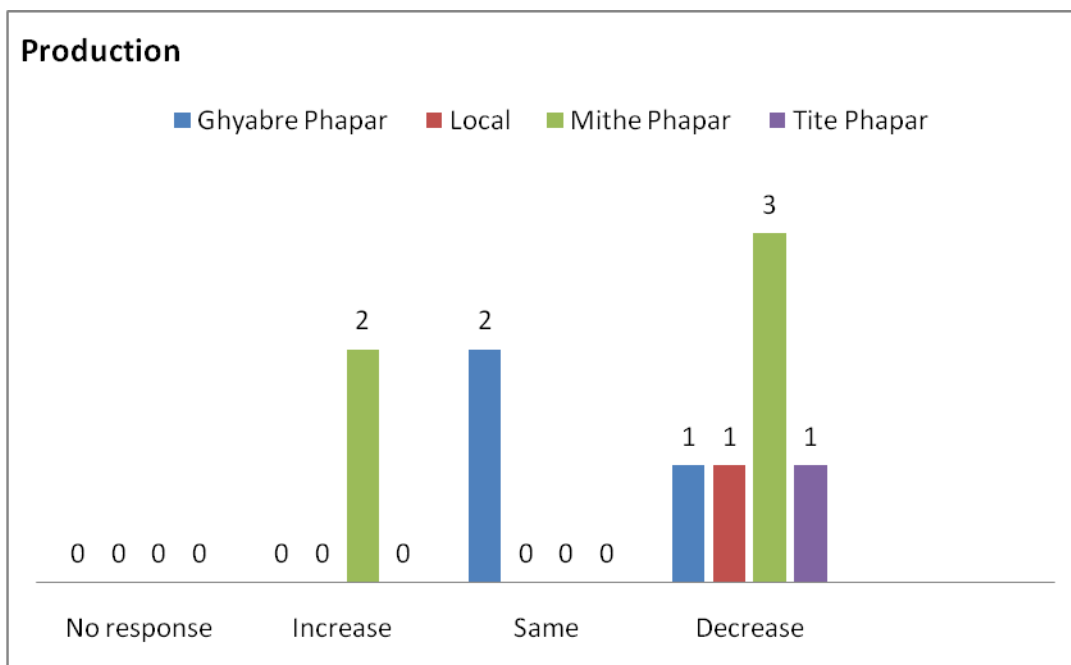


Figure 21B. Number of respondents with respect to status of area and production of buckwheat landrace in Dandagaon VDC

Table 20. Area and productivity of buckwheat landraces in Thuman and Dandagaon VDCs

Landrace	N	Area, Ropani				Productivity, kg/Ropani				
		Mean	Min	Max	SD	Sum	Mean	Min	Max	SD
Thuman VDC										
Mithe	4	0.93	0.15	3	1.37	3.75	33	12	60	19.9
Dandagaon VDC										
Ghyabre	2	1.5	1	2	0.7071	3	18.75	7.5	30	15.91
Phapar										
Local	1	0.5	0.5	0.5		0.5	18	18	18	
Mithe	5	0.864	0.32	2	0.683	4.32	56.7	6	187.5	73.85
Phapar										
Tite Phapar	1	1	1	1		1	30	30	30	

Table 21A. Buckwheat landraces and their features reported by the farmers in Thuman VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower HH
1	Mithe (Chya Broyo)	Medicinal (fever)	Tasty for bread	Low yield	41,42,46,47
			Good for leafy vegetable	Low seed set after long drought period	
			No insect disease problem	Need to sieve flour to separate husk	

Table 21B. Preferred and un preferred traits of existing landraces of buckwheat in Dandagaon VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
1	Mithe Phapar (Kamre, Local)	Medicinal (hot feeling, headache, stomach problem)	No need of hardworking, easy to cultivate	Low yield	2,13,21,55 31,52,60
		Tasty	Good for bread, <i>Sel</i> and <i>Dindo</i>	Decrease soil fertility	
		Good for diabetes	Insect resistance	Can't use directly	
		Fever	No need of intercultural operation	Straw not good for animals	
			Can use leaf as vegetable	Lightening risk in the area where husk is kept	
			High yield even in low manure		
			Very early		
2	Phapar (Ghyabre)	Medicinal (fever)	Raw flour is suitable to eat	Low yield (planted amount of seeds is equal to total production of grains)	2,7,56
			Just to save	Difficult to thresh, winnow, dehusk, grind and sieve	
			Very nutritious		

Table 22A. Farmer practices and their interest in buckwheat in three villages of Thuman VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Dalphedi, Thuman VDC				
Good seed				
Sweet taste				
Thuman, Thuman VDC				
High yielding			Tite	Difficult to cultivate and thresh
Large plant type			Kalo phapar	Eaten by animal
Suitable to Benshi				Need of multiple threshing
Mendogaon, Thuman VDC				
Tite phapar				
High yielding				
Insect and disease resistance				

Table 22B. Seed related information and lost landraces of buckwheat in three villages of Dandagaon VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Karmaryang, Dandagaon VDC				
High yielding	Plumpy seeds	No seeds	Tite	Low yield
Easy to make flour		No irrigation	Mithe	Difficult to grind and thresh
Early		Weeds		Weeds
Easy to dehusk		Insects		Difficult to handle
Suitable to use directly		Damage soil status		Bitter taste
Drought tolerance		Extract more nutrient from the soil		
Soil improving type		No seeds set if no rainfall during flowering		
		Difficult to grind and thresh		
		Low yield		
Dandagaon, Dandagaon VDC				
High yielding		<i>Lahi</i>	Mithe local	
Suitable to eat flour with husk		Seed insect		
Early		Need more time to mature		
Andilo				
Siruchet, Dandagaon VDC				
Improved variety	Selecting good plant in the field	Low yield and decrease soil fertility	Mithe Phapar	Low yield
Large grains	Selecting seeds	Lacking of seeds	Ghyabre Phapar	Make land less fertile
High yielding				
Suitable to <i>Bensi</i> area (lower belt)				
Less husk				
Suitable even in rainy season				

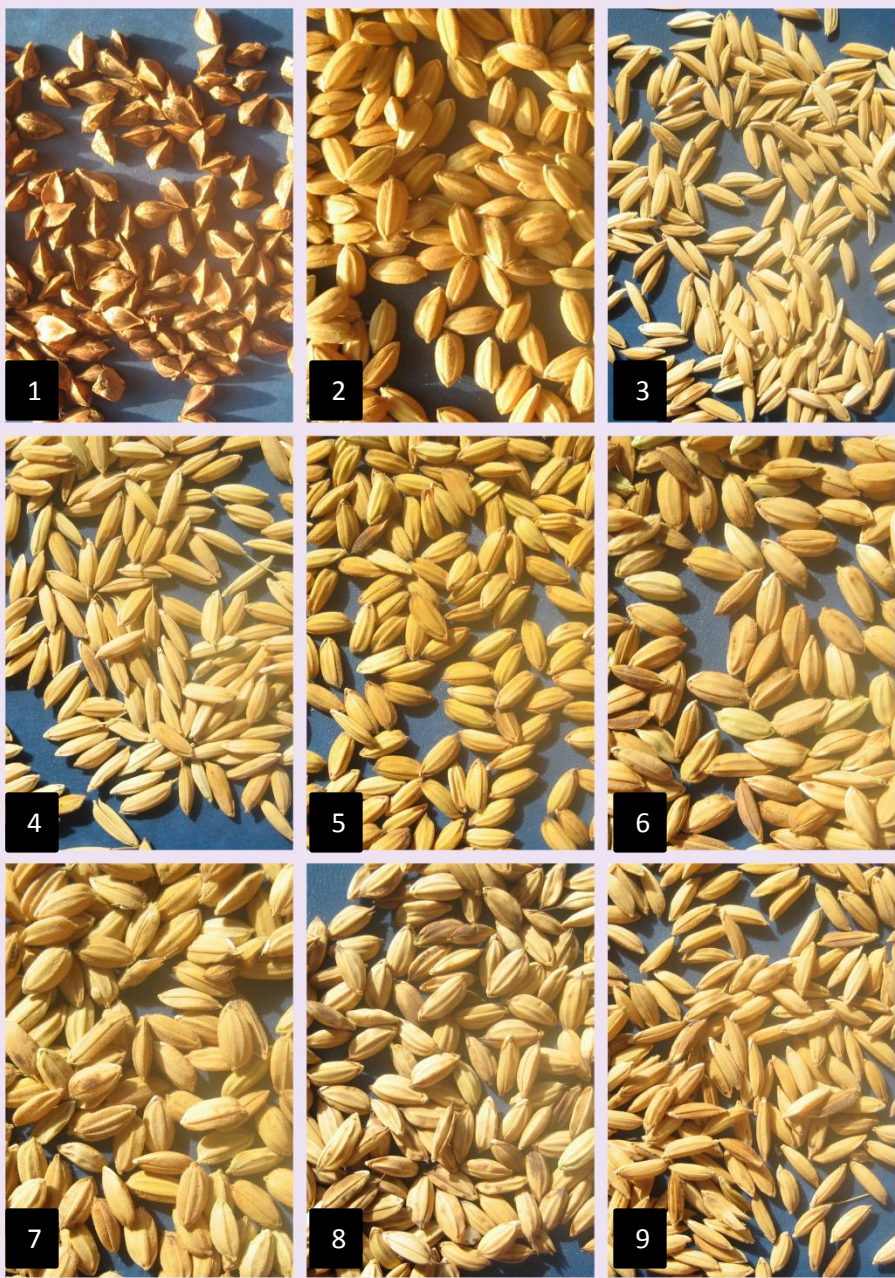
Note: Grains yield is less than the amount seeded. First year, 1 muri grains of buckwheat was harvested by seeding 4 mana seeds. It helps to balance cold-hot problem in the body

Figure 22. Landraces of buckwheat, bean and rice in Thuman VDC



1. Mithe Phapar, 2. Ghiu Simi, 3. Dalle, 4. Seto, 5. Rato Rajma Chirbire, 6. Bhorangi, 7. Tachida Seto Sano, 8. Patla, 9. anga, 10. Bhena Marshi, 11. Taichung

Figure 23. Landraces of buckwheat and rice in Dandagaon VDC



1. Mithe Phapar, 2. Taichung, 3. Khumal-4, 4. Himali, 5. Sikhar Marshi, 6. Taichung, 7. Taichung, 8 & 9. Unknown,

Rice

In both VDCs rice is the first priority crop in the food menu. Due to cold water, quality of rice produced in these is considered very well and all staff in Rasuwa wants to take local rice for consumption in their home. Among the 11 landraces in Thuman, Taichun is very common which is grown by 30 households. This is modern variety suitable to high areas. Other local landraces were generally grown by few households in few areas. Modern varieties are very common in Dandagaon. Among them, Khuma-4 occupied more areas followed by Taichun. Rice varieties suitable to Tarai, Mid Hill and High Hill are found in Dandagaon. Mostly the area and production trend of rice landraces and varieties same over th time in Thuman and Dandagaon.

Areas and productivity of each genotypes are given in Table 23. Borangi is grown in least area and Taichun was grown in more area. There is one landrace without name in Talium. Productivity of Rato and Broraun was the highest and the lowest respectively in Talium. Areas of Khumal-4 and Himali Ghaiya and Kanchan was the highest and lowest respectively in Dandagaon. Production of Ghaiya Dhan was the highest and Himali Ghaiya was the lowest in Dandagaon.

Farmers' preferred and unlike traits of each of genotypes are given in Table 24. This table helps to identify the appropriate genotypes for crop improvement program. Seed related information are given in Table 25 along with their interest. Farmers reported many landraces that are being lost from the local areas. They said that, availability of modern variety is one of the reason of landraces erosion.

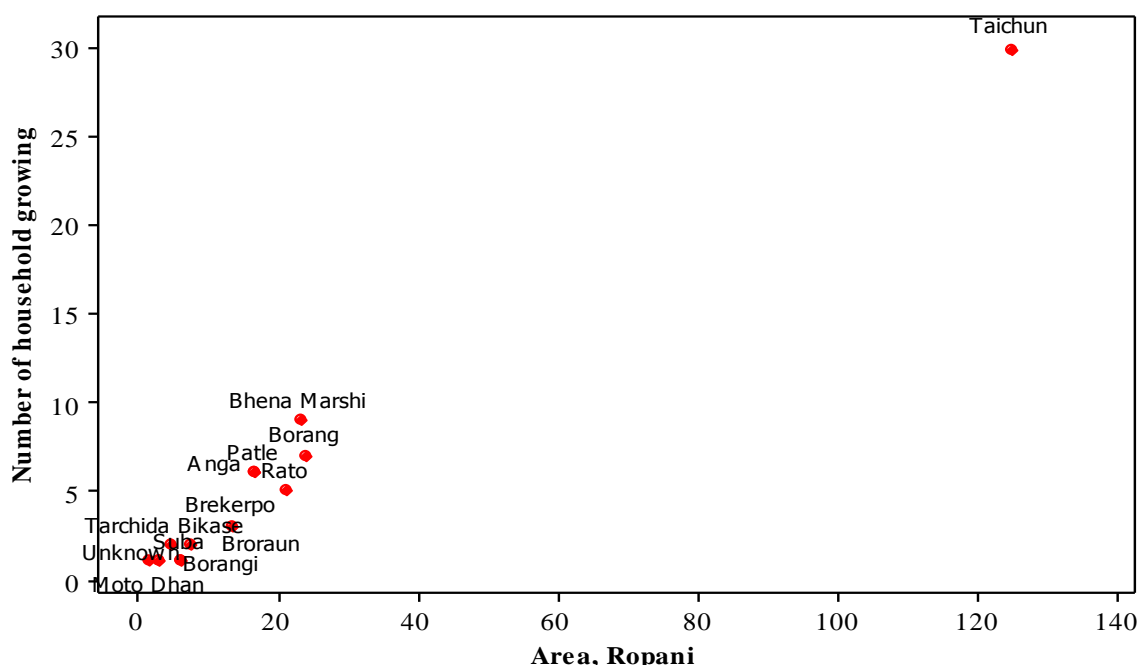


Figure 24A. Distribution of rice landraces (in term of area and number of household growing) in Thuman VDC

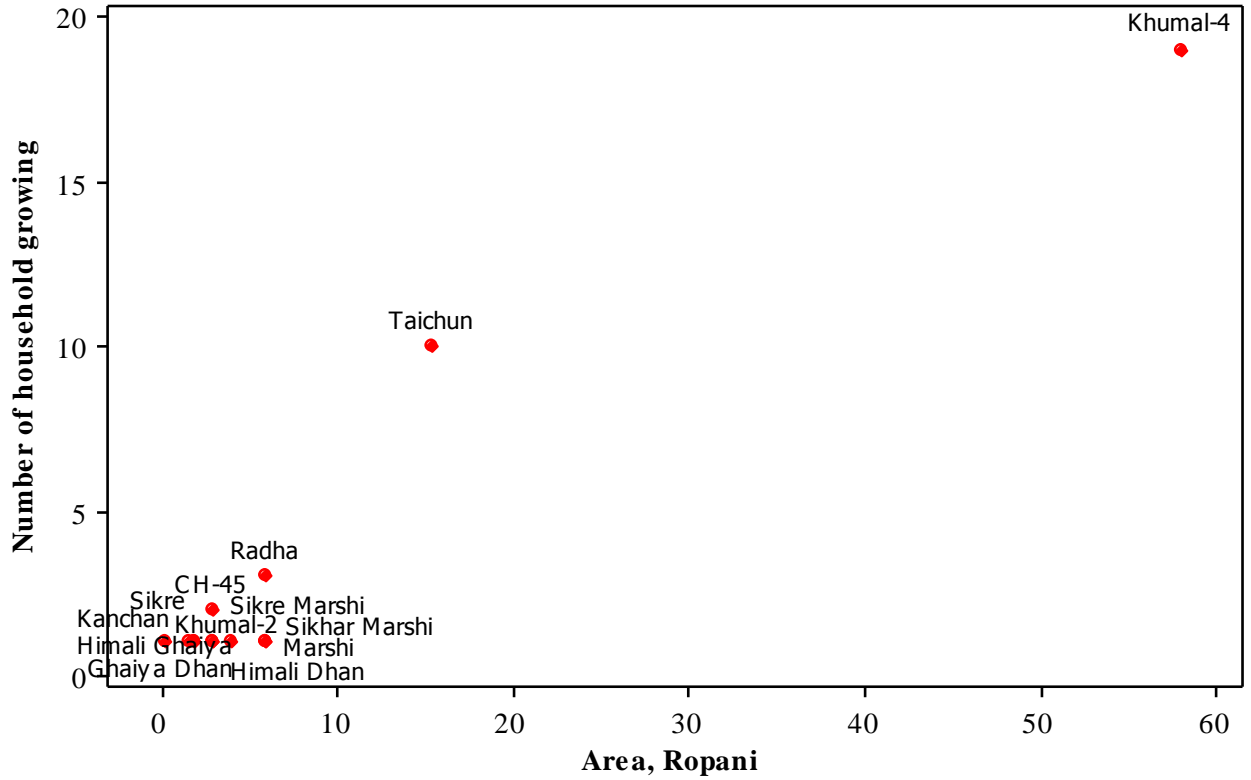


Figure 24B. Distribution of rice landraces in Dandagaon VDC

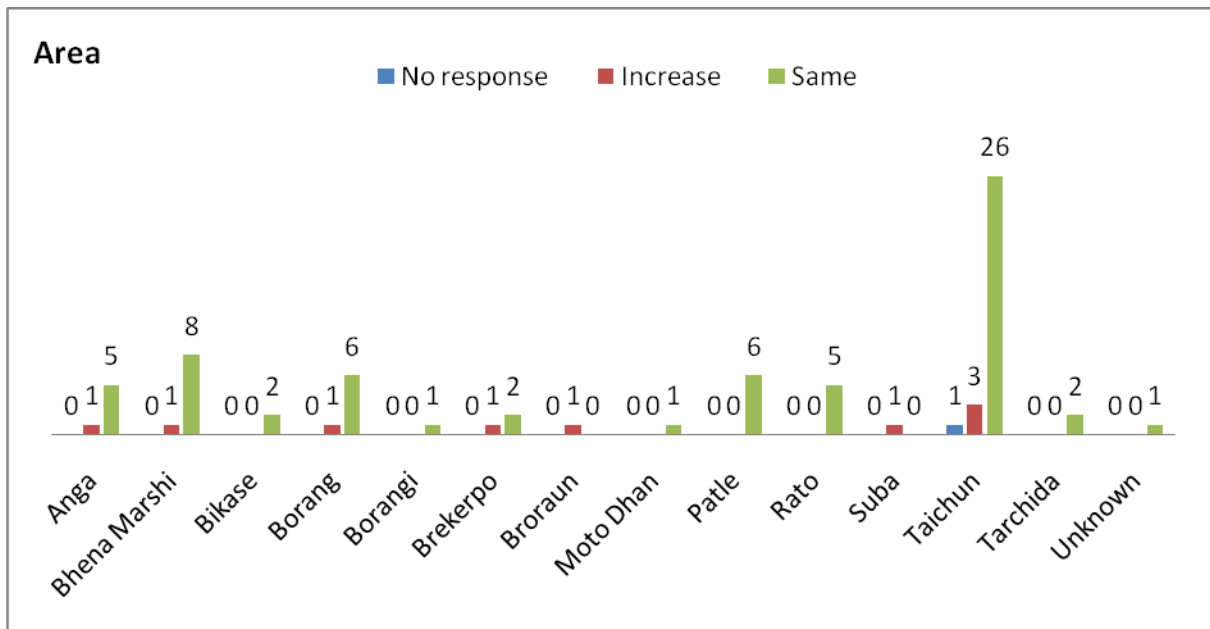


Figure 25A. Number of household responded over the trend of area of rice landraces in Thuman

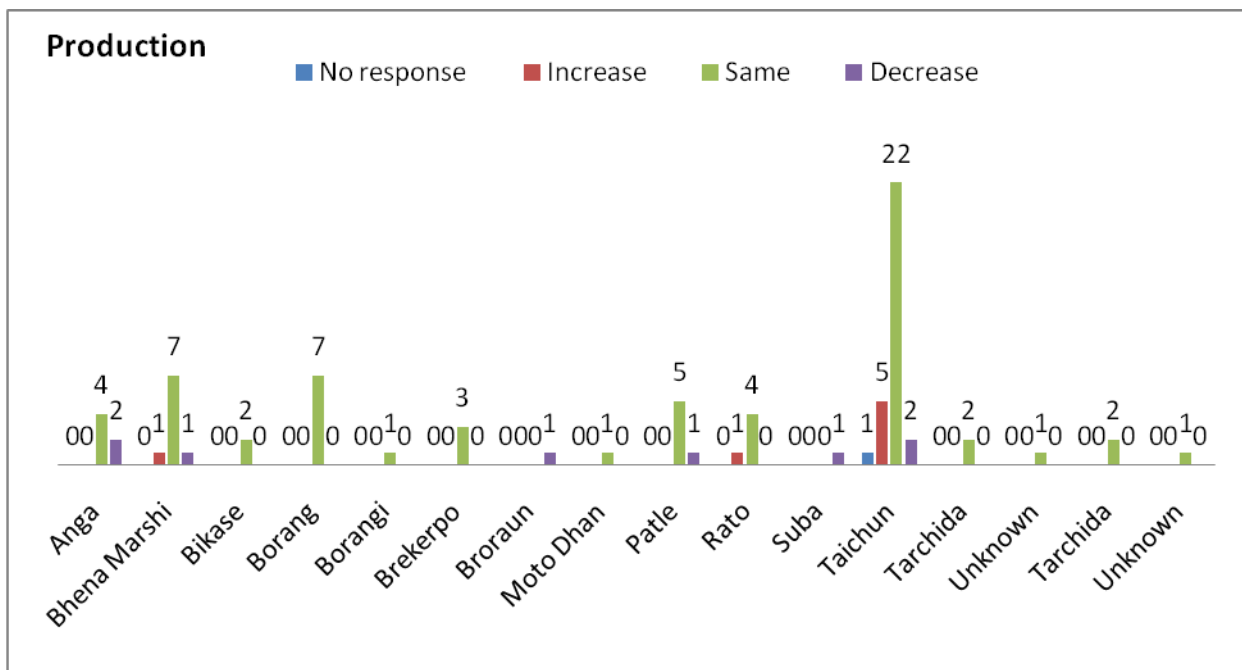


Figure 25B. Number of household responded over the trend of production of rice landraces in Thuman

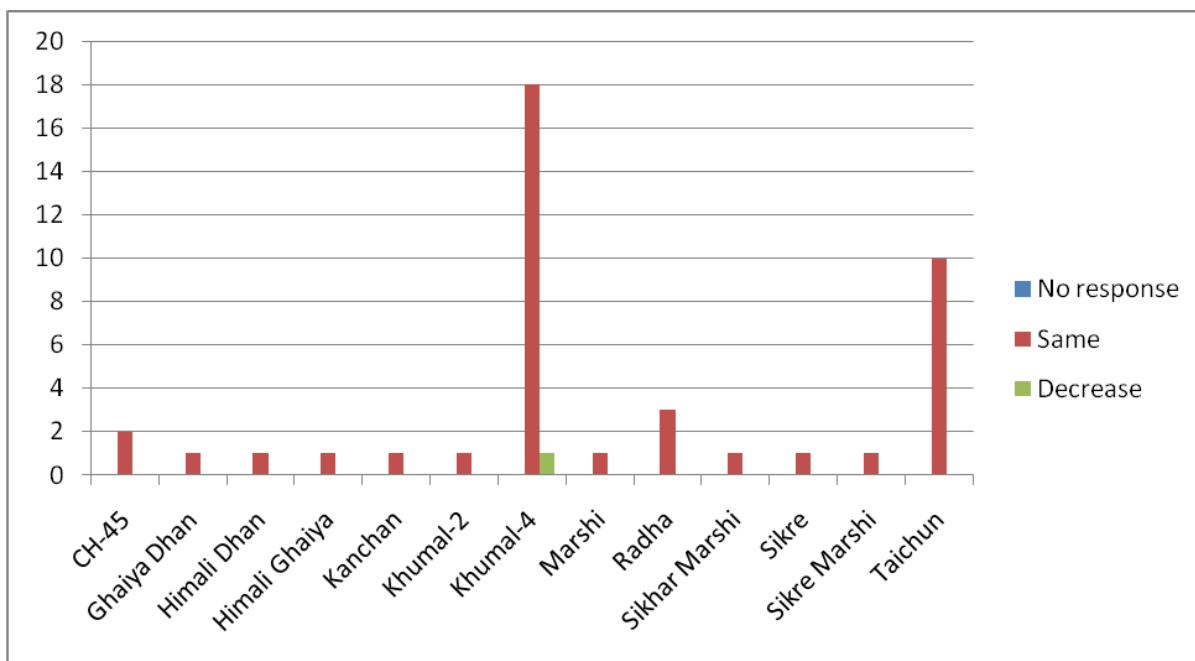


Figure 26A. Number of household responded over the trend of area of rice landraces in Dandagaon

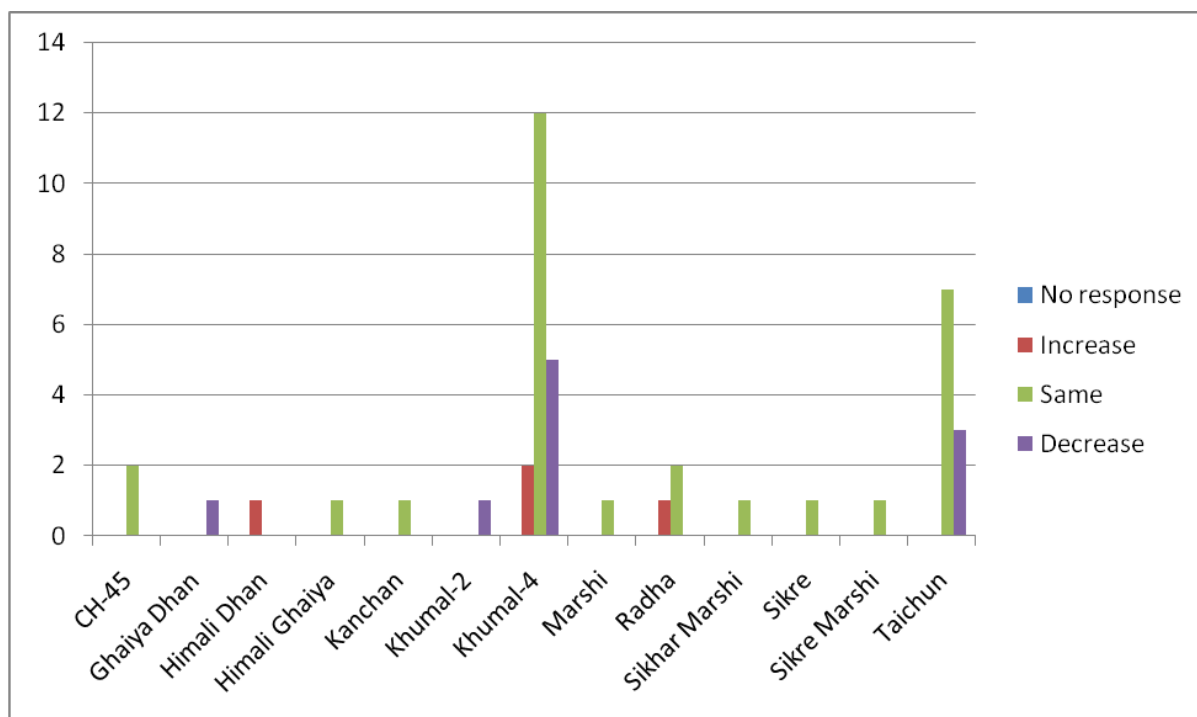


Figure 26B. Number of household responded over the trend of production of rice landraces in Dandagaon

Table 23A. Area and productivity of rice landraces in Thuman

Landrace	N	Area, Ropani					Productivity, kg/Ropani			
		Mean	Min	Max	Sum	SD	Mean	Min	Max	SD
Anga	6	2.75	1.5	6	16.5	1.75	140	40	280	87.64
Bhena Marshi	9	2.57	0.6	4.5	23.1	1.16	71.3	40	100	17.03
Bikase	2	3.75	1.5	6	7.5	3.18	615	30	1200	827.3
Borang	7	3.43	1.5	6	24	1.43	106.2	40	280	85.12
Borangi	1	1.50	1.5	1.5	1.5		120	120	120	
Brekerpo	3	4.50	3	6	13.5	1.50	53.33	20	80	30.55
Broraun	1	6.00	6	6	6		10	10	10	
Moto Dhan	1	3.00	3	3	3		120	120	120	
Patle	6	2.76	0.03	4.5	16.53	1.46	136.7	80	220	65.01
Rato	5	4.20	3	6	21	1.25	183.3	70	400	127.6
Suba	1	6.00	6	6	6		40	40	40	
Taichun	30	4.15	0	12	124.5	2.60	140.7	30	533.3	100.9
Tarchida	2	2.25	1.5	3	4.5	1.06	70	60	80	14.14
Unknown	1	3.00	3	3	3		100	100	100	

Table 23B. Area and productivity of rice landraces in Thuman

Landrace	N	Area, Ropani				Productivity, kg/Ropani				
		Mean	Min	Max	SD	Sum	Mean	Min	Max	SD
CH-45	2	1.5	1	2	0.707	3	127.5	45	210	116.7
Ghaiya Dhan	1	0.32	0.32	0.32		0.32	281.25	281.3	281.3	
Himali Dhan	1	3	3	3		3	200	200	200	
Himali Ghaiya	1	2	2	2		2	30	30	30	
Kanchan	1	2	2	2		2	210	210	210	
Khumal-2	1	1.6	1.6	1.6		1.6	187.5	187.5	187.5	
Khumal-4	19	3.052	1	8	1.870	58	171.7	45	420	95.33
Marshi	1	3	3	3		3	100	100	100	
Radha	3	2	2	2	0	6	250	180	300	62.45
Sikhar Marshi	1	6	6	6		6	120	120	120	
Sikre	1	4	4	4		4	150	150	150	
Sikre Marshi	1	6	6	6		6	140	140	140	
Taichun	10	1.55	0.5	2	0.598	15.5	155.4	54	360	88.83

Table 24A. Rice landraces and their features reported by the farmers in Thuman VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
1	Bhena Marshi (Rato or Borang or Bremarpu)	High market	Suitable in both Lek and Bensi areas	Insect problem during flowering time	1,2,3,6,9 14,27,39
		Good for sick person	High yield	Volume not increased after cooking	17,38,41,46
			Early, mature early even in late planting	Tall and lodging	
			Good taste, tastier than <i>Dhindo</i> and rice from market	Dry bed is necessary	
			Need less water	No seed set sometimes	
			Easy to thresh even in <i>Okhal</i>	Bird, rat and insect problems	
			Milling recovery high	Low yield	
			Volume increase after cooking	Not tasty	
			Straw good for animal, long straw	Shattering	
			Suitable as upland rice and irrigated rice	Lodging sometime	
2	Taichung (Taichin or Brekarpu)		White pericarp, large and short grain	Volume not increased after cooking	15,28,31,44 32,33,34,45
			Many grain in a panicle and short grain stalk	Late planting not good	2,7,8,9, 10,11,17
			Fast and easy dehusking	Not <i>andilo</i> (hungry after short period of	18,19,35,41 20,22,26,37

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
				consumption)	24,25,27
			Tasty, sweet	Need of wet bed	21,38,40
			Milling recovery high (<i>Chamal parne</i>)	Need of clear water for nursery (root broken if seeded in unclean water)	43,46
			Dwarf	More off type appear	
			Wet bed is good	Need more time to sun dry	
			Thin husk	Need of continued water for 15-20 days after just emergence	
			Low insect disease problems	Insect problem (<i>Khumre</i> , grasshopper) in nursery	
			Good for old people	Bird, <i>Badel</i> and <i>Bhalu</i> problems in field	
			High yield	Long duration	
			Straw good for livestock even for goat	Difficult to thresh and dehusk	
			Tasty	Sterility if more water and leaf become large	
			Large grain	Livestock do not like straw	
			Less broken rice	Need of high fertilizers	
3	Anga (Kalo)	Medicinal	Dry bed is also suitable for nursery	Red pericarp	7,12
		Good for fever and diarrhea	Low insect and disease problems	Not tasty	15,16,30
		High and fast energy release after consumption	Increase volume after cooking	Need more time to thresh and dehusk	36
			Easy to thresh	Volume not increase after cooking	
		Wedding, Bratamanda and Puja	Suitable to eat for sick person	Bird problem I nursery and rat	
			Late transplanting is also goods	Difficult to thresh	
			Tasty and soft	Straw is not good for livestock	
			Non shattering	Low yield and low milling recovery	
				Seed not germination if drought prevail	
4	Rato Dhan (Borang or Patle or Thumsi or Palchi or Borangi)	Religious (during <i>Ghewa</i> and <i>Goomba</i> , for <i>Pujari</i>), wedding, <i>Bratabanda</i> , <i>Hom Halda</i>	Increase volume after cooking	Volume not increase after cooking	8,10,12,13
			Easy to thresh	Small grain	15,42
			Tasty and soft	Insect in storage	17,47
			Medium yield	Low yield	29,30,46
			Red pericarp	Milling recovery low	
			Straw good for livestock	Not soft after cooking	
			Large grain	Difficult to dehusk	
			Easy to digest	Dwarf	
			High yield	Wet bed is not good	

SN	Landrace	Value	Preferred traits	Un preferred trait/problems	Grower (HH#)
				however seed might not be germinated in dry bed	
			Less insect and disease problem	Storage pest if store long time	
			Non shattering	Shattering	
			Not damage by <i>Badel</i>		
5	Suba	Religious			11
6	Bikase Dhan	Market	Tasty	Need more time to cook	12,42
			Animal prefer straw	Volume not increase after cooking	
			Large grain		
7	Brekerpo	Religious	Tasty		13,23
			Early than Bhenā Marshi		
			Easy to dehusk		
8	Not known	Market	Large grain	Animal do not like straw	14
			Tasty		
9	Borang (Bhorang)		High yield (higher than Anga)	Not soft	15,16,29 22
			Long straw	Rat, monkey, <i>Badel</i> problems	23,25
			High germination	Insect in nursery	
			Good even in unfertile soil	Leaf roller insect	
			Good even late planting	Not tasty	
			Increase volume after cooking	Need dry bed and difficult to uproot	
			Less insect and disease problem	Poor germination	
			<i>Andilo</i>	Difficult to digest for old people	
				Long duration	
				Difficult to thresh	
10	Tar Jita	Religious	Easy to dehusk		26
			Low husk		
11	Moto Dhan		Old people prefer it	Straw not good for livestock	43
			Soft		
12	Tarchida		Increase volume after cooking	Shattering	46
			Good straw	Low yield	
			Easy to dehusk		

Patle is not good for the area where Anga grow well, and can be cultivated in the area of Patle. Patle was brought from Bhutan keeping seed in the bamboo stick. Some farmer plants different rice variety each year. Bhenā Marshi brought from Borang of Dhading

Table 24B. Preferred and un preferred traits of existing landraces of rice in Dandagaon VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/problems	Grower (HH#)
1	Himali Ghaiya	Market	Very <i>andilo</i>	Red rice	3,59
			Tasty and sweet		
			Suitable to Lek		
			No need of transplanting		
2	Khumal-4 (Khumal)	Market	Soft after cooking	Lodging	24,25,26,
			Good straw for animal (soft	More husk	31,32,33

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
			straw)		34,36,37
			More straw	Sterility	39,42,43
			Fine grain and scented	Even low wind damage flower	45,46,53,54 56,57,60
			Non shattering	Not good in shady area	
			Suitable even to old people		
			High yield (satisfactory yield)		
			Tasty		
3	Taichin (Taichini Chote)	Market	Dwarf	Rat and bird	25,27,30
			Non lodging	Not similar plant in the field	32,33,34 35,36,41,43
			Sweet and tasty	Low straw yield	
			Good yield	More hybrid in the field	
			Good for <i>Chiura</i>	Difficult for germination	
			Good even in cold water	Drought susceptible	
			<i>Andilo</i>	<i>Putla</i> and <i>Khumre</i>	
4	Khumal-2		Soft to eat		29
			Sweet		
			Straw good for animal		
5	Sikhar Marshi	Religious	Sweet and tasty	Shattering	35
			More straw	<i>Putla</i>	
			Good even in cold water		
6	Sikre Marshi	Religious	Scented	Shattering	38,41
			Sweet	Insect (<i>Goon</i> and <i>Putla</i>)	
			High milling recovery	Lodging	
			Straw good for animal		
			Fine grain		
			Insect resistance		
			Increased volume after cooking		
			Soft after cooking		
			Adopted to this area		
7	Radha		High yield	Not soft after cooking	40,44,45,46
			Sweet	<i>Khumre</i>	
			Tall and more straw	Plant dry quickly	
			More milling recover	Animal do not like straw	
			<i>Andilo</i>	Shattering	
				Insect (<i>Goon</i> and <i>Putla</i>)	
8	CH-45		Suitable to this area	Low straw	48,60
			Sweet	Low yield	
			High yield	Insect in stalk	
			Good straw		
			Soft after cooking		
9	Marshi		Scented	Shattering	54
			Tasty		
			More straw		
10	Himali		High yield	Lodging	59

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
	Dhan		Sweet High milling recovery No need of <i>Ghee</i> Good even in cold water Animal like straw <i>Goon</i> and <i>Putla</i> resistance	Shattering	
11	Kanchan		Need of low water	Short straw Rat Low yield	60
12	Ghaiya		Sweet No need of water <i>Andilo</i>		61

Table 25A. Farmer practices and their interest in rice in three villages of Thuman VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Dalphedi, Thuman VDC				
Early High yielding Disease and insect resistance Good seed except Bhena Marshi	During harvesting, and from storage Remove smut infected plant and select white and clean White grain before harvesting, select from standing crop Select panicle from the field	Rat, insect and grasshopper	Nare (Nale), Anga, Chaumare, Takmare (Tangmare),	Low yield High unfilled grains Introduction of Bhena Marshi
Thuman, Thuman VDC				
High yield, insect disease resistance, early, suitable to plant any time, adopted to local area Early, not damaged by insect to seeds, high yield and two crop in a year Long panicle, large grain, early, drought resistance easy threshing, droopy panicle, white pericarp color like Taichung	Select panicle from the field and keep separately Not damaged by insect, good, similar grains, removing off type Fully matured long panicle, large grain	Seed not available, damage by insect if urea not used, damage seeds by frog Cut worm No irrigation More insect disease, storage pest (putla) One crop in a year Weeds	Nare (Nale), Anga, Takmare (Tangmare), Patle (Borang), Padale	New variety produce high yield and taste good Small grain Low milling recovery Need many seed for planting Low yield Nale good in Bari but small seeds
Short duration variety, within 3 months	Seed from storage	Rat Grasshopper, wild animals and birds, monkey	Seto Dhan	Introduction of new variety eg Taichung
New variety	Screen off type in threshing floor	Flower abortion		Preferred by wild animal
Suitable in Bari (Ghaiya) and Lek	Early matured panicle having long and fine grain	<i>Dumsi, Badel, Dhamira</i>		
High straw yield	By sieving after threshing	Lodging		
Need of low inputs	By winnowing just before seeding	Tall plant if rain in Bhadra		
Tasty		Damaged by rainfall		

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Easy for dehusking		Weeds		
Cold tolerance, suitable to Lek		No panicle during late planting and lack of irrigation		
Long panicle		Low output		
Large grain		More unfilled grain due to insect		
Drought tolerances		Leaf turned yellow		
Small and fine grain		Need of high input and irrigation		
Early maturity even in late planting		Drought		
Soft				
Mendogaon, Thuman VDC				
High yielding	Select good panicle from the field	Insect infestation high	Anga	Low yield
Local rice	Large grain	Leaf and whole plant damaged by insect	Patle	Easily broken
Long panicle	Fully matured panicle	Rat	Nale	Small grain
Need of low water	Fully and early matured	Cut worm	Takmare	
New variety	Not damaged by insect	Flower abortion	Gonde	
Early	Large panicle	Rain damage during maturity		
Short duration so that two crop in a year		Grasshopper		
Red color		Drought		
Tasty		Rain damage during flowering		
Insect and disease resistance				

Nale is upland rice like Ghaiya. Tangmore is planted in Lek. If not selected, rice turned red next year

Table 25B. Seed related information and lost landraces of rice in three villages of Dandagaon VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Karmaryang, Dandagaon VDC				
White pericarp		Sterility		
High straw yield		Insect		
Dandagaon, Dandagaon VDC				
High yielding (Mana ko Muri)	Jhakpa (collect seeds after threshing by hitting rice bundle only once)	Lodging	Chote Marshi	Availability of new modern variety
Improved variety		Borer, <i>Khumre</i>	Anp Jhutte	Low yield
Drought tolerance	Selecting panicle (<i>Bala Balaune</i>)	Plant turn yellow during panicle initiation	Sikar Marshi	Not tasty
Good straw for animals	Removing off type (hybrid)	Spider by rounding the leaf	Chinia Marshi	Insect and disease
Non shattering	Selecting best area in the field	Sterility (vigor plant without seed)	Bhangeri Marshi	Dwarf
Long panicle	Panicle from tall plant	Rat and birds on field	Tauli	

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Suitable in cold water		No irrigation	Darmali	
<i>Andilo</i>		<i>Putla</i>	Thankote	
Tasty		Blight	Dhokre	
High straw yield		Leaf roller	Sindali (Sinali)	
Soft straw		Wild animals	Budoli Marshi	
Less husk		Low panicle exertion	Pokhrela	
Insect (<i>Putla</i> , Leaf roller) and disease (blight) resistance		Cold injury	Marshi	
Early		Shattering	Ghajali Kathe	
Soft after cook		Blight	Samundraphinj	
Non lodging		Termites	Mansara	
Long storable capacity		Borer	Mana Muri	
Many grain in a panicle		Insect cut the stem	Gugeli Marshi	
			Anga	
			Damari Dhan	
			Sikre	
			Thangkote (Thankote)	
			Thulo Marshi	
			Mala Bau	
			Bhena Marshi	
			Indrabeli	
			Sano Marshi	
			Taichin	
			Doli	
			Jamari	
			Himali	
			Ghootheli Marshi	
Siruchet, Dandagaon VDC				
Improved variety	<i>Jhakpa</i> (collect seeds after threshing by hitting rice bundle only once)	More insect (<i>Goon, Khumre</i>) in dry land	Marshi	Many off type
High yielding		Lodging	Thankote Marshi	Low yield
High straw yield	Selecting panicle (<i>Bala Balaune</i>)	No labor	Sikre Marshi	Shattering
Sweet		Borer	Bhena Marshi	More insects
Insect and disease resistance	Good panicle	Leaf roller	Pokhrela	
Non lodging		Blight	Anp Jutte	
Suitable to cold water		After few year, hybrid appear		
Non shattering		Leaf spot		
Good even in less water		Powder mildew		

Jhakpa: Rice bundle is hit once and collect seed for next season

Maize

Lanraces richness in maize was relatively higher in both VDCs. Both modern and local landraces are being grown. Kaseli was grown by many farmers, and Thumsi was grown in more area in Thuman VDC. Seto Makai was grown by many household in more area in Dandagaon. Generally many of the landraces were grown by few household in few areas in both VDCs. Most of the household reported that area and production of each landrace and variety ove the year was same. Only few farmers reported either increase or decrease in area and production of maize landraces.

Area and productivity of each maize landrace are given in Table 26. Area of Thumsi was the highest in Thuman and the area of Seto Philinge was the lowest. Balva and Seto Philinge produced the highest grain and Seto Rato lowest in Thuman VDC. In Dandagaon, Seto Makai was grown in many areas and area of Chulthe Makai, Ghaunale and Khumal Pahenle was the lowest. Sathiya Makai produced the highest grain and Local Pahenlo lowest in Dandagaon VDC.

Characteristics of each of landraces of maize reported by the farmers are given in Table 27. Landrace specific trait is very important for the continue cultivation. Seed related traits along with general problems are presented in Table 28. Lost landraces are also presented in Table 28. Farmers reported that mainly due to low yield, these landraces were lost.

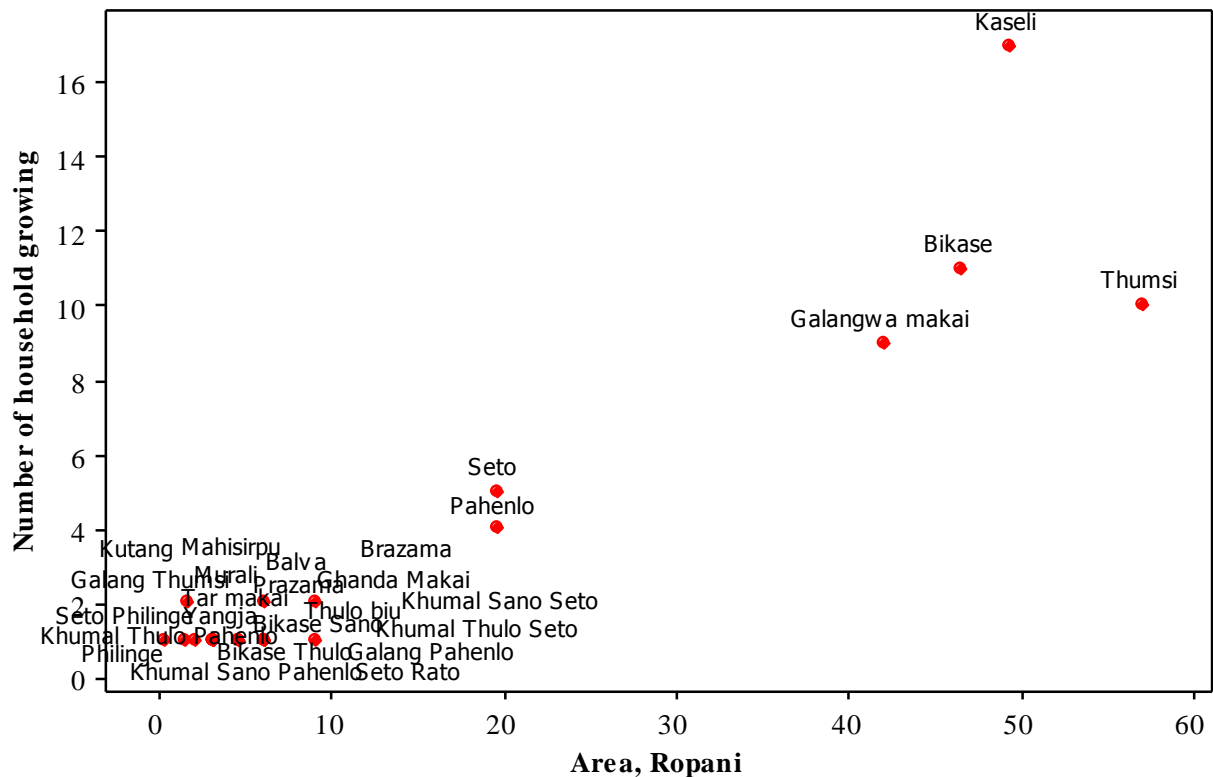


Figure 27A. Distribution of maize landraces in Thuman VDC

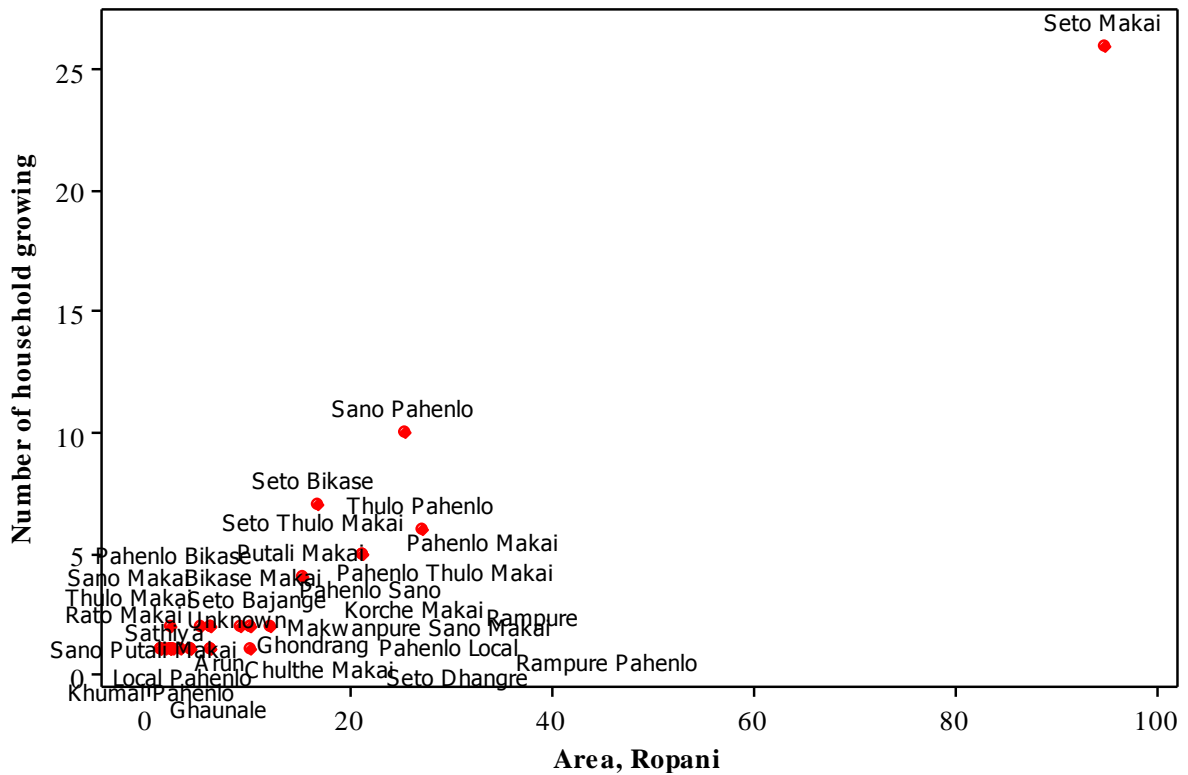


Figure 27B. Distribution of maize landraces in Dandagaon VDC

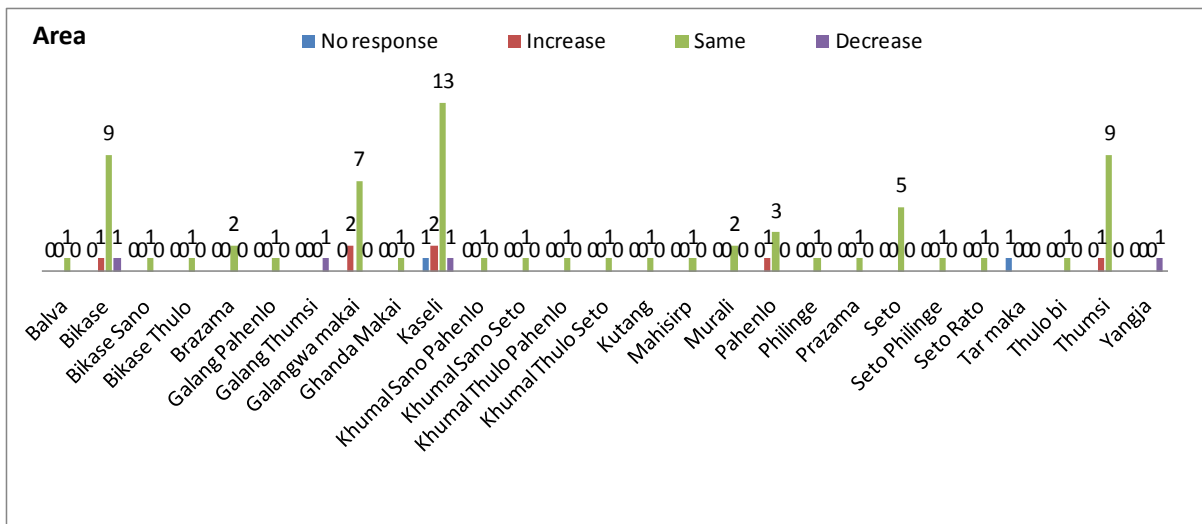


Figure 28A. Number of household responded over the trend of area of maize landraces in Thuman

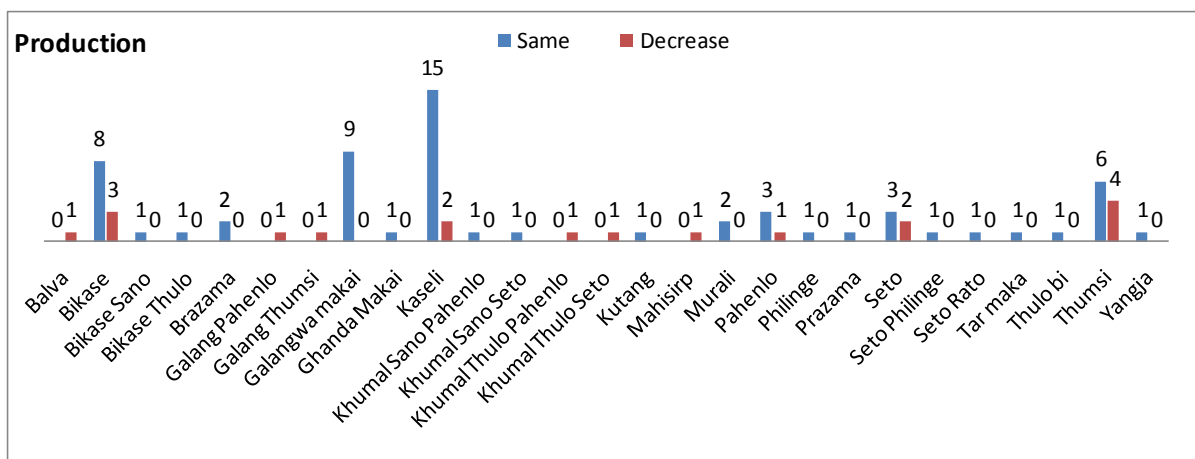


Figure 28B. Number of household responded over the trend of area of maize landraces in Thuman

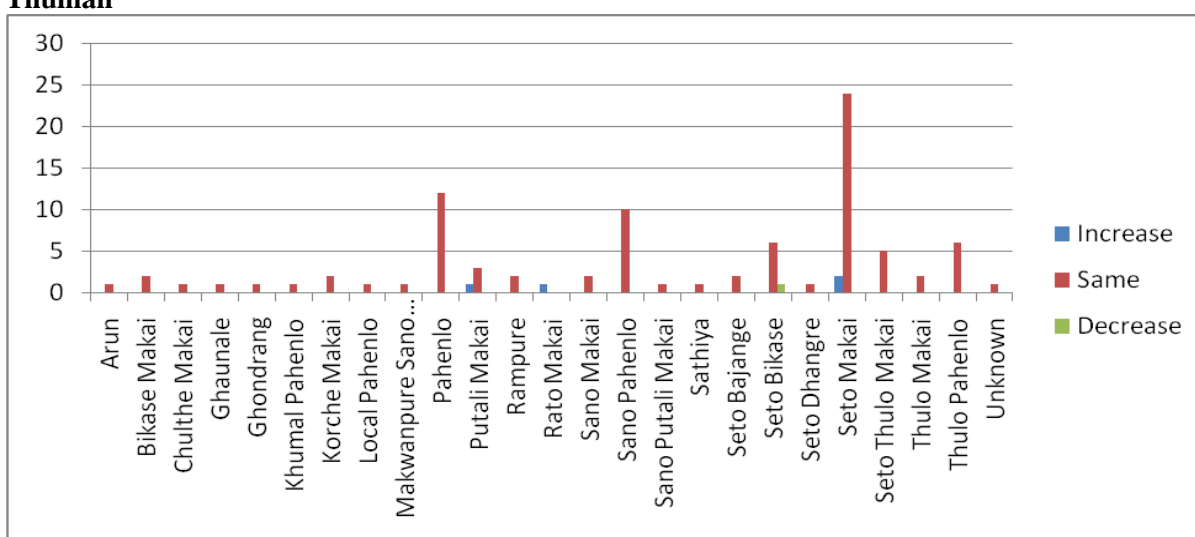


Figure 29A. Number of household responded over the trend of area of maize landraces in Dandagaon

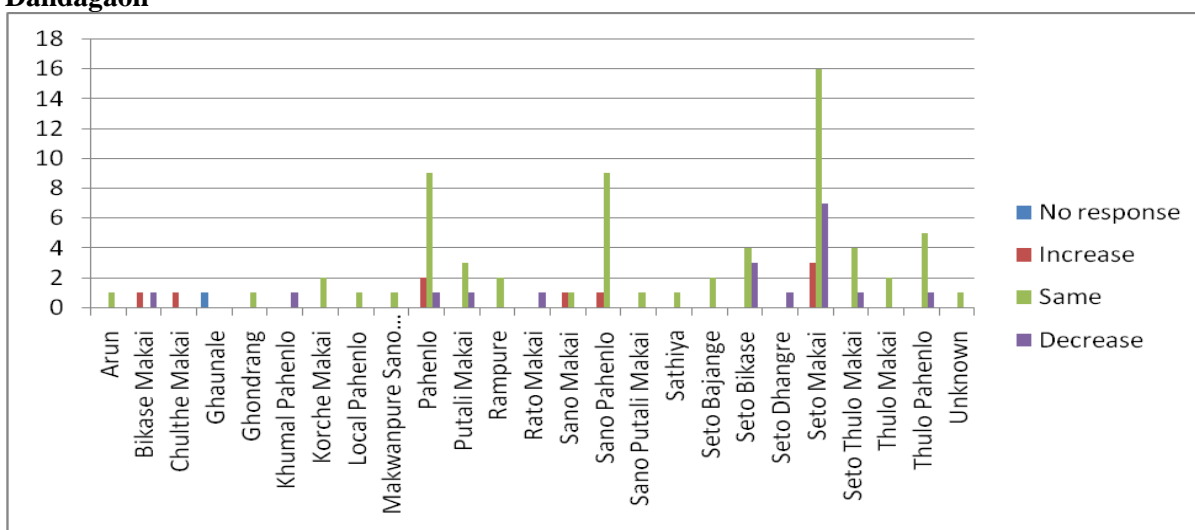


Figure 29B. Number of household responded over the trend of area of maize landraces in Dandagaon

Table 26A. Area and productivity of maize landraces in Thuman

Landrace	N	Area, Ropani				Productivity, kg/Ropani			
		Mean	Min	Max	SD	Sum	Mean	Min	Max

Landrace	N	Area, Ropani				Productivity, kg/Ropani				
		Mean	Min	Max	SD	Sum	Mean	Min	Max	SD
Balva	1	0.03	0.03	0.03		0.03	300	300	300	
Bikase	11	4.227	1.5	9	2.20	46.5	79	18	400	108.5
Bikase Sano	1	3	3	3		3	40	40	40	
Bikase Thulo	1	3	3	3		3	60	60	60	.
Brazama	2	4.5	3	6	2.12	9	47.5	20	75	38.89
Galang Pahlenlo	1	3	3	3		3	72	72	72	.
Galang Thumsi	1	3	3	3		3	60	60	60	.
Galangwa makai	9	4.66	3	6	1.58	42	63.61	7.5	120	31.95
Ghanda Makai	1	3	3	3		3	120	120	120	.
Kaseli	17	2.89	0.3	6	1.71	49.29	59.1	10	140	38.42
Khumal Sano Pahlenlo	2	4.5	4.5	4.5	0	9	36	36	36	0
Khumal Sano Seto	2	6	6	6	0	12	63	63	63	0
Kutang	1	1.5	1.5	1.5	.	1.5	48	48	48	.
Mahisirp	1	4.5	4.5	4.5	.	4.5	80	80	80	
Murali	2	0.765	0.03	1.5	1.039	1.53	115	30	200	120.2
Pahlenlo	4	4.875	1.5	9	3.32	19.5	50.25	5	72	30.58
Philinge	1	6	6	6	.	6	75	75	75	
Prazama	1	6	6	6	.	6	27	27	27	.
Seto	5	3.9	1.5	6	1.71	19.5	70.4	60	80	10.04
Seto Philinge	1	0.24	0.24	0.24	.	0.24	300	300	300	.
Seto Rato	1	3	3	3	.	3	6	6	6	
Tar maka	1	3	3	3	.	3	20	20	20	.
Thulo bi	1	9	9	9	.	9	2.333	2.333	2.333	
Thumsi	10	5.7	3	12	2.626	57	44.35	7.5	90	27.94
Yangja	1	2.1	2.1	2.1	.	2.1	34.29	34.29	34.29	

Table 26B. Area and productivity of maize landraces in Dandagaon

Landrace	N	Area, Ropani				Productivity, kg/Ropani				
		Mean	Min	Max	SD	Sum	Mean	Min	Max	SD
Arun	1	1.6	1.6	1.6		1.6	115.63	115.6	115.6	
Bikase Makai	2	3	2	4	1.41	6	99.38	48.75	150	71.59
Chulthe Makai	1	1	1	1		1	120.00	120	120	
Ghaunale	1	1	1	1		1	150.00	150	150	
Ghondrang	1	4	4	4		4	75.00	75	75	
Khumal Pahlenlo	1	1	1	1		1	75.00	75	75	
Korche Makai	2	5	4	6	1.41	10	62.50	50	75	17.68
Local Pahlenlo	1	6	6	6		6	45.00	45	45	
Makwanpure	1	4	4	4		4	187.50	187.5	187.5	

Landrace	N	Area, Ropani				Productivity, kg/Ropani				
		Mean	Min	Max	SD	Sum	Mean	Min	Max	SD
Sano Makai										
Pahenlo	12	4	1	8	2.34	48	114.27	15	600	158.7
Putali Makai	4	3.795	0.5	12	5.51	15.18	126.93	31.25	210	81.39
Rampure	2	2	2	2	0.00	4	71.25	52.5	90	26.52
Rato Makai	1	2	2	2		2	90.00	90	90	
Sano Makai	1	2	2	2		2	90.00	90	90	
Sano Pahenlo	2	3	2	4	1.41	6	131.25	112.5	150	26.52
Sano Putali Makai	1	10	10	10		10	30.00	30	30	
Sathiya	1	2	2	2		2	210.00	210	210	
Seto Bajange	2	4.5	3	6	2.12	9	131.25	112.5	150	26.52
Seto Bikase	7	2.35	0.5	6	1.97	16.5	181.07	60	600	189.5
Seto Dhangre	1	2.4	2.4	2.4		2.4	125.00	125	125	
Seto Makai	26	3.646	1	14	3.37	94.8	94.18	10.71	300	73.34
Seto Thulo Makai	5	4.2	1	8	2.86	21	117.25	50	180	50.27
Thulo Makai	2	2.5	2	3	0.71	5	76.67	33.33	120	61.28
Thulo Pahenlo	6	4.5	1	8	2.95	27	106.88	37.5	240	76.7
Unknown	1	6	6	6		6	40.00	40	40	

Table 27A. Maize landraces and their features reported by the farmers in Thuman VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/problems	Grower (HH#)
1	Kaseli (Koseli)	Religious, (Puja and Funeral) market	Low husk	Small plant	1,2,3,4,8,31
			Many grains		35,37,39,46
		Use value (Jand, Balu)	large cob and grains	Insect problem, more insect in drought condition, insect in root and top of shoot	12,14,15,41
			Good for use as pop corn	Small cob	16,17,24
			Good for roasting in green stage	More Chyakhla	
			More flour and sweet	Monkey, rat Dumsi, Badel and bird (crow) problem	
			Good for satu	Storage pest (Ghoon, Putla)	
			Small spadix (Khoya) but more grains	Not tasty	
			Shorter than Bikase	Tall plant and difficult to harvest	
			Good for mixing soybean with it	Long duration	
			Good for making	Smut if planted in	

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
			Jand and Raksi	Falgun-Chaitra	
			No smut if planted in Baisakh		
			Good for Dindo to use with Shisnu	Difficult to thresh	
2	Tar (Seto) Makai (Yangja, Makokarpu)	Religious	Very early	Dumsi, Badel (animal damage it more than Pahenlo Makai)	17,32,39
			Tasty	Low yield	21
			Multiple cobs	Need specific time for planting	
			Good for use as pop corn		
			Easy to thresh and grind	Low cob	
		Medicinal (Good for Pinas)	Very dwarf and easy to harvest	Small cob	1,22,30
			White grain and flour	Goon, smut Putla, cut worm	
			Good even late planting	More off type appear	
			good as pop corn	Not tasty	
				Difficult to grind	
3	Bikase (Thulo)	Market	Large cob and grains	Insect problem high	2,3,4,5,6,47
		Use (for Jad)	Sweet flour	Late maturity	15,40,41,42
			Good for livestock	Large plant type	43,44
			High yield	Smut	
			High temperature tolerance	Need to select seeds	
4	Thumsi (Thumsya, Thumse)		Easy to know planting and harvesting time	Storage pest (Ghoon, Putla) if store for a long time	7,11,15,29
			Easy to grind making very small pieces	Smut problem	16,18,19
			Early	Badel, Dumsi, crow	20,31,36
			More energy supply to body	Insect in cob	
			Early (mature early even in late planting)	Low yield	
			Large cob	Small and low cob	
			Medium size cob		
			Sweet flour		
			Good for use as pop corn		
			Good for making Jad		
			Tasty Dindo with Sisnu		
			Animal, insect, disease problems low		
5	Khumal Thulo Seto		High yield	Not tasty	9
			Large and long cob	Insect in cob and grain	
			Tall	Should be planted early	

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
			More flour		
6	Khumal Thulo Pahenlo		High yield	Not tasty	9
			Large and long cob	Insect in cob and grain	
			Tall	Should be planted early	
			More flour		
7	Khumal Sano Seto		Tasty	Low yield	9
			Easy to thresh	Insect problem	
				Small grain	
8	Khumal Sano Pahenlo		Tasty	Low yield	9
			Easy to thresh	Insect problem	
				Small grain	
9	Galang Thumsi (Galang or Galangwa)		2 cobs per plant	Small cob	10,11,33,38
			Grain in all cobs	Low flour	14,16,24
			Early than Koseli	Insect and Dumsi	25,26,28,34
			Small grain, local landrace	Smut	
			Tasty, good as Dhindo with Sisnu	Insect (blue head insect) problem	
			Easy to thresh	Water logged condition susceptible	
			Large cob and grains	Tall	
			Grain from bottom to top of the cob		
			Good even in late planting		
10	Kutang		Sweet	Small cob and grain	12
11	Pahenlo makai (Makiserpu)	Religious	Good to use as pop corn	Goon, pulita	13,22,27,30
			Easy to thresh and to pop	Flour not tasty	
			Early	Low yield, sterility	
			Long and large cob	Large grain and not tasty	
			Tasty	Cut worm	
			Medium plant height	Difficult to store for long time	
			Very fine flour		
12	Balva		Large cob	Insect and disease problems	16,46
			Many grains	Small grain	
			Good for use after roasting green cob		
			Tasty		
			Good for use as pop corn		

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
13	Prazama (Brazama)		Tasty and sweet	Small grain	16,23,26
				Cut worm	
			High yield	Not good for Pinas person	32
			Similar grains	Insect problem in 13-14 days of emergence	
			Good for use as pop corn	Crow, Dumsi, Badel	
			Large cob, high grain/spadix ratio		
			2 cobs per plant		
			Early		
14	Mahisirpu (Pahenle)		Early	Not good for sick person (Pinas)	17
			Good even late planting	Dumsi and Badel	
			Tasty	Low yield	
			Easy to thresh and grind	Low cob	
			Dwarf and easy to harvest		
			Good for use as pop corn		
15	Thulo biu (Gonda)		Large and long cob	Not good for late planting	39,46
			Easy to thresh	No grain in late planting	
			Its Dindo good with Sisnu	Large spadix	
			Tasty Jad	Low grain-spadix ratio	
			More flour	Smut	
			Water logged tolerance	Difficult to grind by teeth after pop	
16	Seto Philinge	Good for Kitchen garden	Tasty	Early planting	39,45
			Early	Small cobs	
			White grain	Many cobs but not grains	
			Easy to thresh		
			High yield	Difficult to thresh	
			Many cobs		
17	Murali		Tasty pop corn	Not good for roasting	41,46
			Tasty flour	Small grain	
			Small spadix		
			Large cob in fertile land		
18	Bikase (Sano)		Tasty	Small cob and grains	42
			Short duration	Insect	

Table 27B. Preferred and un preferred traits of existing landraces of maize in Dandagaon VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
1	Seto Bikase (Seto Thulo)		Tasty	Lodging (become tall after many season)	1,2,6,20 23,31,57,60
			Good for <i>Dindo</i> (tasty)	Not tastier using as pop corn than Pahlenle	47,49,53,63
			High yield	Blight	
			Good to use green cob		
			More flour (8 <i>mana</i> grain produce 10 <i>mana</i> flour)	Small plant, low straw for animal	
			Large cobs	Insect (<i>Goon, Putal</i>)	
			Dwarf and non lodging	Rotten	
2	Ghandrang		Tasty		2
			Non lodging		
			Large cob		
			No problem of borer		
3	Seto Makai (Tar Makai)	Religious (<i>Jand</i> for <i>Jhakri</i> during Wedding and <i>Bratabanda</i>)	Sweet	Insect (<i>Putla, Borer,</i> <i>Khumre</i>)	3,4,5,7,8,50
			Good for <i>Dindo</i>		9,10,11,48
			Good for use as pop corn and roast corn	Tall	12,13,14,52
			Many grains	Drought susceptible	15,16,17
			Drought tolerance	Large spadix	18,19,21
			Good out look	Smut	22,51,54
			Easy to cultivate	Leaf blight	58,59,62
			Good even in late planting	Borer	
			Easy to thresh	Lodging	
			Soft to eat	Thin husk	
			Non lodging	Rotten	
			High yield	Late maturity	
			Large cob		
			Small grain but more flour		
			Dwarf		
			More flour		
4	Rato Makai	Market	<i>Andilo</i>	Not soft after cooking	5
			Digestible	Tall	
				Lodging	
				Insect	
5	Pahlenlo Bikase (Thulo Pahlenlo, Bikase)		High yielding (more than Bajangi and Korche)	insect (<i>Goon, Putla</i>)	6,10,27,42 44,45
			Good for <i>Dindo</i>		32,35,36 38,39
			Dwarf and non lodging, strong stalk	Become tall after many seasons	
			Small grain but many		
			More stalk		
			Large cobs and small spadix	Insect in stalk and cob	
			Good for popping		
			Sweet	Difficult to thresh	
			Insect resistance (<i>Goon</i> and <i>Putla</i>)		
6	Chulthe Makai		<i>Andilo</i>	Out look not good	13
			Good for popping	Insect in the field	
			Good for Lek		

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
7	Pahenlo Makai		More flour	Tall	16,17,25,43 46,50,54
			King of the cereals	Insect	
			Suitable even in Khet area	Lodging	
			Sweet <i>Dindo</i>	Smut	
			More stalks		
			Good for making alcohol	Bitter and bad smell <i>Dindo</i>	
			Early		
			Animal prefer stalk		
			Sweet at green stage		
			Good for popping		
8	Rampure Pahenlo, Rampure		Good for human and animals	Insect	24
			Soft <i>Dindo</i>	Tall	
			Tasty bread	Lodging	
			More gains		
9	Putali Makai		Sweet	Tall	26,28,30 33
			Good for <i>Dindo</i>	Variation in grain color and size	
			Low insect		
			Good out look	Lodging	
10	Sanu Pahenle (Pahenle Sano, Kakani)	Medicinal (good for sick person)	Good to eat and for popping	Insect	26,29,33,59 34,37,45 38,39,40,48 60
			Nutritious	Small grain	
			Drought tolerance	Tall if planting done late	
			No germination after keeping long time together	Taste loss after long time	
			Early	<i>Goon and Putla</i>	
			Mature all in same time	Take time to germinate	
			Non lodging	Drought susceptible	
			<i>Chamro</i> flour		
			Small spadix		
			Good germination		
			Medium height		
			Low insect		
			Sweet		
11	Arun (Bikase)		Large cob	Tall	29,54
			Early		
			Tasty	Lodging	
12	Sano Putali Makai		Tasty		31
			Good for popping	Not yield stability	
			Non lodging	<i>Goon and Putla</i> problem	
			Low insect problem		
	No smell of flour				
13	Khupal Pahenle				34
14	Makawanpure Sano		High yield	Short husk	35
			Early	Rot quickly	
			Good for popping and	<i>Goon and Putla</i>	

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
			sweet		
			Dwarf		
15	Unknown		Ddwarf	More insect	36
			Large cob	Not good for <i>Dindo</i>	
			Good for roasting green cob	Rotten in the field	
16	Korche Makai		Low insect	Smut	37,41
			Sweet after popping	Leaf disease	
			Non lodging	<i>Aijeru</i>	
			Good for <i>Dindo</i>	Lodging	
			Large cob and grain	Tall	
			Small spadix	Rotting from the top of the cob	
17	Sanu Makai		Mature early even in late planting		42,44
			Low insect		
			High yield		
			Sweet		
			Drought tolerance		
18	Thulo Makai		Large cob		43,46
			More flour		
			High yield		
			Early		
			Low insect		
			Non lodging		
			Sweet and more flour		
			Small spadix and large grains		
19	Bajange (Bikase Seto)		Sweet	Insect (borer and leaf cutting insect)	55,56
			Large cob	Lodging	
20	Sathiya		Mature within 60 days		56
			Very early and short duration variety		
21	Seto Ghangre			Tall	61
				Lodging	
				Cob rotting	

Table 28A. Farmer practices and their interest in maize in three villages of Thuman VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Dalphedi, Thuman VDC				
Early	Large seed from storage	Wild animal and bird	Thumsi (white grain)	small grain and cob
high yield improved	Matured cob, large seed	insect and smut	Brajum	not good taste
Short duration crop	large and long cob from the field and keep separately	sterility		small plant and cob crow damage damage by wild animal
Insect and disease resistance	grain from storage	cob damaged by insect (blue head insect), cut worm (<i>Khumre</i>),		
not damage by animal	large cob and seed during harvest			

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
large cob early, 5-6 months, Suitable to this area				
Thuman, Thuman VDC				
Early high yield dwarf	not rotten cob and seeds fully matured grains	Root, leaf and top part damaged by insect poor germination slow growth	Bhalba	no labor, need more manure, difficult to grind, need different Janto
Large cob and grains	not damaged by insect	damaged by insects, grasshopper before germination	Prazam	small grain and cob, low yield
multiple cob > 2	similar grain during threshing select cob from the field	not covered by husk in the top,	Thumsi	Small plant
many grain in a cob	pure seeds	damaged by rain and insect from the open top,	Seto Masino	Smut
high protein,	Large and long cob	cut worm (Khumre), black insect on the top of plant if no rain and eat leaf by insect	Kaseli	Black flour
large grain even in the top of cob	From storage	Sterility	Bikase Sano	
3- 4 cobs with grain in all cobs	Large cob not damaged by insect after harvest	Smut Monkey	Galangwa	
Similar grains in a cob	Good seed during threshing	<i>Ghoon, rat, putla</i>		
Suitable to Lek	White grain cob during sun drying	<i>Dumsi, Badel, Bhalu</i>		
Tall plant	Select just before seeding by removing small grain and rotten grains	Lodging		
Insect and disease resistance	Seed from central part of the cob	Stem borer		
Not able to damage by animal		Drought		
Need of low inputs		Rotten by more water		
Tasty		Stalk become dry before maturing cob		
Easy for grinding				
Dwarf				
More flour recovery				
White grain				
Smut resistance				
Suitable to plant any time				
Mendogaon, Thuman VDC				
More cob	Early matured	Insect damage before germination	Philinge	Long duration variety
Good for <i>Pakho bari</i>	Medium size cob	Smut	Brazam	Small cob
Long cob	Full grain cob	Insect during flowering	Gosryang	Low yield
Medium size grain			Kudang	new variety

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Short duration crop so that two crop can grown in a year	Large grain and cob	Barren		Dwarf plant
High yield (1 <i>mana</i> seed can yield 1 <i>muri</i> grains)	Not damaged by insect	Blight in cob		Very susceptible to Dumsi
Suitable to off season	Not rotten	Drought		
Large cob	Cob from the field	Monkey, <i>Syal</i> , <i>Bhalu</i>		
Insect disease resistance	Early matured cob similar grain	Weeds		
Early				

Table 28B. Seed related information and lost landraces of maize in three villages of Dandagaon VDC

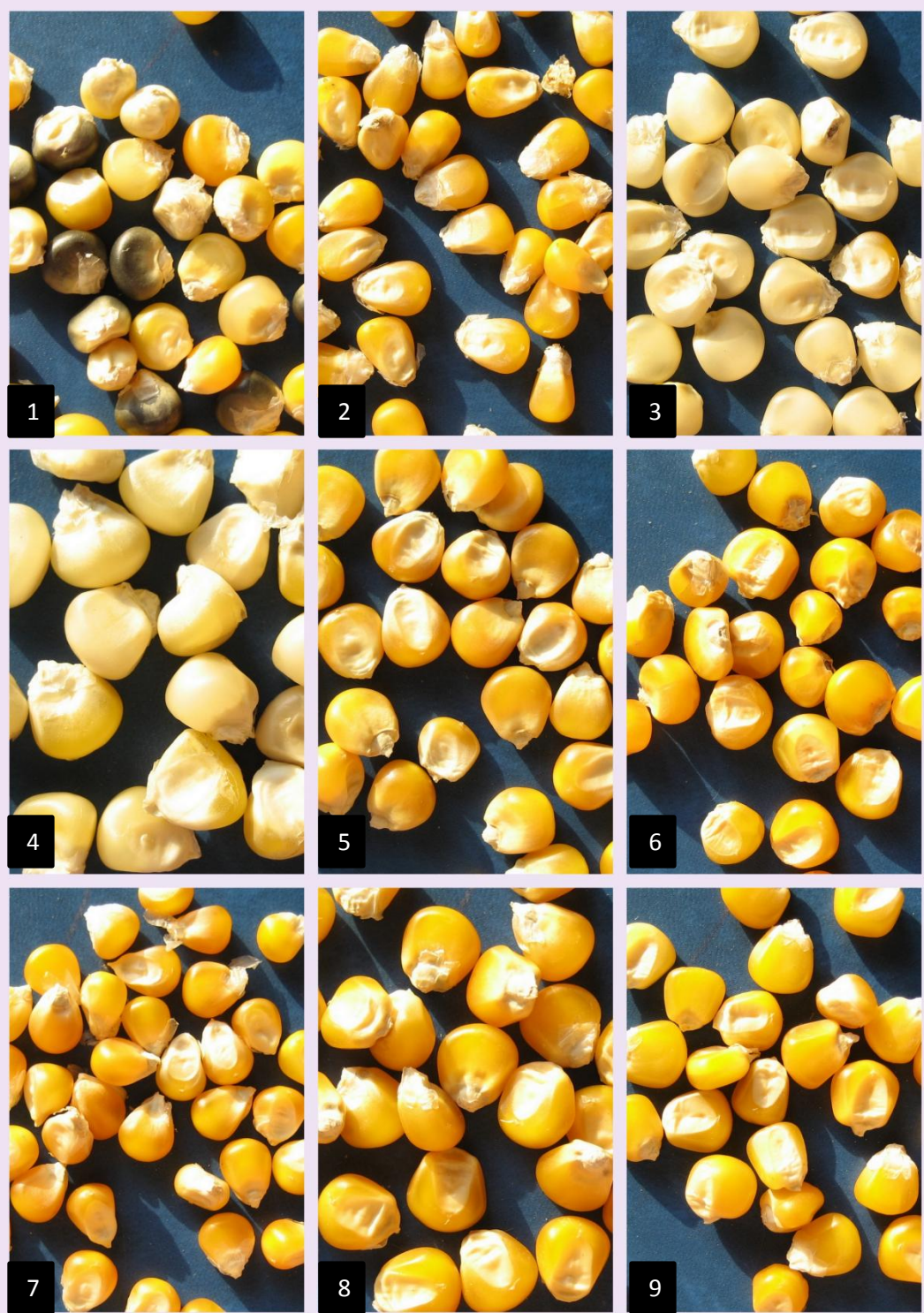
Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Karmaryang, Dandagaon VDC				
Dwarf	Large and shiny grains before seeding	<i>Khumre</i> , borer	Kalda	Low yield
Non lodging	Grains from mid part of the cobs	Smut	Pangre	Lodging
Large cobs		Sterility	Brodoma	Wind damage
Good Putla resistance	Large cobs	Tall	Bajange	Small grains
Drought tolerance	By removing small and very large grains	No rainfall due to which germination is poor	Jhibre Makai	Tall
Many grains per cob	Plumpy grains	Root damaged by insects	Chaite makai	Not suitable to Bari land
Suitable even in late planting	Insect free cobs	Low yield	Ur Sherpapangre	
Long cobs		Storage pests	Local Sano (Sano Makai)	
Suitable to Lek		Low germination if more rainfall	Amricane Makai	Not tasty
Early		Lodging	Pahenlo	
Insect resistance		No manure	Chulthi	Availability of improved seeds
Tasty		Insects (<i>Goon</i> , <i>Putla</i> , <i>Khumre</i>)	Ne	
High yielding		Rotten	Thunse	More insects
		No bull to plough	Seto Thaniya	
			Korche	
Dandagaon, Dandagaon VDC				
High yielding	Insect free cob	Lodging	Korje Pahenle	Low yield
Tasty and nutritious	Seeds from mid portion of cob	Borer, <i>Lahi</i> , Termites	Kakani	
More income	Selecting cobs from the field	Smut	Thulo Pahenlo	Availability of improved seeds
Large cob	Insect free grains	<i>Khumre</i>	Jaiphale	

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Tasty	Shiny and plumpy seeds	<i>Putla</i> and Goon	Thulo Seto	Tall
Dwarf	Removing insect infected plant	Beetle	Thulo Korje	Need early planting
Non lodging	Selecting cob and removing seeds from top part of the cob just before seeding by	Tall	Bangare Makai	Late maturity
Insect resistance		No irrigation	Sano Korje	Lodging
Smut resistance		Low rainfall	Jharlangi	
Local but high yielding	Cob with long husk	No germination if no rainfall	Jaiphale	
Long cob and multiple cobs like Jharlangi	Small spadix	Turn seedling yellow after emergence	Seto Ghange	Lodging
Non lodging		Blight	Poche Makai	
Drought tolerance		Root cutting insect	Rato	
Suitable in water logged condition		Powdery mildew	Putali	
Early				
Suitable even in late planting				
Cold tolerance				
Siruchet, Dandagaon VDC				
Dwarf	Insect free and good out look cob	Lacking of timely rainfall	Pahenle Ramre (Pahenle)	Low yield
Large cob	Large cob	Tall and lodging	Ur	More insect
Insect resistance	Large grain	Insect (<i>Khumre, Goon, Putal</i>)	Julthe (Julthe Kale)	Drought susceptible
Tasty	Seeds from the mid portion of cob	<i>Bunga?</i>	Bajange	Availability of improved variety
Dwarf	Early matured cob	Borer	Tar Makai	
High yielding	Cob fully covered by husk	Insect in cob	Kakani	
Large grain	Seed from lower portion of cob	Disease	Khumaltare	
Non lodging		Difficult to find labor and ox	Jaiphale Seto	
Early		No irrigation	Sanu Makai (Lekko)	
Drought tolerance		Smut		
Short duration variety		Powder mildew		
Suitable to Lek				

Seeds only from the mid portion of the cob mature in the same time. Lodging is the main problem in maize. If yellow seed is planted, red seeds appear and vice versa. *Timur* is used in store for insect.

Landraces from Thuman VDC

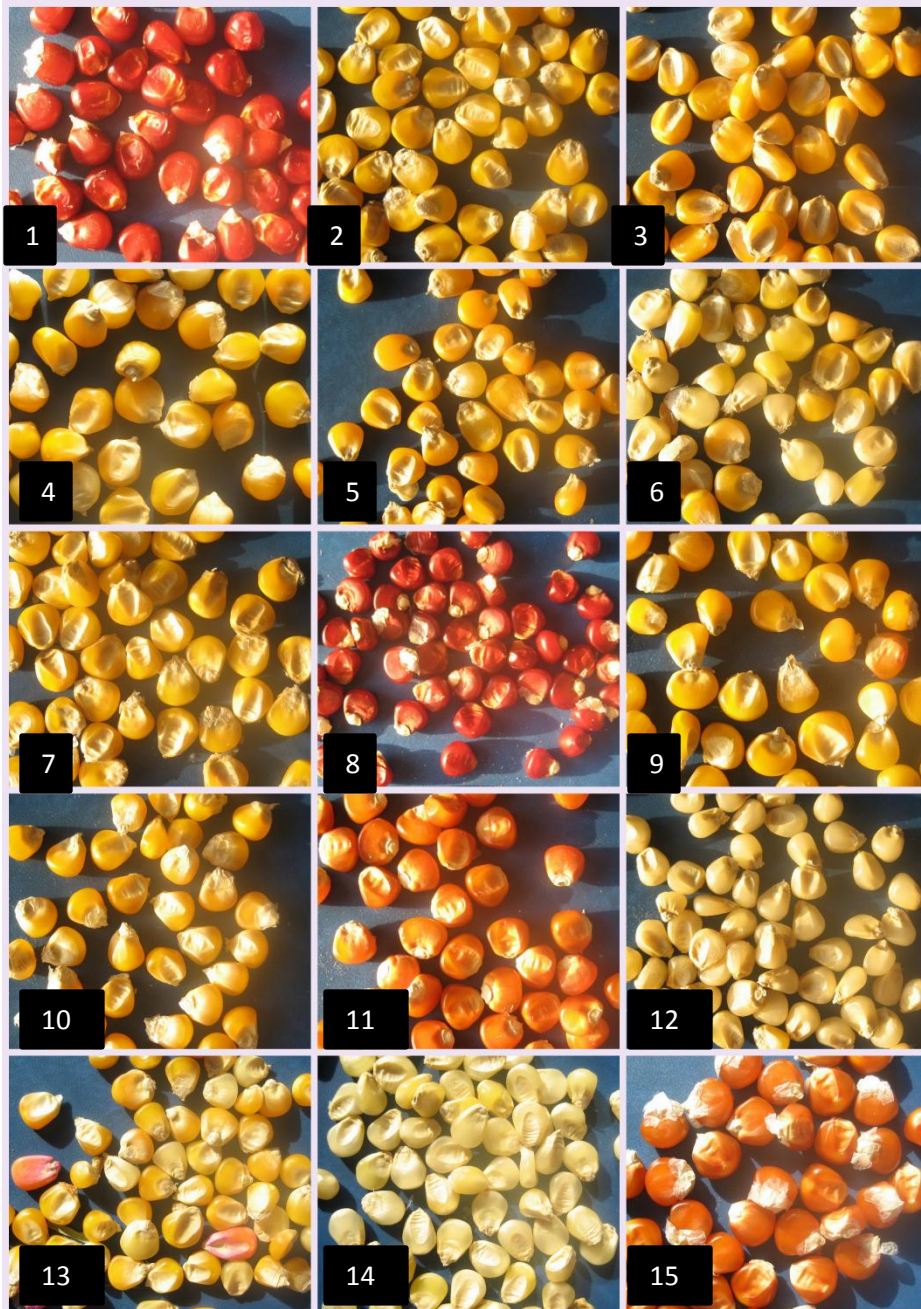
Figure 30. Landraces of maize from Thuman



1. Balba, 2. Khumal Pahenlo, 3. Khumal Seto Sano, 4. Khumal Seto Thulo, 5. Khumal Pahenlo Thulo, 6. Kaseli, 7. Murali, 8. Pahenlo, 9. Bikase

Landraces from Dandagaon VDC

Table 31. Landraces of maize from Dandagaon



1. Putali Rato, 2. Sanu Pahlenlo, 3. Bikase Pahlenlo, 4. Putali, 5. Sano Pahlenlo, 6. Bajange, 7. Ghahunale, 8. Putali rato, 9. Local Pahlenlo, 10. Putali Pahlenlo, 11. Putali, 12. Seto Local, 13. Local, 14. Seto Bikase, 15. Putali

Bean

Lanraces richness in bean maize was relatively higher in Dandagaon than Thuman VDC. Both modern and local landraces are being grown, however most of them are local. Seto Simi was grown by many farmers in more area in Thuman VDC. Ghiyu Simi which is modern variety was grown by many household in more area in Dandagaon. Generally many of the landraces were grown by few household in few areas in both VDCs. Seto Simi is popular in both VDCs. Most of the household reported that area and production of each landrace and variety ove the year was same. Only few farmers reported either increase or decrease in area and production of maize landraces.

Area and productivity of each bean landrace are given in Table 29. Area of Seto Simis was the highest in Thuman and the area of Dalle Simi was the lowest. Rato Simi produced the highest grain and Seto Chirke lowest in Thuman VDC. In Dandagaon, Ghiyu Simi was grown in many areas and area of Seto Chiipe and Seto Kalo was the lowest. Dlle simi produced the highest grain and Chirbire Ghiyu Simi lowest in Dandagaon VDC.

Characteristics of each of landraces of bean reported by the farmers are given in Table 30. Seed related traits along with general problems are presented in Table 31. Farmers reported very few lost landraces from these areas.

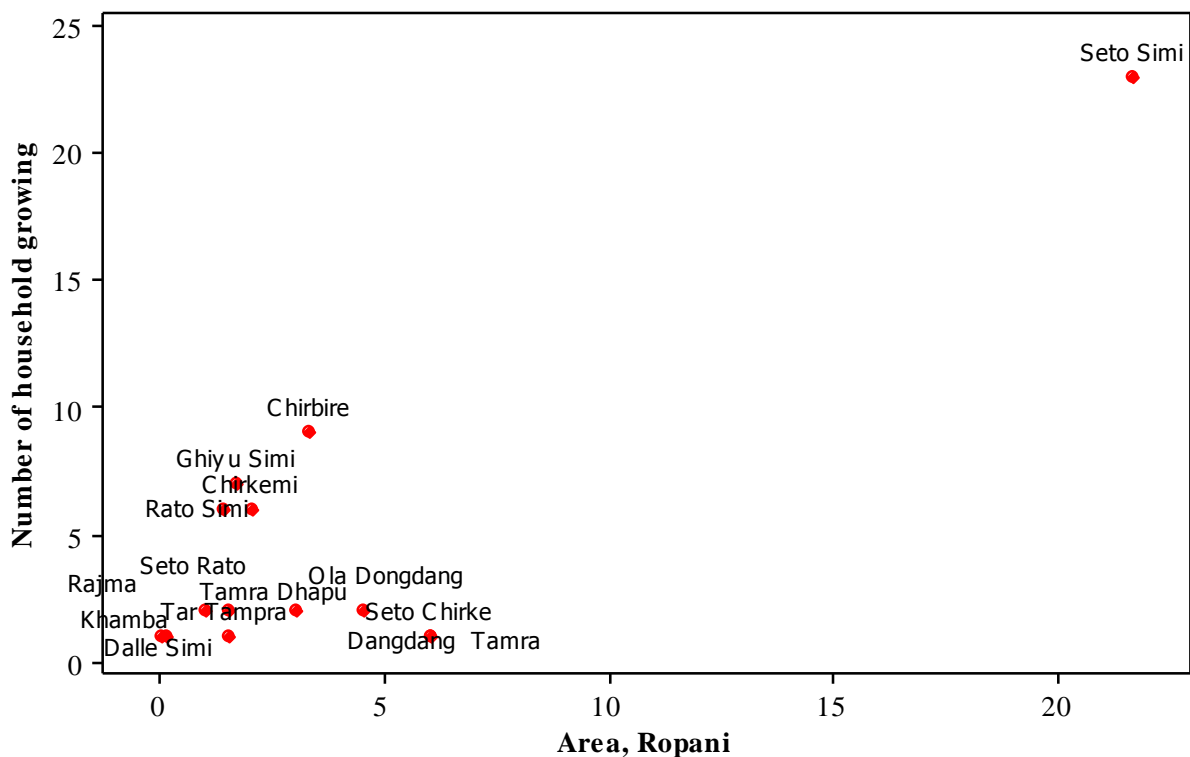


Figure 32A. Distribution of bean landraces in Thuman VDC

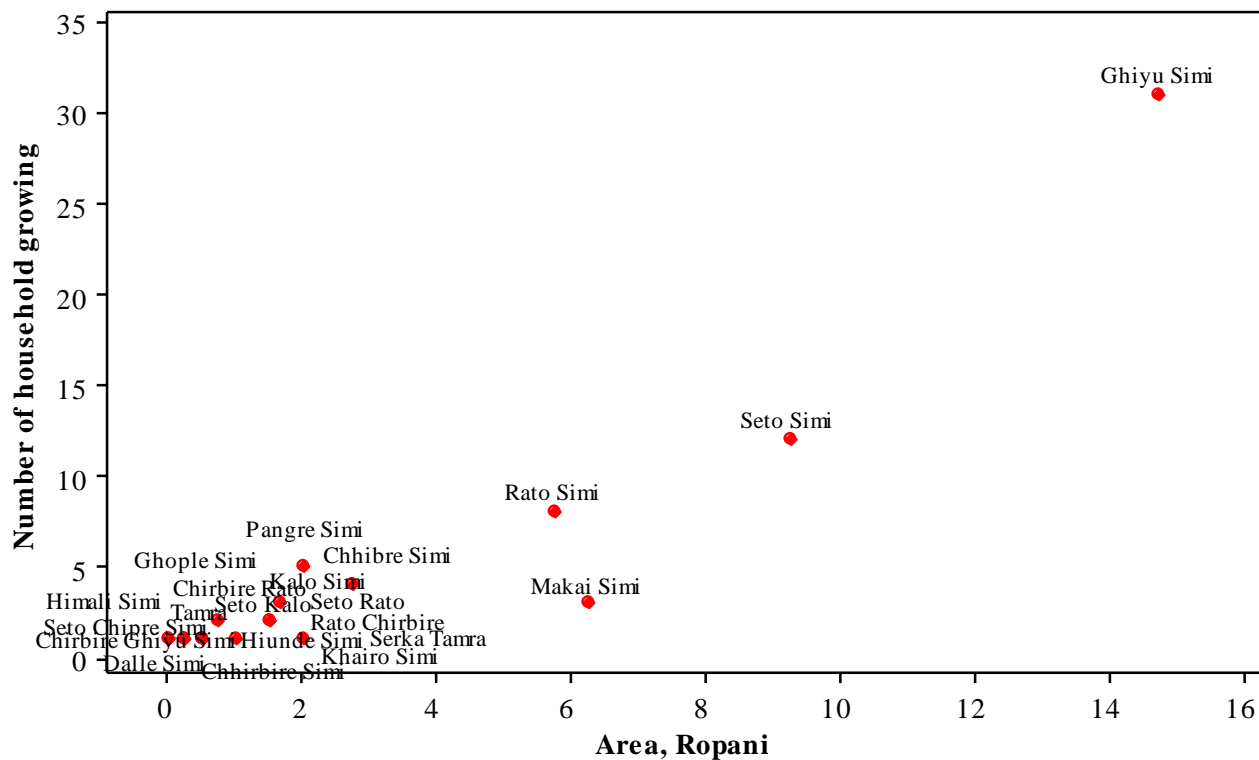


Figure 32B. Distribution of bean landraces in Dandagaon VDC

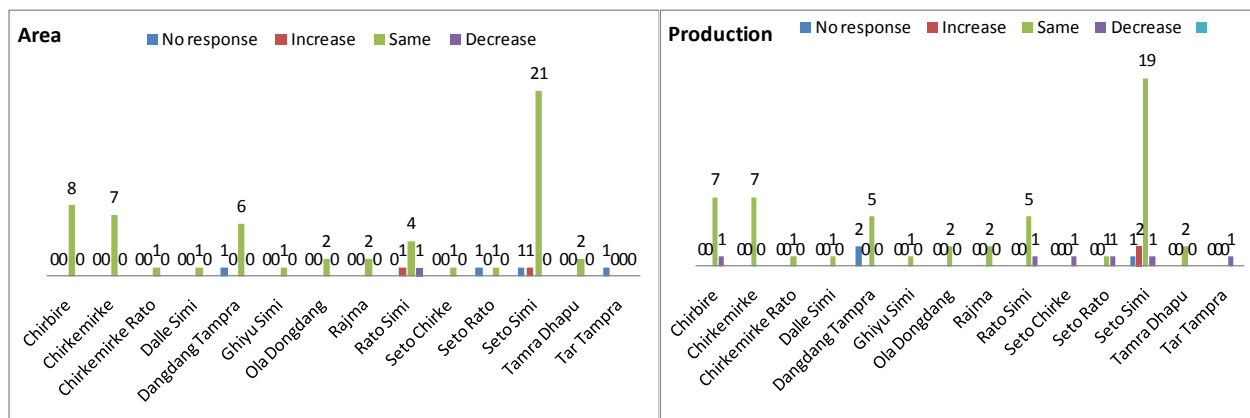


Figure 33. Farmers' response on the status of bean landraces in term of area and production over the time in Thuman VDC

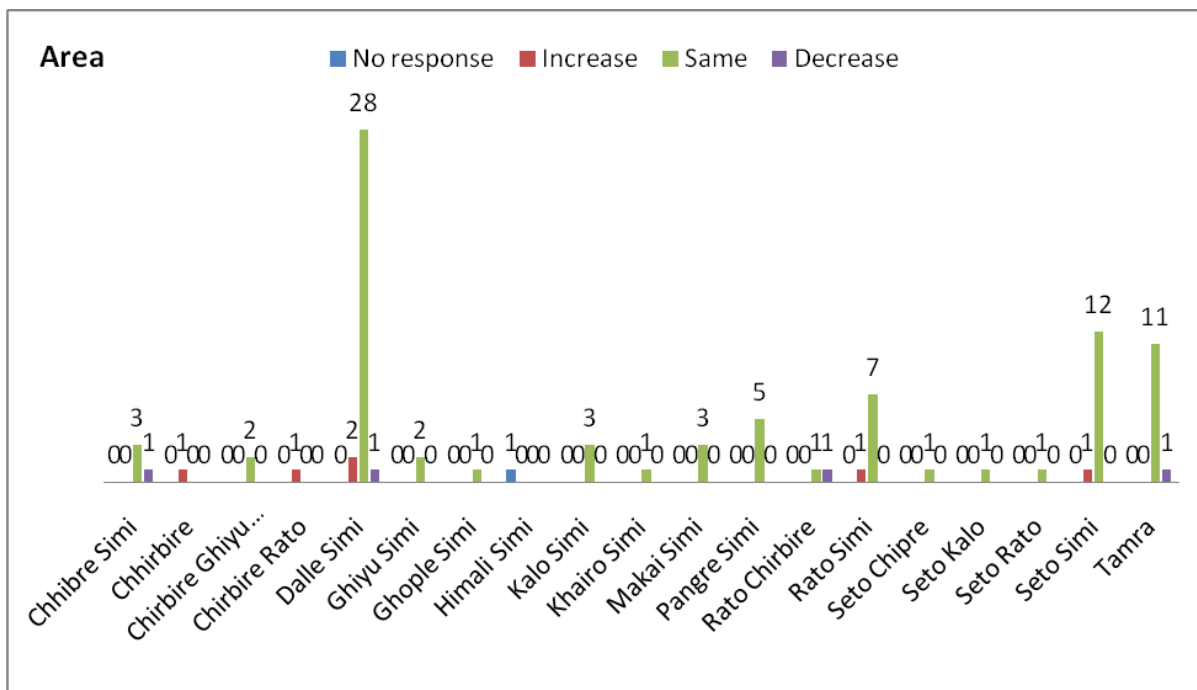


Figure 33A. Farmers' response on the status of bean landraces in term of area over the time in Dandagaon

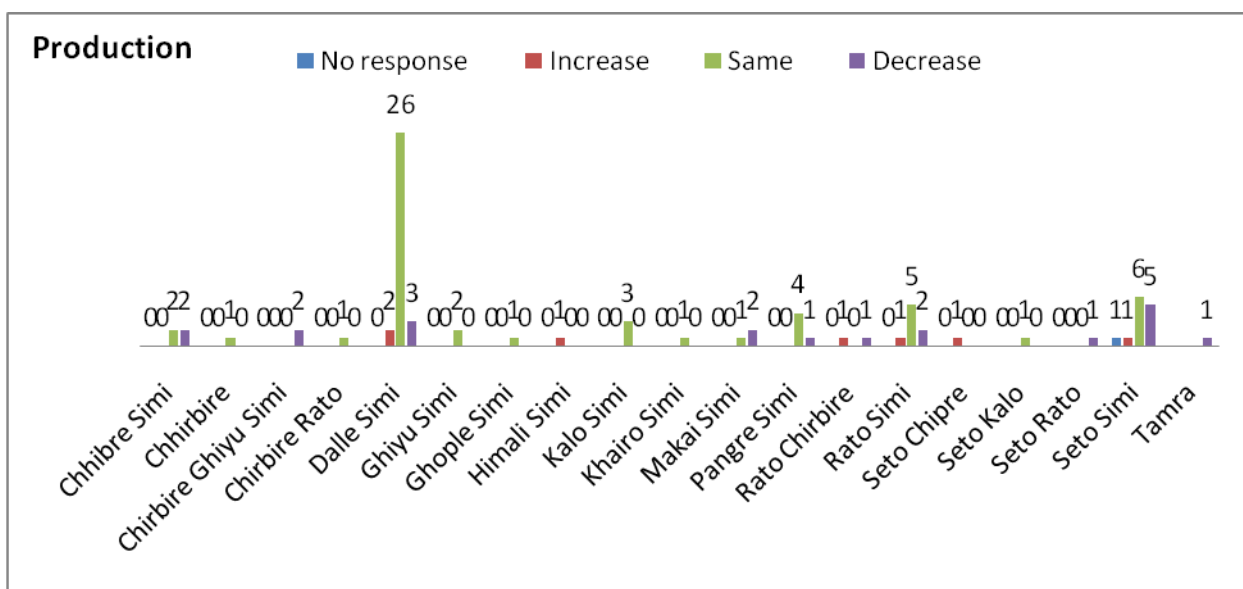


Figure 33B. Farmers' response on the status of bean landraces in term of production over the time in Dandagaon

Table 29A. Area and productivity of bean landraces in Thuman

Landrace	N	Area, Ropani					Productivity, kg/Ropani			
		Mean	SD	Min	Max	Sum	Mean	SD	Min	Max
Chirbire	5	0.36	0.175	0.15	0.6	1.83	53.5	36.64	12.5	100
Chirkemirke	6	0.33	0.175	0.075	0.6	2.025	306.7	633.7	30	1600
Chirkemirke Rato	1	1.5		1.5	1.5	1.5	10		10	10
Dalle Simi	1	0.15		0.15	0.15	0.15	20		20	20
Dangdang Tampra	1	6		6	6	6	7.5		7.5	7.5
Ghiyu Simi	4	0.42	0.40	0.12	0.99	1.71	24.17	20.62		50
Ola Dongdang	2	2.25	1.06	1.5	3	4.5	54	65.05	8	100
Rajma	1	0.99		0.99	0.99	0.99	18.18		18.18	18.18
Rato Simi	5	0.27	0.18	0.03	0.45	1.38	493.3	413.6	20	900
Seto Chirke	1	6		6	6	6	0.5		0.5	0.5
Seto Rato	1	0.75	1.06	1.5	1.5	1.5	14		14	14
Seto Simi	18	1.20	1.50	0.03	6	21.66	117.6	323	5	1400
Tamra Dhapu	2	1.5		1.5	1.5	3	124	164	8	240
Tar Tampra	1	1.5		1.5	1.5	1.5	120		120	120

Table 29B. Area and productivity of bean landraces in Dandagaon

Landrace	N	Area, Ropani					Productivity, kg/Ropani			
		Mean	Min	Max	SD	Sum	Mean	Min	Max	SD
Chhibre Simi	4	0.69	0.25	1	0.375	2.75	37	12	70	24.25
Chhibire	1	0.50	0.5	0.5		0.5	60	60	60	
Chhibire Ghiyu Simi	1	0.50	0.5	0.5		0.5	6	6	6	
Chhibire Rato	1	1.00	1	1		1	30	30	30	
Dalle Simi	1	0.50	0.5	0.5		0.5	180	180	180	
Ghiyu Simi	31	0.48	0.25	1	0.31	14.75	42.32	6	144	37.86
Ghople Simi	2	0.38	0.25	0.5	0.18	0.75	48	36	60	16.97
Himali Simi	1	0.25	0.25	0.25		0.25	40	40	40	
Kalo Simi	3	0.55	0.25	1	0.40	1.65	28	15	45	15.39
Khairo Simi	1	2.00	2	2		2	7.5	7.5	7.5	
Makai Simi	2	3.13	0.25	6	4.07	6.25	19.25	2.5	36	23.69
Pangre Simi	5	0.40	0.25	0.5	0.14	2	58.8	18	120	38.51
Rato Chhibire	2	0.75	0.5	1	0.35	1.5	46.5	18	75	40.31
Rato Simi	8	0.72	0.25	2	0.60	5.75	45.75	15	96	25.09
Seto Chipre	1	0.25	0.25	0.25		0.25	36	36	36	
Seto Kalo	1	0.25	0.25	0.25		0.25	12	12	12	
Seto Rato	2	0.75	0.5	1	0.35	1.5	22.5	9	36	19.09
Seto Simi	12	0.77	0.25	2	0.63	9.25	61.13	1.5	360	102.4
Tamra	1	0.5	0.5	0.5		0.5				

Table 30A. Bean landraces and their features reported by the farmers in Thuman VDC

SN	Landrace	Value	Preferred traits	Un preferred trait	Grower HH	Remarks	
1	Ola Dongdang (Chirkemirke Rato)	Market value	Large grain	No grain in lower part of the plant	1,5,35		
			Religious	high yield			
				Tasty			Low yield
				Very large after soaking			
2	Tar Tampra (Seto Simi)	Market value	Good for use as Khole	Rot stem/vein fast	1,5,11,12,47	Very white like snow	
			Good for vegetable and Dal	Insect problem in pod	16,22,31,38		
			Many veins (branches)	Dumsi, Badel	39,41,42,45		
			Storage pest low	Not good to use green pod			
				Small pod and grains			
			High grain yield	Annual			
3	Rato Simi (Bikase)	Market	Soft pod	Rotting problem if rain more	2,38,41,45,47		
			Large grain	Flower abortion			
			Good for sick person	Low yield			
			Vitamin A rich				
			Tasty				
			Good for use as vegetable and Dal, can use green pod				
4	Chirkemirke (Chirbire)	Market	Large gain	Low yield	2,9,10,12		
			Very good for vegetable and Dal	Plant type not good (Jingringha)			14,15,17
			High yield	Low market value			39,42,43,44
			Fast germination				
			Large pod	Need of sticks			
			Good to eat just after boiling				
			Good outlook of grain	Low market value than Seto			
			Many pod per nodes	Short pod			
			Tasty				
			Good after	Insect			

SN	Landrace	Value	Preferred traits	Un preferred trait	Grower HH	Remarks
			boiling			
			Vein and plant residue good for animal			
5	Ghyiu Simi	Market	Whole pod can be used as vegetable	Low pod yield	2,3,9,46	
			Tasty	More water count not resist	21,39,42	
			All prefer it	Plant die fast		
			High yield	Insect problem in root		
			Many pod in a node			
			Long and large pod			
			Early flowering			
			Good for vegetable (green pod)			
6	Chirbire Rato (Miple)	Religious (durng Maghe Sankranti)	Good for vegetable and Dal	Need stick every year	3,29,34	
			Easy to cultivate			
			Good for Khole			
			Tasty			
			Early			
7	Rato Simi	Market	Whole pod can be used as vegetable	Plant type not good	6,7	
		Religious (Khole during Maghe Sankranti and Lohsar)	Very tasty Khole	Market value low		
			Tasty for use as roast	Insect problem		
			Good for Dal and vegetable	Need of sticks		
8	Seto Simi	Market	Good for Dal and vegetable	Not tasty	7,8,9,14	
			All grains are similar in size	Annual	15,17,28,46	
			Not storage pest	Small grain	19,30,40,43	
			Early	Insect cut just emerged plant	21,24,26	
			Water logged tolerance	Low yield		
			Plant remain green long time	Late flowering		

SN	Landrace	Value	Preferred traits	Un preferred trait	Grower HH	Remarks
			Long veins	Need of sticks		
			Tasty	Pod turn black		
				Not good for vegetable (rough)		
				Not good to eat more (Ringata Lagne, vomiting)		
				Insect damage root and just emergence plant		
				Plant die faster		
9	Rajma (Rato Chirbire or Tamra Dhabu or Pangre)	Religious (for Lohsar and Maghe Sankranti)	Good for Khole, vegetable and Dal	Pod borer	8,22,46	
		Medicinal (during body uncomfortable)	Large grain	Drought susceptible	16,23	
			Large plant	Annual		
			Early	Insect and disease problem		
			Tasty			
			Grain become large after cooking			
10	Kamba (Khairo)	Religious (during Maghe Sankranti and Lohsar)	Soft and good for Khole	Need stick every year	32	
			Early	Need more fertilizers		
			Very tasty grain to make vegetable	Insect damage just emerged shoot		
			Whole pod as vegetable	Should be planted thin		
11	Dalle Simi		No need of stick	More insect problem	41	

Introduced from the market therefore, did not know the time of planting which resulted no yield

Table 30B. Preferred and un preferred traits of existing landraces of bean in Dandagaon VDC

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
1	Chirbire	Market	Tasty	Plant turn yellow	1
			High yielding	High insect and disease	
2	Ghiyu Simi	Market	Can use green pod for vegetable	Lahi	1,2,3,6,7 49,51,52
			All year round fruiting	Plant become yellow	11,15,18
			Large pod	Flower abortion	53,54,55
			Sweet Dal	Black spot in pod	57,58
			Immature pod good for	More husk than grain	8,10,16,39

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
			vegetable		44,45
			Tasty	Pod borer	43,46,60,63
			Pod (even after threshing grains) can be stored after drying	Few pod per plant	28,29,30,32 35,47
			Early	Water logged susceptible	
			Soft pod	Blight	
			Suitable to eat raw	<i>Jureli</i> eat flower	
				More husk and less grains	
				Low yield	
				Low grain set	
				Pod borer more	
				Insect (<i>Khumre</i> , Butterfly) cut plant	
3	Rato Chirbire	Market	Its <i>Dal</i> is tasty	Cut worm	2,23
			Fast cook	<i>Lahi</i> , beetle	
			Sweet		
			Early		
4	Seto Simi	Market	All like it	Need more time to cook	2,6,7,8,49
			High yield	Small grains	10,16,21
				Low yield	24,25,26
			Good for green pod	Insect (<i>Lahi</i>), root cutting insect	53 47
			Good for <i>Dal</i>	Not good to use whole pod	
			Suitable to mix with other vegetables	Difficult to cook	
			Good for vegetable and pickle after boiling	Late maturity	
				Rotting plant during flowering	
				Plant dry fast	
				Blight	
				Low market value	
5	Dalle Simi		Fast cook		2
			Tasty		
			High yielding but less than Chirbire		
6	Chhibre Simi (Chhibre Rato, Jibre, Chhibre Seto)	Market	Small pod and grains	Large plant but low podding	3,9,11,13,39
			Many pods and grains	Insect damage just emerged plant	51
			Tasty	Butterfly in flowers	
			Good for vegetable	Pod borer	
			Early	Low yield	
			Long vein	Water susceptible	
7	Rato Simi	Market	Sweet		4,6,8
			Locally available	Insect	10,15,16
			Many grains	Not suitable to use whole pods	19,22
			Suitable to mix with other vegetables	Rotten even in low water	
			Dwarf	Pod borer	
			Need low manure and stick	Need more time to cook	
			High yield	Late maturity	
			Large vein	Low yield	
			Early	Lodging	

SN	Landrace	Value	Preferred traits	Un preferred trait/ problems	Grower (HH#)
8	Ghople Simi		Good for vegetable	Insect Rainfall damage	7
9	Pangre Simi (Rato Chirbire)		Very sweet (more sweet than other beans) Good for vegetable, suitable to mix with other vegetables Early High yield Long harvesting time	More insect Dry in drought period Rotten	12,18,20 21,55
10	Kalo Simi	Market	Good for and <i>Dal</i> vegetable Insect resistance Suitable to mix different vegetable Large pod High yield	Dwarf Insect in early stage <i>Khumre</i> Low yield Less pod Rotten	12,48,50
11	Seto Rato	Market	Sweet Good for vegetable and <i>Dal</i>	Thin (few) pods Insect during flowering Slow growth	14,31
12	Goplo		Tasty Fast to cook	Low yield	21
13	Makai Simi		Good for growing together with maize and reduce insect infestation Improve soil fertility Good for vegetable	Fast rotting Take time to cook Not good to use whole pod Low yield Small grain	33,36,46
14	Tamra		Good for vegetable Less insect		33
15	Khairo Simi	Market	Good for vegetable and <i>Dal</i> Long vein	Pod borer Rotten in more water	38
16	Serka Tamra		Perennial Year round fruiting		52
17	Hiunde Simi (Kalo)		Perennial Year round fruiting Large pod Large grain Can use whole mature pod		54
18	Himali Simi		Good to use whole pod High yield Suitable to grow any time	Few grains <i>Lahi</i> Blight	?

Table 31A. Farmer practices and their interest in bean in three villages of Thuman VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Dalphedi, Thuman VDC				
Improved and suitable to this area	Remove black and rotten pod and select large seed	Insect damage root and shoot		
Large pods and grains	Early matured pod	Flower abortion		

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Bushy (no need of stick) and more branching type	Large and good pod	Pod borer		
Early	Grain from storage	Pod turned black		
High yielding	Fully matured pod from the field			
Good for <i>Dal</i>	Not damaged by insect			
Insect and disease resistance				
Thuman, Thuman VDC				
Grain in all pod	Not rotten pod and plants	Same variety in all times	Thanam Tamra	
Perennial	Similar grains	Damaged just seeded grains, root and immature pod by insects		
Many pod	Plumpy seed	Insect damage pod		
Long pod	Large and good pod	Root damaged by insect if soil is dry		
Resistance to water logged condition	Shiny grains	If insect cut the plant, more branching but no pods		
Bushy (no need of stick) and more branch	Good pod	Pod become black		
Many pod in a node	Not damaged by insects	Rat cut the plant		
High yielding	Good looking	Pod borer		
New variety	Long pod	Needs of sticks		
Insect and disease resistance	Large grains	Should be planted in rainy time		
Not able to damage by animals	Not shrunken seeds	Grain outlook is not good		
Need of low inputs	Not rotten grains	Leaf drooping		
Tasty				
Long vein				
Pure seed				
Suitable for planting any time				
Mendogaon, Thuman VDC				
High yielding	Early matured pod which is opened automatically after sun dried	Insect in pod and leaf		
Local	Not damaged by insect	Pod turned black		
Bushy (no need of stick)	Not rotten			
Many pod from a nodes	Large grain	Grasshopper and wild birds		
Not Chirkemirke and white simi		Seed rotten due to more water		
High yielding within a short period of time				
Rato simi				
Insect and disease resistance				

Thanam Tamra Simi is very bushy type and no need of stick like Pothre Simi

Table 31B. Seed related information and lost landraces of bean in three villages of Dandagaon VDC

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
Karmaryang, Dandagaon VDC				
No need of stick	Insect free large pods during harvesting	<i>Lahi</i> insect	Seto Makai Simi	Low yield
Large and round seeds	Selection of pods and	Plant turn dry	Seto	Low yield

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
	grains			and more insect problem
High yielding	Good pods	Insect cut the plant	Pruntung	Disease
Perennial	Insect free shiny grains	Rotting		Due to <i>Dumsi</i>
Large pods	Fully matured seeds	<i>Khumre</i> , Butterfly		
Tasty	Not shrunken seeds	Needs of stick		
Many pod per nodes		Plant dry during maturity		
Many grains in a pod		Poor germination in drought period		
Suitable to eat whole pods		Flower and shoots damaged by insects		
No need of stick				
Long plant				
Good even in high rainfall				
Mottle (multi color seeds)				
Early				
Suitable to seed any time				
Insect (pod borer) and disease (blight) resistance				
Dandagaon, Dandagaon VDC				
High yielding	Selecting pods during harvesting	Flower abortion	Makai Simi	
Insect resistance	Removing small grains	Low pods	Tane Simi	Drought
High grains	Not rotten	Insects (beetle, <i>Lahi</i>)	Seto Simi	Low yield
Plant remaining green for longer time	Long and good out look pod	Slow growth		
Long pod and large grains	Large and plumpy grains	Plant die		
Tasty		Rotten during rainy season		
Long plant		Pod borer		
Many pods per node		Small grains		
Soft cobs		Need more inputs		
Suitable to use green pods				
Suitable to grow in any time				
Siruchet, Dandagaon VDC				
Long vein	Insect free large pod	Insect (<i>Lahi</i>)	Chhipre Pangre	Low yield
High yielding	Selecting good grain and mixing them in ash	No germination in water shortage	Makai Simi	More insect
Large grain	Long pod	Quickly rot in case of more water	Seto	Drought
Insect and disease resistance	Large grain	Root cutting insect	Kalo	Not suitable to eat whole pod
Many pods per node	Plumpy grain, not shrunken	No pods in poor soil		
Suitable to use whole		Blight		

Your needs	Criteria and method of seed selection	Problems	Lost landraces	How lost
pod				
Able to harvest all year round		Plant die early		
Red flower		Blight		
Long and large pod		Weed		
Many pods per plant		Lacking of seeds		
Early				

Pruntung bean is planted with maize.

Figure 34. Bean landraces from Dandagaon



1. Himali Simi, 2. Dalle Chirbire, 3. Dalle, 4. Seti Simi, 5. Seto Kalo Ghiu, 6. Kali Rato Chirbire, 7. Hiunde Simi, 8. Ghiu Simi, 9. Chirbire, 10. Jibre Rato, 11. Makai Simi

DISCUSSION

Agroecology

Due to different ecological variation within a VDC, different landraces of cereals and pulses are being maintained over the time. Cereals are the most important group of agricultural crops. Most of the people depend on cereals for their livelihood. Landraces available to these two VDCs are agro-ecologically adapted to different niches and micro environment. All these landraces have their own value eg adapted to specific environment and culture etc. Variability in landraces supports the diverse needs of farmers and consumers over the different areas. Agroecology based crop improvement program should be launched for maintaining the local diversity.

Socioeconomic

Socioeconomic factors are very important in conservation works. They are directly related to crop diversity. All social value, cultural value and economical value of landraces are considered by the farmers for continuing cultivation of these landraces. Generally rich farmers having high social status have more crop diversity.

Landrace richness

Significant diversity which is directly related to farmers' livelihood exists at all levels ecosystem, genera, species and genetic levels. Relatively these VDCs are affected less by modern technology and have maintained indigenous crop species and variety. However, near to market and headquarters, landraces richness is being lost. Culture value and land type are the major determining factors for the continue cultivation of particular landraces.

Rice is the most important crop and many farmers want to cultivate it. Modern as well as landraces of rice are found in these areas. While most of the rice cultivation is done under lowland (wetland) conditions, upland types are also found in these areas. A broad spectrum of resistance to various diseases and insects has been reported by the farmers. Many farmers reported that some landraces are lost over the time. Mostly the loss is related to low grain yield in farmers' fields. Therefore, productivity is necessary to increase for enhancing the conservation. Sustainable management production system should be developed in the context of changed environment. Due to various factors eg modern cultivars, land management system etc, genetic erosion is reported in rice. Genetic erosion must be minimized for long-term food security. Expensive method of ex situ conservation is very difficult to maintain in developing country like Nepal, therefore on farm management of agrobiodiversity should be emphasized. In addition to these, production and productivity of rice is greatly hampered by disease and its management through only chemical is not a solution. Therefore, low yield, losses of genotypes and diseases infestation in rice are the problems that should be considered for program development.

Due to sloppy land in the most of the farming field, maize is the number one crop. Different types of maize variety are found, however, improved variety has dominated farmers' field. Diversity are reported in maturity days, quality, cob size and plant height. Short duration landrace, called Sathiya is very useful for upper part of these areas.

Buckwheat is one of the important food crops in the temperate and hilly region. Two cultivated species (*F. esculentum* and *F. tataricum*) are the staple and life supporting crops in the remote food deficit areas of Nepal. Buckwheat is an important crop in terms of its adaptation to diverse climatic conditions, moisture stress regime, nutrient limitation and cool temperature and it fits well to different cropping patterns due to its short growing period. It possesses high nutritional and medicinal values and is used as a raw material in preparation of different health foods. However, buckwheat has been an under-exploited and there are very few number of landraces in these VDCs. Most of the farmers have reported that, high stable yielding varieties are not available to the farmers. They have to depend on their traditional landraces. In comparison to the cereal crops, the seed yield of *F. esculentum* is often

relatively low and unstable. Tartary buckwheat on the other hand has a tightly adhering husk that is hard to remove, a low groat content and contains a bitter component that limits its use as a food although there has been recent attention being given this species due to its having compounds that are beneficial to health. Progress on crop improvement in common buckwheat has been slow due to its out crossing nature (sled incompatibility) and also due to limited variation. Small seeds, lodging, low fertility are other problems associated with common buckwheat. The finding of rice tartary buckwheat, which has a non-adhering hull and therefore dehulls very readily has been reported in Nepal. This allows the use of it as a rice replacement in the staple diet in its production areas and introduction of this landrace will be very useful to these areas.

Most important protein supplement in Nepalese diet is through grain legume. Because of its importance in soil improvement every farmer has some kinds of pulses in their field. These areas are rich in bean diversity and it has great market value. Most of the farmers grows some kinds of beans.

Genetic erosion

Over the last century, increased human population pressure, poverty, land degradation, environmental change, the introduction of modern cultivars and national policy have contributed to the erosion of crop genetic resources in Nepal. This has resulted in a loss of options to farmers to cope with change and farming community is increasingly vulnerable to access to food and livelihoods. Genetic erosion is reported to be high in at both varietal and species level. There are many examples such as local rice, beans etc whose genetic potential for quality are realized after being lost from the farmers' field. Following are the some of the major factors enhancing the genetic erosion.

- Cultivation practices of monoculture.
- Emphasis to exotic plant varieties
- Fragmentation might also have negative impact.
- Due to unconsciousness of the farmers over the indigenous landraces
- Disease and insects are the natural factors in decreasing the agro biodiversity.
- The replacement of traditional crop varieties and landraces with modern cultivars.
- Changes in land farming business

There are very limited studies on status of plant genetic resources especially on food crops, horticultural crops, fodder and pasture, medicinal and mushroom. Relatively more study was done on forest trees and shrubs about status and diversity. Informal talks indicate the lost of many landraces. Many landraces are being lost and many of them are under threat. Many endangered rare and endemic landraces should get due attention for effective conservation. Study on station of PGR, and genetic erosion over space and time should be done for better managing the agro-diversity.

Agricultural biodiversity conservation strategy

Value of agricultural biodiversity is well known. Plant genetic resources must be conserved and registered for long-term food security and economic development of the country. Patenting system of genes, crop varieties, species or crop modification technology increases the dependency of farmers and crop biologists, especially in developing countries. Biopiracy and genetic erosion are two systems of creating gap between primary users (eg farmers) and plant genetic resources (PGR)

Ex situ and field gene bank conservations are effective and costly strategy to conserve plant genetic resources including endangered and underutilized crop species or varieties. Agricultural crop biologists should have other visions of conservation in addition to these two systems. Priority should be given to endangered, underutilized and wild relatives of cultivated plants to protect effectively and economically. Nepal has 8 national parks, 4 wildlife reserves, 1 hunting reserve and 4 conservation areas, many government's agricultural farms, many public roads, buildings and areas, and many religiously protected areas eg Temple.

These 4 areas (conservation areas, agricultural farms, public areas and secrete places) are the excellent locations for conserving agricultural biodiversity in natural condition. Annual crop species eg wild rice, wild vegetables, wild buckwheat, amaranths, wild pigeon pea, grass pea, wild fenugreek etc are suitable to agricultural farms, public areas and conservation areas. Some of agricultural PGR can be used as living fences around farms, buildings, temple etc. Instead of planting non agricultural crops in non-used areas of agriculture farms, public areas etc, agriculture related non crop species should be planted which will help to get economic benefit and to conserve them.

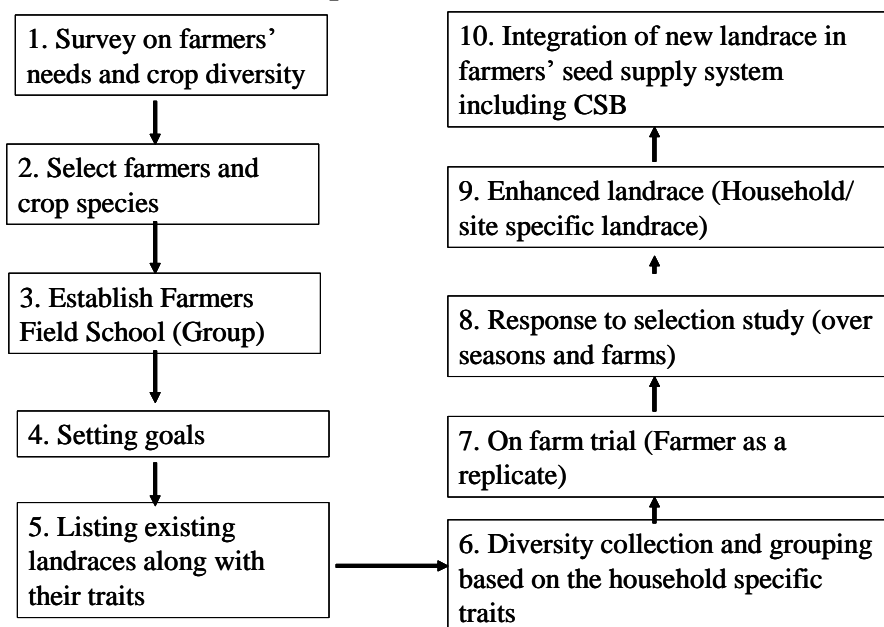
Knowingly or unknowingly farmers are conserving available biodiversity. Followings are the methods that help to conserve the agrobiodiversity, reported by the participants.

- Continued cultivation of local landraces (on farm conservation)
- Product diversification and marketing
- Following of agro forestry, mix farming
- Strong farmers’ seed network
- Ritual practices of Hindu: Like the cow some trees, shrubs and herbs have a special ritual conservation status in Hindu religious practice. Because of their perceived sacredness they are not exploited commercially or misused. Some of these species are ber, pipal, sami, lakuri, rudraoksha, and tulsii. There are many such examples. Similarly the relative importance of different food grains has strong cultural roots. This affects both the consumption and production patterns among different ethnic groups, leading to the conservation of some species and varieties and negligence towards others.
- Link to ex situ conservation system
- Community field gene bank
- School field gene bank
- Existing of INGO, NGO for agrobiodiversity conservation and sustainable use
- Participatory research
- Continued of religious and cultural systems
- Local market and regular organization hat bazaar or agriculture fair

LEC

Landrace Enhancement and Conservation program is the most important one for conserving landraces through better utilization. At least one landrace from each of these four crop species should be considered in LEC program. Its details are given below.

Landrace enhancement step



PVS

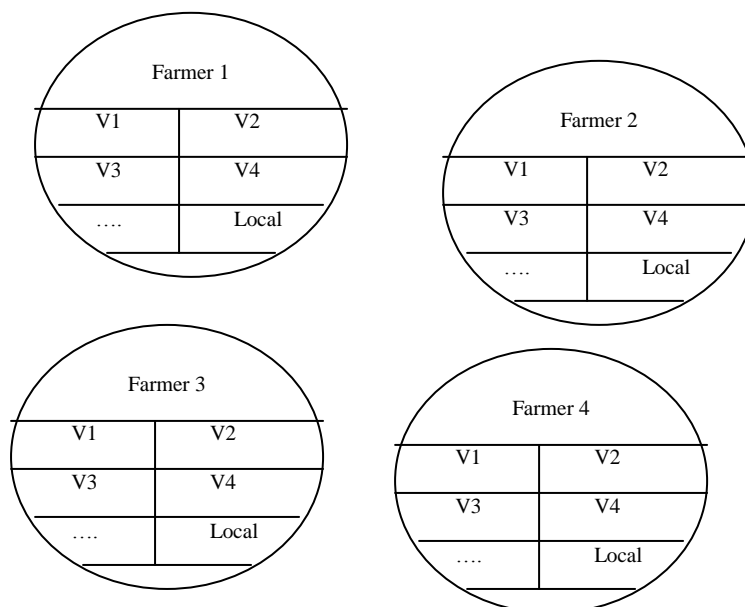
Diverse farmers’ needs and huge variation in ecogeography of Nepal have made varietal development work difficult. Informal seed network system dominates in seed sector and generally participation of farmers in research is low. For making the research more efficient and effective, participatory approach is considered main factor. Thus, participatory varietal selection (PVS) has been considered very effective method to develop site-specific variety (farmers’ needs variety), to increase yield, to disseminate technology faster and to increase biodiversity. This ultimately helps to alleviate poverty and improve food security and protect the environments.

The PVS steps are 1. Need assessment, 2. Search for test entries including local diversity, 3. Field test and evaluation and 4. Dissemination. Field layout that should be adopted is given below. There can be variations in selecting number of farmers per village, number of genotype per farmer. It will better to select at least 3 farmers per village, village should be physiographically homogenous. Number of genotypes per farmer depends on the land size of farmers and their interest. Local variety (also called farmer’s variety) should be used as a check. The trials should be conducted under farmer management conditions considering farmer as a replicate.

Workshop, field visit, traveling seminar, seed distribution and participatory selection should be regularly conducted. At crop maturity interested farmers, extensionists and researchers should be invited to observe experimental site. On the field, farmers should be requested to select the genotypes that meet their demands. Regular visit of neighbors and interaction with them can help to disseminate and select better genotypes faster. Farmer’s field day (Farmer Field School) in each farmer’s field should be organized.

Village 1

Villages/VDC:
Farmers/village:
Genotypes/farmer:



Variations in management, farm land and farmers-desire indicate the necessity of developing site-specific varieties and/or household specific varieties. PVS represent true participatory exercises as the farmers have decision for:

- Identifying the testing site,
- The time of planting,
- The level of inputs used and the cultivation method,
- Whether to use monoculture or mixed cropping and
- Taking whether or not a particular variety is suitable for their conditions.

Varietal mixture

Functional diversification is a sustainable approach in managing farm diversity. Functional biodiversity is based on the principle of using cultivars with diversified functions to limit the

development of diseases. A growing number of studies show that, in natural ecosystems, functional diversity leads to higher stability. Prolonging the useful life of resistance genes and increasing the crop productivity may be achieved by taking into account the functional differences in disease resistance and other agronomic traits of cultivars. Such functional diversification can be achieved by using multilines, isolines and cultivar mixtures.

The usefulness of mixtures, whether multilines, isolines or cultivar mixtures, for disease management has been well demonstrated for rusts and barley powdery mildews of cereals (Finckh et al 2000, Mundt 2002). Multilines are mixtures of genotypically identical lines (nearisogenic lines) that differ only in a specific disease or pest resistance gene. Multiline cultivars of rice are widely used to prevent the breakdown of resistance against blast in Japan, where the first registered rice multiline was released in 1995 (Koizumi 2001). Cultivar mixtures refer to mixtures of cultivated varieties growing simultaneously on the same parcel of land with no attempt to breed for phenotypic uniformity (Mundt 2002). The use of cultivar mixtures is considered to be more practical and requires less investment than the use of multilines because there is no need to breed new cultivars. This can be easily implemented by resource-poor farmers in developing countries— all that they have to do is mix existing cultivars with favorable agronomic traits and performance. Mixing existing cultivars with more diverse genetic backgrounds can enhance functional diversity and improve yield by providing more chances for positive interactions among cultivars. Moreover, this offers better opportunities for on farm conservation of genetic resources by allowing farmers to grow traditional cultivars. Farmers in subsistence farming communities grow several cultivars in a field or adjacent field as a strategy to cope with heterogeneous and uncertain ecological and socioeconomic conditions.

Mix cropping (growing different species in the same field) is very common practices in these VDCs. Growing non-leguminous crops with leguminous not only diversify the products but also improve the soil fertility and sustain the agriculture production system. Farmers usually grow maize with pumpkin and cowpea and/or bean which is defined as 3-sisters cropping. These 3 crops support each other, for example maize function as a stick for cowpea or bean to trail, cowpea or bean improve the soil fertility and pumpkin cover the soil preventing evaporation and weed growth. Farmers field is always rich in diversity at species, varietal and genotypic levels. Even within a landrace, diversity is found high due to which adaptability is high, disease infestation is low and production is assured even with low inputs from this landrace. However, modern variety or agriculture make farmers' field more homogenous. Farmers are well familiar with the advantages of mix cropping (growing more than one crop species in the same land) but they are not well known about varietal mixture. Varietal mixture is the practice of growing more than one variety or landrace of the same species together. This system not only secures the production, but also increases the productivity as well as help to conserve crop genetic resources on farm. Cultivars mixture is a simple and sustainable genetic resources management system to increase yield, to conserve genes and to manage diseases effectively and efficiently. For effectiveness of this system, general and specific mixing ability (GMA and SMA) of cultivars should be estimated. Similarly cultivars and landraces should be selected based on maturity days, plant height and grain quality. This system is very effective for better managing and harvesting benefits from existing agrobiodiversity and therefore should be enhanced so that functional diversity be maintained.

Varietal Hybridization

Varietal hybridization is very simple and effective method to improve population of maize landraces. Farmers generally practice selection of cobs. Varietal hybridization help to exploit heterosis in some extent at farmer levels. This should be a good starting point to initiate LEC program in maize.

Red listing and ex-situ conservation

Grouping of existing landraces in the following clusters help to select landraces for improvement and ex situ conservation. Landraces of these crop species are being plotted based on the area grown and number of household growing landrace. Based on this information, conservation strategy should be taken.

Red listing mechanism has been developed for wild fauna and flora. There are several documents illustrating red listed wild fauna and flora. But there is a lack of information on the red list and red listing criteria of agricultural crop species, varieties or landraces. For initiating on- farm, *in situ* and *ex situ* conservations, red listing is helpful in locating region of crop species, varieties or landraces diversity. Categorization of on-farm crop species, varieties and landraces is based on their areas and number of HHs growing are useful in selecting location for sampling materials for landrace improvement, ex situ conservation and appropriate sites for in situ conservation.

Red list is the list of crop species, varieties or landraces whose population are in decreasing trend (the nature of rarity) due to many factors and if such trend continue, these genotypes will disappear in future. A typology of rare species or variety is based upon the geographic range, habitat specificity and local population size (Rabinowitz 1981).



Basis of categorizing agricultural crop species, variety or landraces whether these are under red list is necessary to develop strategy for initiating *in situ*, on-farm and *ex situ* conservation appropriately. Important consideration for making the red list of crop landraces is amount and distribution of genetic diversity, process used to maintain diversity, people who maintain diversity and factors that influence farmer’s decision making maintaining diverse variety (Sthapit and Jarvis 2002).

Categorization of on farm crop landraces

Rana et al (2000) classified the rice landraces of Kachorwa VDC, Bara into four different cells depending on the average area cultivated and the number of households (HHs) cultivating them. The cut off point for average area used by Rana et al (2000) was less than or more then 0.2 ha (derived from overall average of all landraces at Kachorwa) and the number of HHs was less than or more than five HHs (derived from average of all landraces). The idea behind this categorization was that at least one representative each from four cells would be included in the participatory plant breeding program (Joshi et al 2000). This technique could be useful to understand the farmers’ rationale of allocating land area for each variety and distribution pattern based upon socio-economic and ecological factors.

		Area	
		Large	Small
Farmer	Many	1	2
	Few	3	4

On farm landrace categorization

Modern technology directly influences the diversity of landraces and continuation of cultivating local landraces. If availability of modern technology is high, there is more likely to replace local technology. Similarly, landraces cultivated by poor farmers are more likely to be replaced by modern technology than the landrace grown by rich farmers. These criteria (wealth status of farmers and availability of modern technology) are also helpful to classify landraces that are or may be endangered. Another criterion is the existence of specific production environments. The pattern of changing the land use system should also be considered to identify the landraces that are likely to be endangered.

Register is common means of documentation at community, regional and national level. Recently computer based documentation system have been in hand. A fix and complete model of documentation and information retrieval system should be developed for landraces. A strategy of documenting crop genetic resources at all VDCs by themselves is very cost effective way of registration of biowealth.

Diversity blocks

On-farm variation is important to farmers, breeders and in-situ conservationists. Variation in production environments and food value or farmers' need create diversity and help to maintain different forms of crop plants. For genetic resources conservation in situ method is treated as complement of ex-situ conservation. Information on amount and distribution of genetic diversity maintained by farmer and farmers who maintain diversity on-farm is prerequisite for effective implementation of in-situ conservation activities. This diversity should be maintained and characterized through the diversity blocks.

Value addition through non-breeding approaches

In addition to value addition through breeding approaches, marketing and diversifying products are equally important. The huge knowledge of farmers should be documented from wide range of agro-ecological zones. Integration of modern technology with farmers' knowledge will help more effectively to add value to the local diversity.

Factors shaping the diversity

The diversity distribution was also related to wealth status, farmer's market integration and a specified group of farmers. Resource endowed households and households that are better integrated in the market are more likely to grow both landraces and modern cultivars and to grow a higher number of landraces than those are not. There is direct involvement of women farmers in varietal choice, allocation of land parcels to varieties, seed selection and storage. The majority of local crop diversity are maintained by informal seed exchange within and among communities through social networks.

Knowledge on seed management (supply, production and storage) system of any crop of any place is essential for planning research and development activities and developing in situ conservation strategy for genetic resources. Seed sources and seed exchange type might be significantly related in landraces. Important factors affecting seed source might be sex and land type. Landrace specific seed supply system was not found. Due to the lack of knowledge and training support, farmers are not aware about seed selection, seed and grain production.

Households (HHs) who has more number of landraces of one crop species might have maintained more number of landrace of other crop species. Similarly, farm size devoted to a particular crop species is large, there are more chance to grow more diversity of this crop species. Households having large farm size and maintaining more diversity at any one crop species may be target farmers for genetic resources management.

Information on diversity of one crop with respect to diversity of other crop might be useful for research and development programme of on farm conservation of agrobiodiversity. Farmers generally grow more than one variety and more than one crop species in their farm. Many factors play a determinant roles in maintaining variety and species diversity at farm level. Knowledge on the

relationship of farm size to varietal richness is useful for land reform planning. Similarly, information on diversity of one crop with respect to diversity of other crop might be useful for research and development programme. This information can also be used to predict the diversity of varieties and species maintained by households based on the different household categories.

Gender and policy

Agrobiodiversity conservation is necessary to ensure that our rich crop diversity continues to offer us ecological and economic security. An enabling policy environment is essential for sustainable harnessing, value addition and utilization of agrobiodiversity resources. The policy on biodiversity is more focused on forestry resources including wildlife than overall genetic diversity encompassing agricultural crops. Present agriculture and economic policies tend to focus on introduction and promotion of major crops and modern varieties without considering the suitability and the potential of local varieties. Currently, the country lacks co-ordinated research and development action plans to formulate and implement policies relevant to in situ conservation.

Reliability on information

Both folk taxonomy and botanical taxonomy should be taken into account to facilitate the understanding of the challenges of variation and diversity for today's needs of holistic, comprehensive, yet clearly defined and scientifically acceptable biotic classifications (Teshome et al 1997). Reliability means, how the genotypes based on the names are genetically different. If the basis of recognizable units is same to a particular variety in the community, this name may be reliable. In other words, if many farmers handle variety by the same names, it can be considered reliable. If name of landraces given by farmers has different characters or simple matching coefficient with other landraces is less than one, this also support the reliability. Reliability is likely to vary among crop species and according to the extent of the reference area.

CONCLUSIONS AND RECOMMENDATIONS

- Loss of genetic diversity is the common threat to the sustainable use of plant genetic resources to meet the present needs and aspiration of the future generation. Loss of landraces is reported by many farmers.
- Knowingly or unknowingly, farmers adopt a kind of experimentations to measure the crop varietal diversity they grow and maintain in their fields. The traditional way of classification and identifying of crop varieties/landraces is based on the traits of their preferences and needs. The preferred traits in their crop varieties are generally centered on the morphological color traits, adaptation traits to stresses, diverse traditional utility traits etc.
- Farmers are equipped with a well developed indigenous knowledge of local crop varieties they grow and it has helped in maintenance of traditional crop varieties on-farm.
- Assigning a name in traditional classification of landrace is the starting unit or measure of on-farm diversity of crop varieties. The traditional names given by farmers based on phenotypic traits, adaptation traits, use and quality traits reflects genetic identity in certain circumstances and provides a basic picture of diversity of a crop.
- The framers practices and experimentations on measuring crop diversity help the farmers in maintaining diversity of their preferences on-farm. These practices help in selection and improvement of preferred traits of the diversity that farmers grow and conserve in the field. These on-farm diversity measurement practices build the capacities for farmers with additional insights of local management and sustainable use of plant genetic resources.
- The local crop varieties should be characterized and their specific stress adaptive traits and values be identified and documented. A crop diversity picture drawn at household and site specific level supports scaling up programmes through use of diversity information.
- LEC program should be initiated considering some important landraces of these four crop species
- Linkage should be established with Ex-situ conservation

- Documentation of agrobiodiversity, local skills, techniques and knowledge's are necessary. Hard and electronic copies of community biodiversity register from each VDC should be made available through District Agriculture Office and District Development Committee.
- Adding value through breeding and non-breeding approaches will be the most effective program for biodiversity management and economic upliftment of villagers.
- Awareness program should be run. Access to germplasms should be increased for farmers.
- Impact studies, indicators species studies and genetic diversity and potential genes studies should be carried out for better managing the overall local diversity.
- Commercial cultivation of local genetic resources should be planed at group approach.
- Varieties which possess farmers' preferred traits are less risk from being lost. Therefore efforts should be to make landraces more competitive through adding values on them. Monitoring of trait preference of farmers over space and time help to make landraces competitive.
- Trend on varietal richness and farmers' preferred traits over space and time should be studied for effective strategy development of on farm as well as *ex situ* conservation. Farmers' preferred traits in landraces of these crops are useful for conservation on farm through utilization.

List of recommended activities for landraces conservation through diversifying potentiality of landraces

Landraces enhancement and conservation (LEC) program	लेक (स्थानिय जात सुधार तथा संरक्षण कार्यक्रम)
Participatory varietal selection (PVS)	सहभागितामलक जातिय छनौट
Varietal mixture	जातिय मिश्रण
Diversity block	जातिय विविधता प्रदर्शन
Product diversification	उत्पादन तथा खाद्य परिकारमा विविधता
Development of functional diversity	
Farmer's resources center	कृषक स्रोत केन्द्र
Farmer's field school	कृषक फिल्ड स्कूल
Community field gene bank	सामुदायिक फिल्ड जिन बैंक
School children program	स्कूल विद्यार्थी कार्यक्रम
School field gene bank	स्कूल फिल्ड जिन बैंक
Agrobiodiversity fair	कृषि जैविक विविधता मेला
Local food fair	स्थानिय खाद्य परिकार मेला
Agrobiodiversity registration	अभिलेखिकरण
Linked to ex situ conservation	एक्स सिटु संरक्षण
In situ and on farm management of agrobiodiversity	ईन सिटु संरक्षण
Promotion of local skill and knowledge	स्थानिय सिप तथा ज्ञान संरक्षण तथा संवर्धन
Policy formulation at local and regional levels	स्थानिय स्तरको निति निर्माण
Marketing	बजारिकरण

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ANNEX

Annex 1. Abbreviation

SN:	Serial Number
VDC:	Village Development Committee
Agro-Eco:	Agricultural Ecology
HH:	Household
HHS:	Households
HHS:	Household Survey
NTFP:	Non Timber Forest Product
HYV:	High Yielding Variety
LEC:	Landrace Enhancement and Conservation
oC:	Degree Centigrade
ICDP:	Integrated Community Development Project
USCC:	Unitarian Service Committee of Canada
USCCN:	Unitarian Service Committee of Canada-Nepal
RACE:	Action for Community Empowerment and Resilience
RCEP:	Rural Civil-Society Empowerment Program
♀:	Female
♂:	Male
HHDI:	HouseHold Diversity Index
FYM:	Farm Yard Manure
PVS:	Participatory Varietal Selection
H':	Shannon-Weaver Index
NARC:	Nepal Agricultural Research Council
ABD:	Agriculture Botany Division
Agro-biodiversity:	Agricultural Biodiversity
CBD:	Convention on Biological Diversity
CBR:	Community Biodiversity Register
DNA:	Deoxyribonucleic Acid
FR:	Farmer's Rights
GIS:	Geographical Information System
HH:	Household
HHS:	Household Survey
IPR:	Intellectual Property Right
LEC:	Landrace enhancement and conservation
MoAC:	Ministry of Agriculture and Cooperatives
NARC:	Nepal Agricultural Research Council
NTFP:	Not timer forest products
PCI :	Participatory Crop Improvement
PRA:	Participatory Rural Appraisal
RACE:	Action for Community Empowerment and Resilience
SALT:	Sloping Agriculture Land Technology
SN:	Serial number
Spp:	Species
Var:	Varieties
VDC:	Village Development Committee
WTO:	World Trade Organization

Annex 2. Glossary

Asare Simi:	Field Bean
Baisakh:	First month of the year in Nepal and followed in sequences by Jestha, Ashad, Srawan, Bhadra, Ashwin, Kartik, Mangsir, Push, Magh, Falgun and Chaitra
Bakula Simi:	Broad Bean
Bari:	Upper land without irrigation system
Chauri:	Simila to cow adopted to very high hill
Chyangra:	Hill goat
Dante Makai:	Dent Corn
Dhan:	Rice
Estandhari:	Animals that have a milk glands
Gharsane:	Reptile
Ghatkulo (Bhalpani):	Water collected from rain during rainy season
Guliyo Makai:	Sweet Corn
Hiunde Simi:	Hyacinth Bean
Kali Makai:	Pod Corn
Kause Simi:	Velvet Bean
Khet:	Lower land where rice is usually grown and generally have irrigation facility
Khola:	Natural water river
Kulo:	Irrigation channel made by traditional way
Lek:	Upper most cultivated land where, crop cant be grown in winter
Makai:	Maize/ corn
Mithe Phapar:	Common buckwheat
Mul:	Water coming from under ground
Murali Makai:	Pop Corn
Pahenli Makai:	Flint Corn
Pate Simi:	Winged Bean
Ropani:	Local unit of measuring land
Rs:	Nepalese curency
Simi:	Bean
Tarai:	Lower fertile belt of Nepal
Tarware Simi:	Sword Bean
Tite Phapar:	Tartary buckwheat
Uvaychaar:	Animals that can survive both in water and land

भकपा	A technique of selecting seeds from the lot, in which farmer hit the bundles of harvested cereals just one time in the threshing floor and collect seeds
अपुष्पक	Cryptogams
आनुवांशिक विविधता	Genetic diversity
एकल खेति प्रणालि	Monoculture
कर, सलामि	Royalty
किटनाशक विषादि	Insecticide
किटपतङ्ग	Insect
पारिस्थितिक प्रणालि	Ecosystem
जात	Variety
प्रजाति	Species
जिव जन्तु	Fauna
वनस्पति	Flora
जैविक विविधताको ह्रास	Genetic erosion
नश्ल	Breed

नशलसुधार	Breed improvement
पर स्थानिय संरक्षण	Ex situ conservation
स्व स्थानिय संरक्षण	On farm conservation
यथास्थान संरक्षण	In situ conservation
परागसेचक	Pollinators
पशु	Livestock
प्रजनन्	Breeding
प्रजातिय विविधता	Species diversity
प्रसारण	Propagation
मिश्रीत खेति प्रणालि	Mix farming
राष्टिय निकुंज	National park
वनविनास	Deforestation
वनस्पति उद्दान	Botanical garden
वनस्पतिक अनुवांशिक स्रोत	Plant genetic resources
पशु अनुवांशिक स्रोत	Animal genetic resources
वासस्थान	Habitat
वंशणु	Genetic
संकटापन्न र लोपोन्मुख अवस्था	Endangered and threatened condition
संरक्षण	Conservation
सास्कृतिक विविधता	Cultural diversity
सपुष्पक	Flowering plant
सामुदायिक जैविक विविधता अभिलेख	Community biodiversity register
सामुदायिक विउ बैंक	Community gene bank
सामुदायिक वगैचन वा उद्दान	Community field gene bank
सिमसार	Wetland
सूक्ष्म जिवाणु	Micro organism
स्थानिय ज्ञान सिप	Local knowledge and skill
स्वत्व	Patent
क्रमानुगत उत्पति	Evolution
उत्परिवर्तन	Mutation
लट्टेको साग	Amaranth
बकुल्ला	Bean – Broad
भयाङ्गे सिमी	Bean – Bush
थांके सिमी	Bean - Pole
चुकन्दर	Beetroot
ब्रोकाउली	Broccoli
बन्दा	Cabbage
चाइना बन्दा	Cabbage – Chinese
भेंडे खुर्सानी	Capsicum
गजर	Carrots
काउली	Cauliflower
स्वीस चार्ड	Chard - Swiss
पिरो खुर्सानी	Chilli Pepper
किसनथेमम	Chrysanthimum
क्करो	Cucumber
भण्टा	Egg Plant
मेथी	Fenugreek
लसून	Garlic
ग्यांठगोबि	Kohirabi

छयापि	Leek
जिरीको साग	Lettuce
रायो / तोरी	Mustard Green
भिण्डी	Okra
प्याज	Onion
केराउ / सुगर स्न्याप	Pea – Sugar Snap
चाइना गुलियो केराउ	Pea – Chinese Edible Pod
आलु	Potato
फर्सी	Pumpkin
मूला	Radish
पालुङ्गो	Spinach – Winter
स्क्वास	Squash – 2 nd Year Production
कालो पोके	Smut
घुन	
पुतला	
फट्याग्रा	Grasshopper
दुर्मासि	
वदेल	
भालु	
खुम्रे	White grub
धारो किरा	Wire worm
फेदकाट्ने किरा	Cut worm
लाहि	Aphid
फौजि किरा	Army worm
भुरुम ... भुल्ता	
ताइचिन... ब्रेकर्पो	
लाड.दार खेत	
तम्र ठापु ... रातो छिरके मिर्के	
काम्रे	Buckwheat
काल्दा सुन	Himali Ghaiya
गोलभेंडा	Tomato

Annex 3. Local and metric units conversion

डांडागांड

- १ हल = २ रोपनि
 १ भारि = ५ पाथि
 १ पाथि = ३ के.जि. (धान, सिमि र मकैको लागि)
 १ मूरि = २० पाथि = ६० के. जि.

करमर्यङ्ग

- १ हल = ३ रोपनि
 १ भारि = ५ पाथि
 १ पाथि = ३ के.जि. (धान, सिमि र मकैको लागि)
 १ मूरि = २० पाथि = ६० के. जि.
 १ भारि = २५ के. जि. (मलको लागि)

नाप

१ से.मी.	= १ मिली मिटर	१ फूट	= १२ इन्च
१ मीटर	= १०० सेन्टि मीटर	१ गज	= ३०.४८ सेन्टि मीटर
	= ३९.३७ इन्च	१ गज	= ३ फिट
१ कि.मी.	= १००० मीटर		= ९९.४४ सेन्टि मीटर
१ इन्च	= २.५ सेन्टि मीटर	१ माइल	= १७६० गज
			= १.६ किलो मीटर

तौल

१ पाउ	= २०० ग्राम	१ धानी	= २.४ के.जी.
१ ग्राम	= १००० मिली ग्राम	१ के.जी.	= ५ पाउ
१ कि.ग्रा.	= १००० ग्राम	१ मन	= ३७.३२ किलो ग्राम
	= २.२ पाउण्ड		= ४० सेर
१ पाउण्ड	= १६ औंस	१ धानी	= २.२७ किलो ग्राम
१ औंस	= २८.३५ ग्राम		= ५ पाउण्ड
१ क्विन्टल	= १०० किलो ग्राम	१ सेर	= ४ पाउ = १३३ ग्राम
१ टन	= १० क्विन्टल	१ तोला	= ११.६६ ग्राम = १० ग्राम
		१ मासा	= १० लाल (गेडी)

आयतन

१ लिटर	= १००० मिलि लिटर	१ पाथी	= ४५.४६ मिलि लिटर
	= ०.२२ ग्यालन		= ४.५ लिटर
१ मुरी	= २० पाथी		= ८ माना
	= ९०.९ लिटर		= १ पिन्ट

क्षेत्रफल

१ हेक्टर	= १०००० वर्ग मीटर	१ धुर	= १८२.२५ वर्ग फिट
	= २.४७ एकड	१ कठा	= २० धुर
	= १.४८ विघा	१ विघा	= २० कठा
	= १९.६६ रोपनी		= १३.३१ रोपनी
	= ३० कठा	१ एकड	= ८ रोपनी
१ रोपनी	= ५४७६ वर्ग फिट		= ४३५६० वर्ग फिट
	= ५०८.५ वर्ग मीटर		= ०.४ हेक्टर
	= १६ आना		
१ आना	= १६ दाम = ४ पैसा		

Annex 4. Person involved in orientation workshop and HHS and their action plan

A. Person involved

SN	Name	Address	Contact	Survey VDC	Remarks
1.	Anil Lama Tamang	Craneu, Gatlang, Gatlang-6	9841903545	Thuman	Educated farmer, trainee of goat farming
2.	Pratap Lama	Jhumbar, Gatlang, Gatlang-4	9841084612	Thuman	Educated farmer, trainee of livestock Farming
3.	Rishi Raj Paudel	Badhaure, Dandagaon, Dandagaon-1	9741086264	Dandagaon	Veterinary staff, trainee of agro-biodiversity promoter's training
4.	Santosh Gurung	Barighar, Thulogaon-3	9841889408	Dandagaon	Educated farmer
5.	Yaka Raj Paudel	Badhaure, Dandagaon, Dandagaon-1	9841083627	Dandagaon	Educated farmer, trainee of agro-biodiversity promoter's training
6.	Dilip Sampurna	RACE-Nepal, Dhunche-5	9741086728, 010-670006	Dandagaon	Staff, supervisor
7.	Hira N. Ghimire	RACE-Nepal, Dhunche-5	9841889282, 9741180045	Thuman	Staff, supervisor
8.	Jhanindra P. Khatiwada	RACE-Nepal, Dhunche-5	9849094450	Thuman	Staff, supervisor
9.	Murari P. Lamichhane	RACE-Nepal, Dhunche-5	9841581350, 010-540116		Staff
10.	Bal K. Joshi	Kathmandu	9841417217		Expert

B. Action plan

SN	Action	Sub-activity	Date, 2065	Required items for field
1.	Preparing items for HHS		12 Chaitra	Questionnaire
2.	PRA, village wise	HH listing and labeling	14-16 Chaitra in Thuman	Pencil, Pencil cutter
3.		Listing of key informants		Eraser, Stapler
4.		Conducting PRA		Loose and chart papers
5.		HH categorizing in 3 groups		Extra questionnaire
6.		Estimate sample size from each group (25%)	14-17 in Dandagaon	Clear bag
7.		Listing of sampling HH		Sampling format
8.		Crop landraces mapping		Action plan
9.	HHS	Collect required items	17-24 Chaitra in Thuman,	HH categorizing format
10.		Interview along with supervisor	18-25 Chaitra in Dandagaon	Objectives
11.		Checking in group		Sampled HH format
12.		Discussion in RACE-Nepal	Chaitra 26	Steps for survey
13.	Monitoring	Visit of expert	17 Chaitra in Shayfru, 18 Mendo-Shayfru, 19 Dunche, 20 Dandagaon, 22 Kathmandu	Copy, Markers

Annex 5. Key informants used for wealth ranking of households

SN	VDC	Agro-Eco-Zone	Village	Key informants	Sex					
1.	Thuman	High Hill	Thuman (16)	Nima Chomo Tamang	F					
2.				Sonam Tamang	F					
3.				Chande Tamang	M					
4.				Palke Tamang	M					
5.				Pemba Gyalmo Tamang	F					
6.				Pasang Tamang	F					
7.				Karmu Tamang	F					
8.				Dava Sangbo Tamang	M					
9.				Pemba Tamang	M					
10.				Phurpu Tamang	M					
11.				Bhunima Tamang	M					
12.				Kale Tamang	M					
13.				Pasang Dolmo Tamang	F					
14.				Gombo Chiring Tamang	M					
15.				Bhomu Nima Tamang	F					
16.				Kami Gyalmu Tamang	M					
17.			Dalphendi (20)			Chander Tamang	F			
18.						Thulo Kharba Tamang	M			
19.						Niru Tamang	F			
20.						Plek Ghale Tamang	F			
21.						Chir Ghale Tamang	F			
22.						Kharba Tamang	M			
23.						Khuna Rani Ghale	F			
24.						Binod Tamang	M			
25.						Purne Tamang	M			
26.						Kami Tamang	F			
27.										
28.						Ram Maya Tamang	F			
29.						Hum Maya Tamang	F			
30.						Tarchi Ghale	F			
31.						Suk Lama Tamang	M			
32.						Eda Tamang	M			
33.						Phurba Tamang	F			
34.						Nima Tamang	F			
35.						Pemba Ghale	M			
36.						Mansuk Ghale	F			
37.	Mid Hill		Mendogaon (11)	Gha Thapa Tamang	M					
38.				Pingmar Tamang	M					
39.				Selker Tamang	F					
40.				Phurba Tamang	F					
41.				Nima Tamang	F					
42.				Pasang Tamang	M					
43.				Sarki Tamang	F					
44.				Phe Maya Tamang	F					
45.				Lakpa Ghale	M					
46.				De Lamu Tamang	F					
47.				Kami Tamang	M					
48.	Dandagaon	High Hill	-							
49.		Mid Hill	Karmaryang	Singha Bahadur Tamang	Male					

SN	VDC	Agro-Eco-Zone	Village	Key informants	Sex
50.			(44)	Suba Tamang	Male
51.				Uttam Bahadur Tamang	Male
52.				Regh Tamang	Male
53.				Sita Maya Tamang	Female
54.				Santi Tamang	Female
55.				Bir Maya Tamang	Female
56.				Padam Bahadur Tamang	Male
57.				Tarjom Tamang	Female
58.				Ranjana Tamang	Female
59.				Kali Maya Tamang	Female
60.				Chesang Ghale	Male
61.				Palden Ghale	Male
62.				Karna Bahadur Tamang	Male
63.				Namgyal Tamang	Male
64.				Cheysang Tamang	Male
65.				Marsing Tamang	Male
66.				Nirmaya Tamang	Female
67.				Suku Bahadur Tamang	Male
68.				Kali Maya Tamang	Female
69.				Mendo Maya Tamang	Female
70.				Chhanjar Tamang	Female
71.				Nuni Tamang	Female
72.				Aaiti Tamang	Female
73.				Manki Tamang	Female
74.				Sancha Tamang	Female
75.				Rikit Tamang	Male
76.				Kaising Tamang	Male
77.				Putali Tamang	Female
78.				Kali Tamang	Female
79.				Mori Maya Tamang	Female
80.				Suk Maya Tamang	Female
81.				Yangji Tamang	Female
82.				Buddhi Maya Tamang	Female
83.				Putali Maya Tamang	Female
84.				Dindup Tamang	Male
85.				Dolma Tamang	Female
86.				Santa Maya Tamang	Female
87.				Luli Maya Tamang	Female
88.				Budi Maya Tamang	Female
89.				Lal Maya Tamang	Female
90.				Sel Maya Tamang	Female
91.				Sing Bahadur Tamang	Male
92.				Purna Bahadur Tamang	Male
93.			Siruchet (15)	Mangle Tamang	Male
94.				Suba Bahadur Tamang	Male
95.				Donorbu Tamang	Male
96.				Bhume Maya Tamang	Female
97.				Tulki Maya Tamang	Female
98.				Budha Sing Tamang	Male
99.				Satal Tamang	Male
100.				Urmila Tamang	Female

SN	VDC	Agro-Eco-Zone	Village	Key informants	Sex
101.				Sirmaya Tamang	Female
102.				Purdi Maya Tamang	Female
103.				Mahili Tamang	Female
104.				Subba Sing Tamang	Male
105.				Santi Maya Tamang	Female
106.				Tej Kumari Tamang	Female
107.				Sancha Maya Tamang	Female
108.			Dandagaon (21)	Laxman Paudel	Male
109.				Ananta Prasad Paudel	Male
110.				Tanka Prasad Paudel	Male
111.				Kamala Adhikari	Female
112.				Kalpana Gurung	Female
113.				Siva Prasad Bhatta	Male
114.				Rajan Prasad Paudel	Male
115.				Khuwa Prasad Subedi	Male
116.				Dharma Datta Sapkota	Male
117.				Prem Kumari Gurung	Female
118.				Siva Prasad Paudel	Male
119.				Khuwa Gurung	Male
120.				Krishna Maya Gurung	Female
121.				Manju Gurung	Female
122.				Lila Gurung	Female
123.				Nen Kumari Sapkota	Female
124.				Patale Gurung	Male
125.				Amir Gurung	Male
126.				Karna Nepali	Male
127.				Hasta Bahadur Ghale	Male
128.				Ram Bishnu Gurung	Male

Annex 6. Household diversity index and landraces in Thuman VDC

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
1	Kali Ghale	1.055	3	Rice	Bhena Marshi	4.5	300	Modern	
				Maize	Kaseli	3	360	Modern	
					Tar makai	3	60	Local	
				Bean	Ola Dongdang	3	300	Local	
					Tar Tampra	1.5	180	Local	
2	Mansuk Ghale	1.079	3	Rice	Bhena Marshi	1.5	60	Modern	
					Taichun	0	0		
				Maize	Bikase	3	120	Local	
					Kaseli	1.5	60	Modern	
				Bean	Rato Simi	0.45	360	Modern	
					Chirkemirke	0.075	120	Local	
3	Chir Ghale	1.055	3	Rice	Bhena Marshi	1.5	120	Local	
				Maize	Kaseli	3	420	Local	Early maturity
					Bikase	3	162	Modern	
				Bean	Chirbire Rato	0	6	Modern	Looking by large eye
					Ghiyu Simi	0	1.5	Local	
4	Pemba Ghale	0.000	3	Maize	Kaseli	3	36	Local	
					Bikase	3	54	Modern	
5	Malang Tamang	0.000	2	Maize	Bikase	3	120	Local	Large grain
				Bean	Ola Dongdang	1.5	12	Local	Red chirkemirke
					Seto Simi	1.5	18	Local	
6	Ram Maya Tamang	1.099	3	Rice	Bhena Marshi	0.6	45	Modern	
				Maize	Bikase	3	180	Modern	
				Bean	Rato Simi	0.15	12	Local	
7	Pemba Gyalmu Tamang	1.055	3	Rice	Taichun	1.5	300	Modern	
					Anga	1.5	240	Local	
				Maize	Thumsi	6	216	Local	Grain white like butter
				Bean	Seto Simi	0	15	Local	
					Rato Simi	0	15	Local	
8	Daba Chenjom Tamang	1.055	2	Rice	Taichun	6	600	Local	
					Rato Dhan	6	420	Local	
				Maize	Kaseli	3	108	Local	
				Bean	Rajma	0	12	Local	
					Seto Simi	0	3	Local	
9	Palkhe Tamang	1.061	2	Rice	Taichun	4.5	2400	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
					Rato	4.5	1800	Local	
				Maize	Khumal Thulo Seto	6	378	Modern	
					Khumal Thulo Pahlenlo	6	378	Modern	
					Khumal Sano Seto	4.5	162	Modern	
					Khumal Sano Pahlenlo	4.5	162	Modern	
				Bean	Seto Simi	0.75	15	Local	
					Ghiyu Simi	0	0	Modern	
					Chirbire	0.6	15	Local	
10	Pasang Tamang	1.040	2	Rice	Taichun	4.5	540	Modern	
					Rato	3	360	Local	Brought from Palchi of Nuwakot
				Maize	Galang Thumsi	3	180	Local	Seed from Galang
				Bean	Chirbire	0.3	15	Local	
11	Giyungchi Tamang	1.055	2	Rice	Suba	6	240	Local	
					Taichun	6	300	Modern	
				Maize	Galangwa makai	6	360	Local	
					Thumsi	6	45	Local	
				Bean	Seto Chirke	6	3	Local	
12	Pasang Lamu Tamang	1.079	3	Rice	Borangi	1.5	180	Modern	
					Anga	1.5	180	Local	
					Bikase	1.5	1800	Modern	
				Maize	Kutang	1.5	72	Local	Brazam
					Kaseli	1.5	126	Local	
				Bean	Seto	0.15	9	Local	
					Chirkemirke	0.3	15	Local	
13	Lakpa Singhi Tamang	0.637	3	Rice	Brekerpo	6	120	Modern	White pericarp
					Broraun	6	60	Modern	Red pericarp
				Maize	Pahlenlo	6	30	Local	
14	Daba Dolma Tamang	1.099	2	Rice	not known	3	300	Local	Seed from Pajung
					Bhena Marshi	3	240	Modern	
				Maize	Galangwa makai	6	360	Local	
					Kaseli	3	126	Local	
				Bean	Seto	0.3	15	Local	
					Chirkemirke	0.3	18	Local	
15	Pemba Tamang	1.061	2	Rice	Taichun	3	360	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
					Patle	3	240	Local	
					Borang	3	300	Modern	
					Anga	3	180	Local	
				Maize	Bikase	1.5	126	Modern	
					Thumsi	6	270	Local	
					Kaseli	1.5	90	Modern	
				Bean	Seto	1.5	45	Local	
					Chirkemirke	0.3	18	Local	
16	Pemba Chiring Tamang	1.040	2	Rice	Anga	1.5	420	Local	
					Bhorang	1.5	420	Local	
				Maize	Kaseli	6	162	Local	
					Thumsya	6	180	Local	
					Balva	6	162	Local	
					Prazama	6	162	Local	
				Bean	Seto	0.48	6	Local	
					Chirbire	0.48	6	Local	
17	Nima Sangbu Tamang	1.082	2	Rice	Patle	4.5	360	Local	
					Rato	4.5	660	Local	Seed from Bhorang of Dhading
					Taichun	4.5	660	Modern	
				Maize	Kaseli	0.3	36	Modern	
					Seto Makai	4.5	360		
					Mahisirpu	4.5	360	Local	
				Bean	Seto Simi	0.3	60	Local	
					Chirbire Simi	0.15	12	Local	
18	Pasang Dolma Ghale	0.693	2	Rice	Taichun	3	540	Modern	
				Maize	Thumsya	3	270	Local	
19	Nima Wangdel Ghale	1.099	2	Rice	Taichun	1.5	300	Modern	
				Maize	Thumsi	3	270	Local	
				Bean	Seto Simi	0.3	18	Local	
20	Bu Nima Tamang	1.040	2	Rice	Taichun	3	360	Modern	
				Maize	Thumsi	12	288	Local	
21	Sonam Lama Tamang	1.040	2	Rice	Taichun	1.5	360	Modern	
				Maize	Seto	1.5	108	Local	
				Bean	Seto Simi	0	6	Local	
					Ghiyu Simi	0	0.4		
22	Karmu Tamang	1.099	2	Rice	Taichun	4.5	900	Local	
					Borang	4.5	420	Local	
				Maize	Seto	3	180	Local	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
					Pahenlo	1.5	108	Local	
				Bean	Seto	0	15	Local	
					Chirbire Rato	0	6	Local	
23	Pemba Tamang	1.040	2	Rice	Borang	3	120	Local	Bhena Marshi
					Brekerpo	3	180	Modern	
				Maize	Brazama	6	450	Local	
				Bean	Chirkemirke Rato	1.5	15	Local	
24	Pasang Tamang	1.040	2	Rice	Taichun	6	480	Modern	
				Maize	Kaseli	6	60	Local	
					Galangwa makai	6	45	Local	
				Bean	Seto Simi	6	30	Local	
25	Pasang Lamu Tamang	0.637	3	Rice	Taichun	6	180	Modern	
					Borang	6	300	Modern	
				Maize	Galangwa makai	6	360	Local	
26	Yangjen Tamang	1.055	2	Rice	Brekerpo	4.5	360	Modern	
					Tar Jita	1.5	120	Local	White pericarp
				Maize	Galangwa makai	3	90	Local	
					Brazama	3	60	Local	
				Bean	Seto	1.5	15	Local	
27	Deve Ghale	0.637	3	Rice	Taichun	3	540	Modern	
					Rato	3	540	Local	
				Maize	Galang Pahenlo	3	216	Local	
28	Lakpa Deji Tamang	1.099	2	Rice	Taichun	3	300	Modern	
				Maize	Galangwa makai	3	360	Local	
				Bean	Seto Simi	0	18	Local	
29	Daba Sangbo Tamang	1.040	2	Rice	Patle	3	480	Local	
					Borang	3	420	Local	
				Maize	Thumse	6	360	Local	
				Bean	Chirbire Rato	0	12	Local	
30	Gombo Chiring Tamang	1.055	2	Rice	Anga	3	540	Local	
					Patle	3	240	Local	
				Maize	Seto	4.5	360	Local	
					Pahenlo	9	576	Local	
				Bean	Seto	3	135	Local	
31	Chende Tamang	1.040	3	Rice	Taichun	3	240	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
				Maize	Thumse	3	120	Local	
					Kaseli	3	90	Modern	
				Bean	Tamra Dhapu	1.5	360	Local	
32	Phurpu Tamang	1.040	2	Rice	Taichun	9	720	Modern	
				Maize	Pahenlo	3	180	Local	
					Seto	6	360	Local	
				Bean	Khamba	0		Modern	
33	Daba Sangbo Tamang	0.693	2	Rice	Taichun	3	960	Modern	
				Maize	Galangwa makai	3	240	Local	
34	Phurpa Chenjom Tamang	1.099	3	Rice	Taichun	9	360	Modern	
				Maize	Galangwa makai	3	240	Local	
				Bean	Tamra Dhapu	1.5	12	Local	
35	Lakpa Yangjen Ghale	1.099	2	Rice	Taichun	6	300	Modern	
				Maize	Kaseli	6	450	Local	
				Bean	Dangdang Tampira	6	45	Local	
36	Cheden Lama Tamang	0.693	2	Rice	Anga	6	240	Modern	
				Maize	Thumsi	6	126	Local	
37	Daba Yangjen Lama	0.693	2	Rice	Taichun	3	600	Modern	
				Maize	Kaseli	3	108	Modern	
38	Lohakabri Tamang	0.693	2	Rice	Taichun	3	300	Modern	
					Bhena Marshi	3	180	Modern	
				Maize	Galangwa makai	6	450	Local	
					Seto Rato	3	18	Local	
39	Ga Thapa Tamang	0.974	2	Rice	Bhena Marshi	3	300	Local	
				Maize	Thulo biu	9	21	Local	
					Seto Philinge	0.24	72	Local	
					Kaseli	0.99	72	Local	
					Yangja	2.1	72	Local	
				Bean	Ghiyu Simi	0.12	6	Local	
					Chirbire	0.3	30	Local	
					Seto Simi	3	60	Local	
40	Sandu Tamang	1.099	3	Rice	Taichun	12	1800	Modern	
				Maize	Bikase	6	288	Modern	
				Bean	Seto Rato	0	9	Local	
41	Sarko Maya Tamang	1.342	3	Rice	Taichun	1.5	90	Local	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
					Bhena Marshi	3	180	Local	
				Buckwheat	Mithe	0.3	9	Local	
				Maize	Bikase	6	180	Local	
					Kaseli	3	120	Local	
					Murali	1.5	45	Local	
				Bean	Rato	0.45	300	Local	
					Seto	0.45	30	Local	
					Dalle Simi	0.15	3	Local	
42	Daba Dolmo Tamang	1.357	3	Rice	Bikase	6	180	Modern	
					Borang	3	120	Modern	
				Buckwheat	Mithe	0.15	9	Local	
				Maize	Bikase Thulo	3	180	Local	
					Bikase Sano	3	120	Local	
				Bean	Ghiyu Simi	0.45	12	Modern	
					Seto Simi	0.3	15	Local	
					Chirkemirke	0.45	18	Local	
43	Sider Tamang	1.055	3	Rice	Taichun	6	600	Modern	
					Moto Dhan	3	360	Modern	
				Maize	Bikase	9	180	Modern	
				Bean	Chirkemirke	0.6	18	Local	
					Seto	0.3	12	Local	
44	Lomaya Ghale	1.099	3	Rice	Taichun	3	360	Modern	
				Maize	Bikase	6	450	Modern	
				Bean	Seto Rato	1.5	21	Local	
45	Daba Nurpu Tamang	1.040	1	Rice	Taichun	3	180	Modern	
				Maize	Philinge	6	450	Local	
				Bean	Rato	0.3	6	Local	
					Seto	0.3	6	Local	
46	Nima Tamang	1.308	3	Rice	Taichun	1.5	180	Modern	
					Patle	0.03	6	Local	
					Bhena Marshi	3	240	Local	
					Tarchida	3	180	Local	
				Buckwheat	Mithe	0.3	9	Local	
				Maize	Ghanda Makai	3	360	Local	
					Kaseli	1.5	90	Local	
					Murali	0.03	6	Modern	
					Balva	0.03	9	Local	
				Bean	Rajma	0.99	18	Local	
					Seto	1.5	24	Local	
					Ghiyu Simi	0.99	0	Local	
47	Nima Cheden Tamang	1.332	1	Rice	Patle	3	660	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
				buckwheat	Mithe	3	36	Local	
				Maize	Bikase	3	1200	Modern	
				Bean	Seto	0.03	42	Local	
					Rato	0.03	27	Local	

WC, Wealth category: 1: Rich, 2: Medium, 3: Poor. HHDI, House hold diversity index based on Shannon-Weaver Index (H'). HHN, Household Number

Annex 7. Household diversity index and landraces in Dandagaon VDC

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
1	Ful Maya Atamang	1	2.000	Maize	Seto Bikase	2	180	Modern	
				Bean	Chirbire	0.5	30	Local	
					Ghiyu Simi	0.25	30	Modern	
2	Purna Bahadur Tamang	1	2.000	Buckwheat	Tite Phapar	1	30	Local	
					Ghyabre Phapar	2	15	Local	
				Maize	Ghondrang	4	300	Modern	Large grain
					Seto Bikase	6	450	Modern	
				Bean	Rato Chirbire	0.5	9	Local	
					Seto Simi	0.5	180	Local	
					Dalle Simi	0.5	90	Local	
	Ghiyu Simi	0.5	30	Modern					
3	Pokchi Maya Tamang	1	2.000	Rice	Himali Ghaiya	2	60	Local	
				Maize	Seto Makai	14	150	Modern	
				Bean	Ghiyu Simi	1	21	Modern	
					Chhibre Simi	1	12	Local	
4	Mangit Maya Tamang	1	2.000	Maize	Seto Makai	2	180	Modern	
				Bean	Rato Simi	0.5	12	Local	
5	Sancha Tamang	0	2.000	Maize	Seto Makai	2	180	Modern	
					Rato Makai	2	180	Local	
6	Dewdati Tamang	1	3.000	Maize	Pahenlo Bikase	1	600	Modern	
					Seto Bikase	1	600	Modern	
				Bean	Rato Simi	1	45	Local	
					Ghiyu Simi	1	30	Modern	
					Seto Simi	1	15	Local	
7	Suku Bahadur Tamang	1	3.000	Buckwheat	Ghyabre Phapar	1	30	Local	
				Maize	Seto Makai	2	30	Local	
				Bean	Ghople Simi	0.25	15	Modern	
					Seto Simi	0.25	12	Local	
					Ghiyu Simi	1	12	Modern	
8	Luli Maya Tamang	1	3.000	Maize	Seto Makai	1	30	Modern	
				Bean	Ghiyu Simi	1	10	Modern	
					Seto Simi	1	150	Local	
					Rato Simi	1	30	Local	
9	Putali Maya Tamang	1	3.000	Maize	Seto Makai	2	210	Local	
				Bean	Chhibre Simi	0.25	9	Local	
10	Kali Maya Tamang	1	3.000	Maize	Seto Makai	1	30	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
					Pahenlo Bikase	1	15	Modern	
				Bean	Rato Simi	2	30	Local	
					Seto Simi	2	12	Local	
					Ghiyu Simi	1	10	Modern	
11	Phaisingh Tamang	1	3.000	Maize	Seto Makai	2	180	Modern	Chine makai
				Bean	Chhibre Simi	1	30	Local	
					Ghiyu Simi	1	21	Modern	
12	Nirmaya Tamang	1	3.000	Maize	Seto Makai	1	90	Local	
				Bean	Pangre Simi	0.25	9	Local	
					Kalo Simi	0.4	18	Local	
13	Chesang Ghale	1	3.000	Buckwheat	Mithe Phapar	2	60	Local	Ghyabre
				Maize	Seto Makai	4	300	Modern	
					Chulthe Makai	1	120	Local	Suitable to Lek
				Bean	Rato Chibro	1	75	Local	
14	Santi Maya Tamang	1	3.000	Maize	Seto Makai	1.2	300	Modern	
				Bean	Seto Rato	1	36	Local	
15	Nagi Maya Tamang	1	3.000	Maize	Seto Makai	6	75	Local	
				Bean	Ghiyu Simi	0.25	9	Modern	
					Rato Simi	0.25	15	Local	
16	Maya Rani Tamang	1	3.000	Maize	Seto	2	75	Modern	
					Pahenlo Makai	2	75	Modern	
				Bean	Seto Simi	0.25	15	Local	
					Rato Simi	0.25	24	Modern	
					Ghiyu Simi	0.25	20	Modern	
17	Suppa Tamang	0	3.000	Maize	Seto Makai	4	75	Local	
					Pahenlo Makai	2	75	Local	
18	Aiti Maya Tamang	1	3.000	Maize	Seto Bikase	1	180	Modern	
				Bean	Pangre Simi	0.25	30	Local	
					Ghiyu Simi	0.25	30	Local	
19	Athiti Maya Tamang	1	3.000	Maize	Seto Makai	4	600	Modern	
				Bean	Rato Simi	0.25	12	Local	
20	Dhana Kumari Tamang	1	3.000	Maize	Seto Makai	2	180	Modern	
				Bean	Pangre Simi	0.5	30	Local	
21	Chanjer Maya Tamang	1	2.000	Buckwheat	Mithe Phapar	1	30	Local	
				Maize	Seto Makai	4	75	Local	
				Bean	Pangre Simi	0.5	30	Local	
					Ghople Simi	0.5	18	Local	
22	Kumari Maya	1	3.000	Maize	Seto Makai	4	600	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
	Tamang								
				Bean	Rato Simi	0.5	24	Local	
23	Dil Bahadur Tamang	1	3.000	Maize	Seto Makai	6	375	Modern	
				Bean	Chirbire Rato	1	30	Local	
24	Khul Prasad Sapkota	1	2.000	Rice	Khumal-4	3	840	Modern	
				Maize	Rampure Pahenlo	2	180	Modern	
				Bean	Seto Simi	2	3	Modern	
25	Bhim Bahadur Ghale	1	2.000	Rice	Khumal-4	6	660	Modern	
					Taichun	2	300	Modern	
				Maize	Pahenlo Makai	8	1200	Modern	
				Bean	Seto Simi	0.5	12	Modern	
26	Mongale Gurung	1	3.000		Khumal	2	600	Modern	
				Maize	Putali Makai	0.68	120	Modern	
					Sanu Pahenlo	0.68	105	Local	
				Bean	Seto Simi	0.5	6	Modern	
27	Kumari Gurung	1	3.000	Rice	Taichun	1	120	Modern	
				Maize	Thulo Pahenlo	1	240	Modern	
28	Nisa Gurung	1	3.000	Maize	Putali Makai	2	180	Modern	
				Bean	Chirbire Ghiyu Simi	0.5	3	Modern	
29	Bimala Gurung	1	3.000	Rice	Khumal-2	1.6	300	Modern	
				Maize	Sanu Pahenlo	1.6	270	Local	
					Arun	1.6	185	Modern	
				Bean	Ghiyu Simi	0.5	6	Modern	
30	Charki Maya Gurung	1	3.000	Rice	Taichun	0.5	180	Modern	
				Maize	Putali Makai	0.5	105	Local	
				Bean	Ghiyu Simi	0.25	1.5	Modern	
31	Padam Maya Gurung	1	3.000	Rice	Khumal-4	8	600	Modern	
				Buckwheat	Mithe Phapar	0.5	3	Local	
				Maize	Sano Putali Makai	10	300	Local	
					Seto Bikase	0.5	30	Modern	
				Bean	Seto Rato	0.5	4.5	Local	Mixing all
32	Dol Kumari Sapkota	1	3.000	Rice	Khumal-4	2	240	Modern	
					Taichun	2	300	Modern	
				Maize	Bikase Makai	4	195	Modern	
					Rampure	2	105	Modern	
				Bean	Seto Kalo	0.25	3	Local	Mixing all
33	Suku Bahadur Gurung	1	3.000	Rice	Khumal-4	1	180	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
					Taichun	2	360	Modern	
				Maize	Sano Pahenlo	2	225	Local	
					Putali Makai	12	375	Modern	
				Bean	Makai Simi	0	0	Local	
					Tamra	0.5	0	Local	
34	Sete Ghale	1	3.000	Rice	Khumal-4	1	93	Modern	
					Taichun	1	54	Modern	
				Maize	Khumal Pahenlo	1	75	Modern	
					Ghaunale	1	150	Modern	
35	Debaki Paudel	1	2.000	Rice	Sikhar Marshi	6	720	Local	
					Taichun	2	240	Modern	
				Maize	Makwanpure Sano Makai	4	750	Modern	
					Thulo Pahenlo	4	300	Local	
				Bean	Ghiyu Simi	0.25	6	Modern	
36	Thuli Maya Tamang	1	2.000	Rice	Khumal-4	4	720	Modern	
					Taichun	2	180	Local	
				Maize	Pahenlo Thulo Makai	4	525	Local	
					Unknown	6	240	Modern	
				Bean	Makai Simi	0.25	9	Modern	
37	Govinda Prasad Paudel	1	3.000	Rice	Khumal-4	6	600	Local	
				Maize	Korche Makai	6	300	Local	
					Pahenlo Sano	6	375	Local	
38	Tika Datta Paudel	1	1.000	Rice	Sikre Marshi	6	840	Local	
				Maize	Pahenlo Thulo Makai	6	600	Local	
					Sano Pahenlo	6	150	Local	
				Bean	Khairo Simi	2	15	Local	
39	Muna Gurung	1	3.000	Rice	Khumal-4	2	360	Local	
				Maize	Sano Pahenlo	2	300	Local	
					Thulo Pahenlo	4	600	Local	
				Bean	Seto Chipre Simi	0.25	9	Modern	
					Ghiyu Simi	0.25	6	Modern	
40	Jambu Kumari Sapkota	1	3.000	Rice	Radha	2	360	Modern	
				Maize	Sanu Pahenlo	5	450	Local	
				Bean	Ghiyu Simi	0.25	3	Modern	
41	Januka Paudel	1	2.000	Rice	Sikre	4	600	Local	
					Taichun	2	480	Modern	
				Maize	Korche Makai	4	300	Local	
					Pahenlo Sano	6	375	Local	
42	Ram Kumari Tamang	1	1.000	Rice	Khumal-4	4	1680	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
				Maize	Sano Makai	4	600	Local	
					Thulo Pahlenlo	8	750	Local	
43	Buddhi Bahadur Ghale	1	3.000	Rice	Taichun	1	90	Local	
					Khumal-4	2	540	Modern	
				Maize	Pahlenlo Makai	3	300	Local	
					Thulo Makai	2	240	Local	
				Bean	Ghiyu Simi	0.25	20	Modern	
44	Laxmi Tamang	1	3.000	Rice	Radha	2	540	Modern	
				Maize	Sano Makai	2	225	Local	
					Thulo Pahlenlo	8	300	Local	
				Bean	Ghiyu Simi	0.25	15	Modern	
45	Isowri Sapkota	1	3.000	Rice	Khumal-4	2	300	Modern	
				Maize	Sano Pahlenlo	2	90	Local	
					Thulo Pahlenlo	2	90	Local	
				Bean	Ghiyu Simi	0.25	10	Modern	
46	Tej Kumari Paudel	1	3.000	Rice	Khumal-4	4	420	Modern	
					Radha	2	600	Modern	
				Maize	Local Pahlenlo	6	270	Local	
					Thulo Makai	3	100	Local	
				Bean	Makai Simi	6	15	Local	
					Ghiyu Simi	0.25	6	Modern	
47	Sanja Maya Tamang	1	3.000	Maize	Seto Thulo Makai	1	180	Modern	
				Bean	Ghiyu Simi	0.25	9	Modern	
					Seto Simi	0.5	4.5	Local	
48	Nir Maya Tamang	1	3.000	Rice	CH-45	1	45	Local	
				Maize	Sano Pahlenlo	1	60	Local	
					Seto Makai	1	150	Local	
				Bean	Kalo Simi	0.25	6	Local	
49	Buddhi Maya Tamang	1	3.000	Maize	Seto Bikase	4	450	Modern	
				Bean	Ghiyu Simi	1	18	Modern	
					Seto Simi	0.25	6	Local	
50	Manas Tamang	1	3.000	Maize	Seto Makai	14	900	Modern	
					Pahlenlo Makai	6	300	Modern	
				Bean	Kalo Simi	1	15	Modern	
51	Ful Maya Tamang	1	3.000	Maize	Seto Makai	4	300	Modern	
				Bean	Chhibre Simi	0.5	35	Local	
					Ghiyu Simi	0.5	15	Local	
52	Shree Bahadur Tamang	1	3.000	Buckwheat	Mitthe Phapar	0.32	60	Local	
				Maize	Seto Makai	3	900	Modern	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
				Bean	Ghiyu Simi	0.5	15	Modern	
					Serka Tamra	0.01	0	Local	Pernnial
53	Mongale Tamang	1	2.000	Rice	Khumal-4	2	90	Modern	
				Maize	Seto Bikase	2	300	Modern	
				Bean	Seto Simi	0.5	12	Modern	
					Ghiyu Simi	0.5	12	Modern	
54	Mahili Maya Tamang	1	1.000	Rice	Khumal	3	300	Modern	
					Marshi	3	300	Local	
				Maize	Bikase Makai	2	300	Modern	
					Seto Makai	3	600	Local	
					Pahenlo Local	3	75	Local	
				Bean	Ghiyu Simi	0.25	9	Local	
					Hiunde Simi	0	0	Local	
55	Kumari Tamang	1	2.000	Buckwheat	Local	0.5	9	Local	
				Maize	Seto Bajange	3	450	Local	
				Bean	Pangre Simi	0.5	9	Local	
					Ghiyu Simi	0.5	3	Modern	
56	Lale Tamang	1	2.000	Rice	Khumal-4	2	480	Modern	
				Buckwheat	Ghyabre Phapar	0	0		
				Maize	Sathiya	2	420	Modern	
					Seto Bajange	6	675	Modern	
57	Purni Maya Lama	1	2.000	Rice	Khumal-4	2	210	Modern	
				Maize	Seto Thulo Makai	4	375	Modern	
				Bean	Ghiyu Simi	0.25	9	Modern	
58	Chanjer Maya Tamang	1	2.000	Maize	Seto Makai	4	525	Local	
				Bean	Ghiyu Simi	0.25	36	Modern	
59	Ambe Maya Tamang	1	2.000	Rice	Himali Dhan	3	600	Local	
				Maize	Sano Pahenlo	3	225	Local	
					Seto Thulo Makai	2	225	Modern	
				Bean	Himali Simi	0.25	10	Local	
60	Kanchi Maya Tamang	1	2.000	Rice	Khumal-4	2	420	Modern	
					CH-45	2	420	Modern	
					Kanchan	2	420	Modern	
				Buckwheat	Mithe Phapar	0.5	15	Local	
				Maize	Sano Pahenlo	2	180	Local	
					Seto Thulo Makai	8	1200	Local	
				Bean	Ghiyu Simi	0.25	30	Modern	
61	Purni Maya	1	2.000	Rice	Ghaiya Dhan	0.32	90	Local	

HHN	Farmer	H'	WC	Species	Landraces	Area, Ropani	Prod, kg	Type	Meaning
	Tamang			Maize	Seto Dhangre	2.4	300	Local	
62	Suku Maya Tamang			Maize	Seto Makai	1.6	180	Modern	
63	Suba Siingh Tamang	1	2.000	Maize	Seto Thulo Makai	6	300	Modern	
				Bean	Ghiyu Simi	0.5	15	Modern	

WC, Wealth category: 1: Rich, 2: Medium, 3: Poor

Annex 8. Baseline survey questionnaire

Crop Diversity, Agro Ecological and Socioeconomic Baseline Survey RACE-Nepal, Rasuwa, 2009

A. General Information

SN Agro-Eco Zone
1 = High Hill; 2 = Mid Hill

VCD Ward No

Village

Settlement Pattern *Code for Settlement Pattern: 1 = Clustered; 2 = Scattered*

Name of the Household Head Sex
Code for sex: 1 = Male; 2 = Female

Caste of HH Head

Occupation of HH Head
*Code for Occupation:
1 = Agriculture; 2 = Off-farm*

Current Stay of HH Head
*Code for Current Stay:
1 = Within village; 2 = Seasonal migration; 3 = Outside village*

Respondent' Name (Decision Maker in Agriculture)

Sex of Respondent Education of Respondent
Code for Education: 1 = Illiterate; 2 = Primary; 3 = 6-10; 4 = >10

Food Sufficiency Level *Code for Food Sufficiency:
1 = < 6 months; 2 = 6-12 months; 3 = > 12 months*

Economic Status *Code for Economic Status:
1 = Better-off; 2 = Medium; 3 = Worse-off (Based on wealth ranking of HH)*

B. Household (HH) Information

1. Type of Family?

Code for Family Type:
 1 = Nucleus (Husband, wife and children)
 2 = Joint (Parents, brother and sister)

2. How many members in your family? Total

Number of Adult (>12 years) **Current Stay (Use code)** *Code for Current Stay:*
 1 = Within village; 2 = Seasonal migration; 3 = Outside village

Male 1= 2= 3=

Female 1= 2= 3=

Number of Children (<12 years)

Male 1= 2= 3=

Female 1= 2= 3=

3. How many HH members involved in farm works?

Male Female

4. How many HH members work away from village?

Male Female

5. What are the major sources of livelihood? Rank based on the importance in livelihood with 1 = Most important and subsequent ranks in descending order.

Agron. Crop Hort. Crop Livestock

NTFP Services in Nepal Business

Services Outside Nepal Wage Labor Others

C. Farmer Resources

6. Do you have your own land?

*Code for land ownership
1 = Yes; 2 = No*

(If No, move to question 9)

7. Give number of parcels of land

Within VDC

Khet

Bari/Bhit

Lekh

Outside VDC

Khet

Bari/Bhit

Lekh

8. Give area of land holding (Total area in Ropani Hal)

Within VDC

Khet

Rainfed

Irrigated

Bari

Rainfed

Irrigated

Lekh

Outside VDC

Khet

Rainfed

Irrigated

Bari

Rainfed

irrigated

Lekh

9. What is the fertility status of your land?

Khet (area in Roapani or Hal)

High fertility

Medium fertility

Low fertility

Bari

High fertility

Medium fertility

Low fertility

Lekh

High fertility

Medium fertility

Low fertility

10. Do you share-in/ share-out your land? Give area in Ropani or Hal.

Share-in	<input type="text"/>	Share-out	<input type="text"/>
Khet	<input type="text"/>	Khet	<input type="text"/>
Bari/ Bhit	<input type="text"/>	Bari/Bhit	<input type="text"/>
Lekh	<input type="text"/>	Lekh	<input type="text"/>

11. Do you rent-in /out your land? Give area in Ropani or Hal.

Rent-in	<input type="text"/>	Rent-out	<input type="text"/>
Khet	<input type="text"/>	Khet	<input type="text"/>
Bari/ Bhit	<input type="text"/>	Bari/Bhit	<input type="text"/>
Lekh	<input type="text"/>	Lekh	<input type="text"/>

12. Give irrigation types and area irrigated for your land?

Types	Area (Ropani, Hal)	Management system	Irrigation reliability
Kulo	<input type="text"/>	<input type="text"/>	<input type="text"/>
Khola pane	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mul	<input type="text"/>	<input type="text"/>	<input type="text"/>
Gadkule/ Bhalpani	<input type="text"/>	<input type="text"/>	<input type="text"/>

*Code for Irrigation management system:
1 = Private; 2 = Community managed; 3 = Government managed
Code for Reliability: 1 = All year round; 2 = Seasonal*

13. What are the major cropping patterns?

Major cropping pattern in Khet land

Major cropping pattern in bari/bhit land

Major cropping pattern in Lekh

14. What crops grow together (mix cropping/ intercropping system)?

Khet land

Bari land

Lekh

D. Main crops (Rice, Buckwheat, Maize and Bean)

Note: Area, Production = local units

Trend (Area and Productivity): 1 = Increase; 2 = Same; 3 = Decrease

Fertility: 1 = High; 2 = Medium; 3 = Poor

15. Give the following information on farmer's cultivars/ landraces

D1. Buckwheat

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Variety type: Improved Local Meaning of name:

Original Source of Seeds: Local Exotic

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Variety type: Improved Local Meaning of name:

Original Source of Seeds: Local Exotic

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

D2. Rice (Land type: Sim, Tari, Kanle)

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Variety type: Improved	<input type="text"/>	Local		<input type="text"/>	Meaning of name:	
Original Source of Seeds: Local	<input type="text"/>	Exotic		<input type="text"/>		

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Variety type: Improved	<input type="text"/>	Local		<input type="text"/>	Meaning of name:	
Original Source of Seeds: Local	<input type="text"/>	Exotic		<input type="text"/>		

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Variety type: Improved	<input type="text"/>	Local		<input type="text"/>	Meaning of name:	
Original Source of Seeds: Local	<input type="text"/>	Exotic		<input type="text"/>		

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

D3. Maize

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Variety type: Improved	<input type="text"/>	Local	<input type="text"/>	Meaning of name:		
Original Source of Seeds: Local	<input type="text"/>	Exotic	<input type="text"/>			

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Variety type: Improved	<input type="text"/>	Local	<input type="text"/>	Meaning of name:		
Original Source of Seeds: Local	<input type="text"/>	Exotic	<input type="text"/>			

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms	Land type	Fertility	Area	Trend	Production	Trend
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Variety type: Improved	<input type="text"/>	Local	<input type="text"/>	Meaning of name:		
Original Source of Seeds: Local	<input type="text"/>	Exotic	<input type="text"/>			

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

D4. Bean

Name and synonyms Land type Fertility Area Trend Production Trend

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Variety type: Improved Local Meaning of name:

Original Source of Seeds: Local Exotic

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms Land type Fertility Area Trend Production Trend

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Variety type: Improved Local Meaning of name:

Original Source of Seeds: Local Exotic

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

Name and synonyms Land type Fertility Area Trend Production Trend

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Variety type: Improved Local Meaning of name:

Original Source of Seeds: Local Exotic

Reason for growing the cultivar (medicinal, cultural, monetary and religious value, if any) and what are the preferred and un-preferred traits

16. What type of varieties you want?

SN	Crop	Desired traits	Remarks
1	Rice		
2	Buckwheat		
3	Maize		
4	Bean		

17. Do you select seeds for next season planting?

SN	Crop	Yes/ No	Selection criteria and method
1	Rice		
2	Buckwheat		
3	Maize		
4	Bean		

19. Major problems

SN	Crop	Problems	Remarks
1	Rice		
2	Buckwheat		
3	Maize		
4	Bean		

20. Lost landraces

SN	Crop	Lost landraces	Why/ how lost
1	Rice		
2	Buckwheat		
3	Maize		
4	Bean		

21. Do you apply compost/FYM in your farm?

Code for compost application

1 = Yes; 2 = No

22. Specify the crop, land type and the compost applied for each crop

Rice

	Area	Compost use (Amount)	Trend
Sim Khet	<input type="text"/>	<input type="text"/>	<input type="text"/>
Tari Khet	<input type="text"/>	<input type="text"/>	<input type="text"/>
Kanle Khet	<input type="text"/>	<input type="text"/>	<input type="text"/>

Buckwheat

Khet	<input type="text"/>	<input type="text"/>	<input type="text"/>
Bari	<input type="text"/>	<input type="text"/>	<input type="text"/>
Lekh	<input type="text"/>	<input type="text"/>	<input type="text"/>

Maize

Khet	<input type="text"/>	<input type="text"/>	<input type="text"/>
Bari	<input type="text"/>	<input type="text"/>	<input type="text"/>
Lekh	<input type="text"/>	<input type="text"/>	<input type="text"/>

Bean
Khet

Bari

Lekh

22. Do you use chemical fertilizers?
(If No, move to question 24)

1 = Yes; 2 = No

23. Give information on the following

Crop

Fertilizer type Amount (pathi, kg + applied area)

Trend

Improved rice

Local rice

Buckwheat

Improved maize

Local maize

Bean

Note: Fertilizer type: 1 = Urea; 2 = DAP; 3 = MoP; 4 = TSP; 5 = Micronutrients

24. Do you use pesticides for crop protection?
(If No, move to question 26)

1 = Yes; 2 = No

25. On which crop the pesticide is used?

Crop

Type of pesticides

Purpose of use

E. Livestock and linkage

26. Do you own any livestock?

1 = Yes; 2 = No

(If No, move to question 32)

27. Provide detail on the following

Type	Total, n	Improved, n	Local, n
Chauri	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cattle	<input type="text"/>	<input type="text"/>	<input type="text"/>
Buffalo	<input type="text"/>	<input type="text"/>	<input type="text"/>
Goat	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sheep	<input type="text"/>	<input type="text"/>	<input type="text"/>
Poultry	<input type="text"/>	<input type="text"/>	<input type="text"/>

28. What is the trend in livestock number over the years?

	Increase	Same	Decrease
Chauri	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cattle	<input type="text"/>	<input type="text"/>	<input type="text"/>
Buffalo	<input type="text"/>	<input type="text"/>	<input type="text"/>
Goat	<input type="text"/>	<input type="text"/>	<input type="text"/>
Sheep	<input type="text"/>	<input type="text"/>	<input type="text"/>
Poultry	<input type="text"/>	<input type="text"/>	<input type="text"/>

29. What is the livestock rearing system?

Summer season	Free grazing	Stall feeding	Both
Chauri	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cattle	<input type="text"/>	<input type="text"/>	<input type="text"/>
Buffalo	<input type="text"/>	<input type="text"/>	<input type="text"/>
Goat/sheep	<input type="text"/>	<input type="text"/>	<input type="text"/>
Winter season			
Chauri	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cattle	<input type="text"/>	<input type="text"/>	<input type="text"/>
Buffalo	<input type="text"/>	<input type="text"/>	<input type="text"/>
Goat/sheep	<input type="text"/>	<input type="text"/>	<input type="text"/>

30. Give feed composition of livestock (amount in percentage)

Composition	Chauri	Cattle	Buffalo	Goat	Sheep
Crop by-product	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Seasonal grass	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Fodder trees	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Concentrates	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Grazing	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

31. Which months of the year are the feed deficit periods?

From to From to

32. Are you a member of any group? *1 = Yes; 2 = No*

33. If yes, give the name of the group

34. Have you ever taken any agricultural training? *1 = Yes; 2 = No*

35. Have you ever taken training related to conservation?

36. Have you ever used government extension services?

37. Do you listen/ watch to agricultural program broadcast through radio/ TV?

38. Do you read journals/articles on agriculture?

39. Whom do you approach for information on agriculture?

40. What and where agricultural items are sold?

Items	Market	Distance (km) or (Hours)
<input type="text"/>	<input type="text"/>	<input type="text"/>

41. In your view, which areas you like to focus on for agriculture development:

Interviewer and address:

Date:

Thank you for the time and the valuable information.

Annex 9. Plant genetic resources collection form

A. Sample identification

Genus:
Species:
Subspecies:
Collector's number:
Collecting institute:
Date of collection:
Local name:

B. Collecting site

I. General

District:
Village DC:
WNo.:
Village:
Farmer's name:
Latitude N:
Longitude E:
Altitude (m):

II. Collection source (circle one)

1. Wild
2. Farmland
3. Farm store
4. Backyard
5. Village market
6. Commercial market
7. Institute
8. Other (specify)

III. Topography (circle one)

1. Swamp
2. Flood plain
3. Plain level
4. Undulating
5. Hilly
6. Mountainous
7. Other (specify)

IV. Associated wild and weedy species and crops (specify):

V. Site (circle one)

1. Level
2. Slope
3. Summit
4. Depression

VI. Stoniness (circle one)

1. None
2. Low
3. Medium
4. Rocky

VII. Soil texture (circle one)

1. Sand
2. Loam
3. Clay
4. Silt
5. Highly organic

VIII. Drainage (circle one)

1. Poor
2. Moderate
3. Good
4. Excessive

IX. Other observations

C. Characterization and management

Sowing month:

Harvest month:

Usage (specify):

Descriptors used by farmers:

Disease and insect pest (specify):

D. Sample

I. Status of sample (circle one)

1. Wild
2. Weedy
3. Breeder's line
4. Landrace
5. Cultivar
6. Other (specify)

II. Number of plants sampled:

III Quantity of material (number of seed of plant/sample):

IV. Type of sample (circle one)

1. Vegetative
2. Seed
3. Both

V. Herbarium sample (circle one)

1. Yes
2. No

VI. Cultural practices

1. Shifting cultivation (circle one)

1. Yes 2. No

2. Irrigated (circle one)

1. Yes 2. No

3. Transplanted (circle one)

1. Yes 2. No

4. Terraced (circle one)

1. Yes 2. No

Collector's name and comments:

