

- **Farmer-Led Participatory Maize Breeding in Middle Hills of Nepal**

- *Final Report of First Phase of the Project*
 - *(Jan 1999 – Dec 2000)*

- Local Initiatives for Biodiversity, Research and Development (LI-BIRD)

CGIAR System wide Program on Participatory Research and Gender Analysis for Technology Development and Institutional Innovation

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1 INTRODUCTION

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- Maize (*Zea mays* L.) is the second most important crop after rice in Nepal. Maize is grown on *bari*¹ land during summer relayed with millet or beans or sole cropped. It is also grown in *khet*² land during spring in altitudes below 1000 m asl. It occupies nearly 0.8 million ha (almost 30% of the total cultivated area) and 80% of this occurs on terraced hill agriculture, producing over 1.3 millions tonnes per annum (MoA, 1995). However, the productivity of maize is quite low (1.7 t/ha). Among various reasons, poor access to improved varieties, low seed replacement rate, and rapid genetic deterioration of the existing maize varieties are regarded as major reasons for low productivity of maize in the country.
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- Maize plays an important role in the livelihood strategy of the people living in the hills. The hilly area of Palpa, Gulmi, Arghakhanchi districts extending towards Pyuthan and further west has unique geo-physical environment, which is different than other maize growing areas of Nepal. The area comprised unbunded, unterraced, sloppy hills and is characterized by low rainfall leading to acute moisture stress particularly during the winter. Farmers of these areas have poor access to agricultural input, including improved genetic materials, and the improved maize varieties tested in the region have not been very suitable for the unique growing environment and farmers need of the area. Therefore, major proportion of the maize area in Palpa, Gulmi, and Arghakhanchi districts is dominated by local varieties. According to past studies conducted in Gulmi and Arghakhanchi districts (Kadayat *et. al.*, 1998; Sthapit *et. al.*, 1997), average productivity of maize is below 1.5 t/ha in both the districts. Poor adoption of improved maize varieties and low productivity of local maize varieties have been considered as main contributing factors for such a low productivity of maize in the area.
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- Based on past experiences and successes in upgrading the productivity of local landraces through introduction of improved varieties and subsequent seed selection, LI-BIRD is currently researching into a farmer-led participatory plant breeding in maize in the Gulmi district of Western hills of Nepal. The project was implemented with the objective to test Participatory Crop Improvement (PCI) methods in open-pollinated crop (maize), develop new farmer preferred maize variety, and strengthen farmers' breeding and informal seed selection and maintenance process. This report presents a summary of the processes adopted for the implementation of the project activities, accomplishments and intermediary impact of the first Phase (Jan 1999 – Dec 2000) of the project.

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- ¹ rainfed cultivated land with maize-based cropping systems.

- ² Partially or fully irrigated land with (puddled) rice-based cropping systems.
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2 THE PROCESSES AND ACCOMPLISHMENTS

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2.1 Initial planning process

Prior to field implementation, a series of in-house planning meetings and discussions was held among team members in order to outline the process for smooth implementation of the project. Consultation with various organizations, institutions and individuals, namely Dr BR Sthapit currently with IPGRI and KB Kadayat³ currently District Agricultural Development Officer (DADO) Lamjung, K. Adhikari from National Maize Research Programme (NMRP), JP Jaiswal from Gulmi-Arghakhanchi Development Project (GARDP), and review of existing literature and analysis of secondary information was done to improve the research process outlined in the research proposal. Field visit was also done to understand the situation of the area. The participation of Plant Breeder and Socio-economist of LI-BIRD, involved in the project, in 2nd International Seminar on "Assessing the Impact of Using Participatory Research and Gender Analysis" held in Quito, Equador during 6-12 September 1998 also helped to refine the research process.

2.2 Identification of partners

It was initially envisaged that the project would be implement by a joint team of researcher farmers from the farming community of the research sites, and researchers from LI-BIRD and National Maize Research Programme (NMRP) of Nepal Agriculture Research Council (NARC). LI-BIRD initiated and held a series of discussion with NMRP and Nepal Agricultural Research Council (NARC) authorities to establish formal agreement for a collaborative work in the project. However due to delays in processing agreement paper a formal agreement could not take place. Despite this, NMRP and NARC researchers were involved in the project activities on an informal basis. NARC has now agreed to establish a formal collaboration with LI-BIRD on the second phase of this project.

2.3 Staff recruitment

Two full time field/community based staff Ms N.K. Khatri and Mr B.B. Paudel have been recruited and posted to Simichaur and Darbar-Devasthan sites respectively. These site-based staffs were recruited before the selection of the research sites in order to involve them from the initial stage of the project implementation and provide them an opportunity to learn from the process. These field-based staff were technically backed up by a team of seven centre-based staff of different discipline.

2.4 Site selection

The following processes were followed during the site selection:

- Review of existing literature and analysis of secondary information to identify a list of potential villages
- Consultation with various organizations, institutions, and individuals (Annex-I).
- Reconnaissance survey of large number of villages by a small team of project staff
- In-house meeting and discussion among team members for further planning
- Site selection survey by a multi-disciplinary group from different partner organizations using Rapid Rural Appraisal (RRA) techniques
- Analysis of the information collected and matrix ranking of potential villages against various site selection criteria

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• ³ Both of them were involved in a studies titled "Report on need assessment for Participatory Variety Selection on food crops in Arghakhanchi district, Nepal" and "Consultancy report on Participatory Variety Selection on food crops in Gulmi district, Nepal: Need assessment and future strategy" for LI-BIRD during 1997 and 1998.

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- Selection and delineation of geographic boundary of the research sites on the basis of farmers' group discussion and survey findings

The following parameters were agreed as criteria for the final selection of site after a series meeting and discussion (Subedi and Shrestha, 1999):

1. Highest contribution of maize in the livelihood strategy
2. Mid hill agro-ecological zone
3. Higher proportion of *bari* land
4. Low varietal intervention/ widespread use of local landraces
5. Low seed replacement rate
6. Low productivity of existing maize varieties
7. Farming as a main occupation of the majority of the people in the village
8. Diversity in aspects of the land orientation
9. Diversity in ethnicity
10. About 4-5 hours walk from the all season road
11. High interest of the community

- Before conducting a site selection survey by multi-disciplinary team a **Reconnaissance survey** was extensively done in 28 villages of Palpa, Gulmi, and Arghakhanchi districts. Out of these, six villages were identified as the most potential sites for the project on the basis of site selection criteria mentioned above. Final **Site selection survey** to these potential villages was done by a team comprising farmers, local leaders, plant breeders, outreach agronomists, socio-economist, extension personnel, research assistants from the community, NARC, Department of Agriculture (DoA), and LI-BIRD. The team conducted PRA and field observations and held discussions with farmers. A checklist was used to collect the required information (Annex-II). In each of the surveyed villages, a **Village level meeting** was held with the representatives of farming communities in order to collect information about the geo-physical condition of the area, socio-economic situation of the farming communities, and farmers' interest on the proposed programme. The discussion was initiated with a brief introduction of the proposed project.

After analysing the information collected through farmers' discussion, direct observation, and secondary information, two VDC's, viz. Darbar-Devasthan and Simichaur of Gulmi district were selected as appropriate sites to implement the research activities (refer Subedi and Shrestha, 1999 for details). Summer maize is the main crop at these sites, grown on unirrigated sloppy *bari* terraces. Bari constitutes more than 95% of the cultivated land at these sites (Subedi and Shrestha, 1999; Shrestha *et al*, 2000). The main feature of the site is presented in Table 1.

Table 1. Important characteristics of the selected sites.

Characteristics	Selected sites in Gulmi District	
	Darabar-Devisthan	Simichaur
Agro-ecological settings		
Ward no.	5	5
VDC	Darabar-Devisthan	Simichaur
District	Gulmi	Gulmi
Latitude	28°00.12 N	28°03.42 N
Longitude	83°19.93 E	83°14.77 E
Altitude (m)	1500	1460
No. of Households	1100	105
Distance from all season road (hour)	6.5	8.5
Distance from fair season road (hour)	1.0	1.0
Willingness of the farmers to participate	Very High	Very high
Domain (% land)		
Low hill (600-1000m)	33	-
Mid hill (1000-1500m)	67	90
High hill (>1500m)	-	10
Land type (% land)		
<i>Khet</i> land	5	3
<i>Bari</i> land	95	97
Ethnic composition (% households)		
Brahmin	67.5	41.7
Chhetri	30	25
Jogi		1.7
Newar		1.7
Magar		13.3
Gurung		1.7
Occupational Caste (Kami, Damai, Sarki)	2.5	15
Crop diversity (No. of crop species)	7	7
Important crops	1. Maize 2. Oilseed (Rape) 3. Ginger	1. Maize 2. Wheat 3. Oilseed (Rape)
Varietal diversity of maize		
Landrace (% area covered)		
<i>Thulo Pinyalo</i>	80 %	80%
<i>Sano Pinyalo</i>	15%	10%
<i>Thulo Seto</i>		Negligible
<i>Sano Seto</i>		6%
<i>Amrikane</i>	Negligible	
Improved variety (% area covered)		
Khupal Yellow		3%
Manakamana-1	5%	1%
Uses of maize		
Human food	70	60
Animal feed	30	40
Varietal Constraints	1. Lodging 2. Low yield	1. Lodging 2. Low yield

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2.5 Village workshop

- After the selection of research sites, village workshops were organized at these sites. Key stakeholders (farmers both male and female, local leaders/ VDC representatives, researchers from NMRP, extensionist from DADO) participated in the workshop. The objectives of the workshop were:
 - Brief farmers about the project
 - Understanding maize diversity and analysis of their traits
 - Validate research agenda/ questions and objectives
 - Identify possible options to achieve the research objectives
 - Develop farmers' breeding strategies
 - Identify the roles of different stakeholders.
 - Develop initial plan of action for Year-I.
-
- Stakeholders' views were also shared, and their comments and suggestions were incorporated in the annual work programme. The activities of the workshop are briefly outlined under the following points.

2.5.1 Goal setting exercise

This exercise was done jointly by the Farmers' (both male and female), VDC representatives, researchers from NMRP and LI-BIRD, and extensionist from District Agriculture Development Office. Researchable problems were explored through preferred trait analysis. Major traits of interest and problems associated with the preferred trait were identified and listed out. After that, most important problem was identified by ranking the problems associated with the preferred trait.

Initially, researchers perceived low yield associated with inferior local varieties as the main constraint in maize production for the area. So, the initial objective of the programme was to increase farmers' access to new improved genetic materials and provide them with training on Mass Selection. A different scenario emerged during the site selection survey and research goal setting processes with the farmers. Farmers reported that maize production in the area was affected mainly by lodging of maize plant (Table 2).

Farmers in the area have developed and maintained a variety, called *Thulo Pinyalo*, that possesses most of the farmer preferred traits. However, the variety is prone to severe lodging resulting in the yield loss of 15 to 85 percent (Table 3).

Except for lodging problem, farmers prefer most of the traits of *Thulo Pinyalo*. This variety has good yield, both in terms of grain and fodder biomass, when lodging is not heavy. It has bold/flint grain with attractive orange-yellow grain colour and good taste in all food recipes and, therefore, it is easy to sell/barter. The biomass, both green as well as dried, is liked very much by the livestock. *Thulo Pinyalo* is also the most popular variety of the region, which occupies as high as 80% of the maize area in most villages. Lodging problem is equally high in other local varieties, namely *Thulo Seto* and *Amrikane*, however the area under these varieties is very low. It was reported that the low production of *Thulo Pinyalo* has great implication on the food security of the region than any other variety. So, the lodging in *Thulo Pinyalo* was considered as a major problem. Farmers were very keen to improve *Thulo Pinyalo* in order to minimise the lodging while retaining majority of the traits. Farmers, therefore, strongly suggested that rather than just introducing new varieties, their local varieties be improved to address the problem. As a result, the breeding objective was

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changed from increasing grain yield through introduction of high yielding variety to reducing lodging in *Thulo Pinyalo* maize (Subedi *et al.*, 2000).

• **Table 2.** Ranking of preferred traits of maize in surveyed villages, 1999.

• Traits	• Surveyed villages						
	• Diga m, Gulmi	• D/Devisthan, Gulmi	• Simichaur, Gulmi	• Chaunbari, Palpa	• Banjha, Palpa	• Kaule, Arghakhan chi	
• Higher grain yield	• 1	• 2	• 2	• 1	•	• 1	
• Non-lodging	• 3	• 1	• 1	• 2	•	• 2	
• More stover yield	• 5	• 3	• 3	• 3	•	•	
• Demands less soil fertility	• 6	•	•	•	•	•	
• More grit recovery	•	• 5	• 5	•	•	•	
• Good taste	• 2	• 4	• 4	•	•	• 3	
• White grain colour	•	•	•	• 4	•	•	
• Early maturity	• 4	•	•	•	•	•	
• Short plant height	•	• 1	•	•	•	•	
• Good husk cover	•	•	•	• 5	•	•	

• **Table 3.** Desirable and undesirable traits of local varieties of maize grown in surveyed villages, 1999.

• Parameters	• Surveyed villages						
	• Diga m, Gulmi	• D/Devisthan, Gulmi	• Simichaur, Gulmi	• Chaunbari, Palpa	• Banjha, Palpa	• Kaule, Arghakhan chi	
1. Desirable traits	•	•	•	•	•	•	
• High yield potential	• *	• *	• *	• *	•	• *	
• High fodder yield	• *	• *	• *	• *	•	• *	
• High flour recovery	•	• *	•	•	•	•	
• Good taste	• *	• *	• *	• *	•	• *	
2. Undesirable traits	•	•	•	•	•	•	
• Lodging	• *	• *	• *	• *	• *	• *	
• Head smut	•	•	•	•	•	• *	

2.5.2 Formation of Farmers' Research Committee (FRC)

An idea of forming a farmers' group, interested to participate in the research, emerged while discussing on mechanism of implementing research activities with the farming community. Capitalising on this idea, a *Krishak Anusandhan Samuha*, literally meaning Farmer's Research Committee (FRC) was formed at each site in order to empower farmers and to ensure their leadership in the project. Farmers formed the committee themselves by selecting the members using the following criteria developed during the village workshop.

- farmer having good knowledge and skills in various aspects of maize production
- permanently living in the village and engage in farming
- socially respected and trusted within the community
- a good facilitator and have a good co-ordinating ability

Members for the FRC were nominated unanimously by the farmers at both the sites. They were, however, suggested to include female members in the committee. The committees comprise 11 members and female representation in the committee is 36% in Simichaur and 45% in Darabar-Devisthan.

Operational mechanisms of the committee was also discussed in the workshop. It was agreed that the committee would work as a link body between farmers and researchers. The specific roles of the committee have been identified as:

- Annual planning of research activities. Decide on the research activities to be implemented at each research site in joint agreement with the research scientists.
- Ensure and facilitate implementation of the agreed research activities. This include selection of research farmers and research plots, distribution of trial materials to participating farmers, organise Farm Walk (FW), Focus Group Discussion (FGD) and Post Harvest Evaluation.

During the last two years, FRC of both Darbar Devisthan and Simichaur organized 18 meetings to discuss various issues (Annex-III). The activities accomplished by FRC during this period are outlined below.

- Organized and participated in the planning activities
- Selected participant farmers and research plots
- Distributed seed of maize and other winter crops
- Organized and conducted FW, FGD, and post harvest evaluation
- Facilitated training programme on Mass Selection Method for the farmers.
- FRC of Simichaur formed one sub- committee (Seed Producers' Group), and FRC of Darbar Devisthan formed three sub-committees (Advisory Committee, Women's Group, and Seed Producers' Group) to complement their maize breeding programme.
- FRC of both the sites discussed, decided, and then requested the researchers for various support, on:
 - PVS on winter crops
 - training on mass selection technique for additional farmers than included in the first year
 - training in neighboring village outside the project area
 - maize sheller to FRC for the use by the farming community
 - an exposure visit to formal research stations and farmers' cooperatives

2.5.3 Identification of institutional roles and establishing working mechanisms

The working mechanisms, and the roles and responsibilities of key stakeholders (LI-BIRD, NMRP and farming communities represented by FRC) were outlined to ensure the smooth

implementation of the project activities (Table 4). Initial planning of research activities was also done during this process, identifying researchers' and farmers' role, which is discussed in detail under point 2.6.

Table 4: Role of different stakeholders in the project.

• Farmers' Research Committee (FRC)	• LI-BIRD researchers	• NARC breeders
<ul style="list-style-type: none"> • Strengthening local institution • Selection and mobilisation of participating farmers • Identify preferred traits • Analysis of existing diversity • Organise Farm Walk • Organise Focus Group Discussion 	<ul style="list-style-type: none"> • Identify farmers' preferred traits • Mobilisation of farmers • Capacity building 	<ul style="list-style-type: none"> • Participate in research process
<ul style="list-style-type: none"> • Planning and implementation of identified activities. • 	<ul style="list-style-type: none"> • Search suitable material • Introduce participatory approaches to testing and evaluation 	<ul style="list-style-type: none"> • Provide wide range of germplasm both exotic and local
<ul style="list-style-type: none"> • Set breeding objective • Need and problem assessment • Choice of parent 	<ul style="list-style-type: none"> • Facilitate setting breeding goals • Choice of parent 	<ul style="list-style-type: none"> • Assess technical feasibility of the breeding goal
<ul style="list-style-type: none"> • Creating variability • Share local material and knowledge • On-farm crossing, detasseling, saving seed under target environment 	<ul style="list-style-type: none"> • Assist to create new variability • Training • Monitoring 	<ul style="list-style-type: none"> • Create new variation • Provide elite materials
<ul style="list-style-type: none"> • Selection and evaluation • Mobilisation and selection of participating farmers • Select preferred material in target agronomic conditions • Post harvest evaluation 	<ul style="list-style-type: none"> • Identify knowledge gaps and train farmers • Promote discussion 	<ul style="list-style-type: none"> • Screen for stress invisible to farmers • Assist in training
<ul style="list-style-type: none"> • Seed Diffusion • Seed multiplication, sale and exchange 	<ul style="list-style-type: none"> • Study informal seed supply system • Scale up of PPB products 	<ul style="list-style-type: none"> • Include PPB product in formal testing

2.6 Programme planning process

Programme planning was done annually. All the major stakeholders (FRC, Farmers, VDC representatives, LI-BIRD, NMRP) were involved in the process. The programme planning exercise for 1999 (the first year of project implementation) was done during the village level workshop, however a separate programme planning meeting was organised in the second year. During 1999, the planning process was led by researchers of LI-BIRD and NMRP.

Researchers suggested different possible options to achieve the breeding goal. The objective, methodologies and processes of each activity were explained in detail. Farmers' queries and questions were answered, and their views on each activity was carefully studied. The options, which could be implemented within the project framework, and which farmers thought

possible considering their resources (time), knowledge and skill, were approved by the meeting.

In the second year, researchers just facilitated FRC and farmers in developing annual work programme. Researchers prompted the questions, such as which cross to advance and which to drop? Which variety to test in wider areas etc.? Farmers discussed among themselves, and came up with the answers based on the review of the last years' research activities, and their evaluation during Farm Walk, FGD, and post harvest evaluation. FRC agreed to prepare the annual work programme for the third year and researchers agreed to provide technical comments and suggestion on the programme prepared by FRC.

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2.7 Variety search, procurement, collection, and Packaging of trial materials

- The characteristics of available varieties were reviewed to identify varieties with farmer preferred traits. Such varieties were included in different research activities. Consultation with maize scientists of Nepal were made in order to refine the variety search process, and different institutions were consulted for the source seed and germplasm (Annex-IV).

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- The collected materials packed in different amounts (sizes) according to the plot size of the activity. The trial materials were handed over to the Farmers' Research Committee (FRC) at three weeks before the expected planting time, which was again distributed to the cooperating farmers two weeks before the expected planting time by FRC.

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2.8 Collaboration

- In addition to partner organizations, collaboration was established with other institutions during the process of project implementation. The Observation Nursery was conducted in collaboration with CIMMYT and NMRP. The trial materials (seed and instructions) was received from CIMMYT, which were tested in two villages of Gulmi district as a multi-locational testing of NMRP. The data generated from the field research was supplied to NMRP as per the prior commitment. Similarly, collaboration with District Agriculture Development Office, Gulmi , DoA/ HMG- Nepal, Outreach Research Division of Nepal Agricultural Research Council (NARC), and Gulmi-Argkhanchi Rural Development Project (GARDP), Gulmi was established at various occasion in various activities.

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2.9 Orientation to Farmers' Research Committee (FRC)

- The technique of plot selection, farmer selection, and research methodology to implement different activities were discussed with FRC in order to produce quality outputs from the activities.

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2.10 Researcher farmer selection

- Researcher farmers were selected by FRC considering the following.
- selection of innovative farmer
- farmer who can afford losses due to experimentation
- farmer interested in the project activity
- farmer residing in the project area
- balancing participation from gender, ethnicity and wealth category

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2.11 Trial material distribution to researcher farmers and briefing on the methodology

- The distribution of trial materials was done by FRC with the help of site based staff. Planting and other management methods were briefed by site based staff along with the handing over of trial material. The site based staff assisted farmers in planting the activities, which required to plant the seed in specific design, eg. Crossing block, Observation nursery etc. While simple activities like PVS, IRD were planted by farmers themselves.

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2.12 Field implementation of the planned activities

- The programme planned by the joint meeting of the FRC, farmers and researchers was implemented in participatory manner. The trial material (seed) and technical support to implement the field activity was provided by LI-BIRD, while the trial plot, inputs and labour was provided by the cooperating farmers. The outcome was evaluated by a group of FRC, farmers, researchers, and extensionists.
- A multiple approach was adopted to enhance the process of farmer-led participatory plant breeding in developing new maize varieties. These approaches included variety improvement through mass selection and crossing; and variety selection through other supportive research activities, such as observation nursery, co-ordinated varietal trial, varietal display, participatory variety selection (PVS), and informal research and development (IRD) programme. Farmers' research was further supported by training on mass selection technique for use under their own local circumstances. A short description of these methods/approaches is presented below (Table 5).

Table 5. Summary of the maize breeding, socioeconomic, and training activities accomplished in the project sites during 1999 and 2000.

Activities	Project 1999		Project 2000		Remarks
	Darb ar-Devis than	Simichaur	Darb ar-Devis than	Simichaur	
1. Crossing Programme (farmers involved)	4	5	4	4	<ul style="list-style-type: none"> F1 generation selected through mass selection method. 'x' indicates rejected by farmers During 2000, FRC of only Darbar planned to make one additional crossing of Rampur Composite and <i>Thulo Pinyalo</i>. But, FRC of Simichaur decided to go only through farmer breeding.
• Ganesh-1 x <i>Thulo Pinyalo</i>	✓	✓	F ₁	F ₁	
• <i>Thulo Pinyalo</i> x Ganesh –1	✓	✓	x	F ₁	
• Rampur Composite x Ganesh –1	-	✓	-	F ₁	
• <i>Thulo Pinyalo</i> x Khumal Yellow	✓	✓	F ₁	F ₁	
• Pop –22 x <i>Thulo Pinyalo</i>	✓	✓	F ₁	x	
• Rampur Composite x <i>Thulo Pinyalo</i>	-	-	✓	-	
2. Mass selection Programme (Farmers involved)	5	5	8	13	
• <i>Thulo Pinyalo</i>	4	4	7	12	
• <i>Resunga</i> Composite	1	1	1	1	
3. PVS (farmers involved)	40	40	33	60	<ul style="list-style-type: none"> 12 varieties in '99 9 varieties in '00 (6 screened from '99 PVS and 3 new)
4. Introduction of elite germplasm (farmers involved)	2	2	2	2	35 lines in '99 (32 CIMMYT lines + 3 elite composites), 12 lines (6 lines screened from '99 + 6 new lines) in '00
5. Varietal display (farmers involved)	2	2	2	2	14 varieties in '99 and 12 varieties in '00 (All new lines used in observation nursery.)
6. Farmer breeding (farmers involved)	-	-	100	100	Each farmer received 1 kg seed of Rampur composite and training on mass selection. Farmers doing rest of the activities themselves.
7. Farmers Training (farmers involved)	37	25	110	435	Training on 'Mass selection' in separate session for male and female farmers.
• Female farmer	22	6	55	261	
• Male farmer	15	19	55	174	

• Activities	• Project year		• Project year		• Remarks
	• 1999	• year	• 2000	• year	
	• Darbar-Devis than	• Simic haur	• Darbar-Devis than	• Simic haur	
• Female %	• 59	• 24	• 50	• 60	•
8. Farmers Tour (farmers involved) • Female farmer • Male farmer	• - • - • -	• - • - • -	• 20 • 14 • 6	• 20 • 7 • 13	• To provide an exposure to formal research stations and farmers' group 1. National Maize Research Programme (NMRP), 2. Farmers seed cooperative, Pithuwa 3. Lumle Agriculture Research Station.
9. Socio-economic baseline survey	• 40	• 60	• -	• -	•
10. Gender analysis	• 12	• 18	• -	• -	•

2.12.1 Variety Improvement Programme

- The following two broad field activities, which includes eight sub-activities (two mass-selection and six crossing activities), were planned and implemented. Later on farmers and NMRP initiated their own breeding programme.

2.12.1.1 Population improvement through mass selection

- a. **Improvement of *Thulo Pinyalo*:** Mass selection programme has been under taken in order to develop new lodging resistant *Thulo Pinyalo* maize variety. Altogether 19 farmers are directly involved in this activity. Farmers have perceived mass selection as a simple method to handle and a good way of improving specific traits of their preference while retaining the other desirable traits of the variety.
- b. **Improvement of *Resunga Composite*:** The seed resulted from random crossing between five different superior composite varieties (Rampur Composite, Rampur-1, Across-9331, Naryani and Rampur-2) was provided to farmers as a source of variation. The material was obtained from NMRP. Farmers grew and selected population after detasseling of undesirable plants from standing crops and seed selection at harvest. They named this Composite as *Resunga Composite* after *Resunga* mountain, a Hindu shrine in the region and will continue to do mass selection until they obtain an uniform population.

2.12.1.2 Crossing programme

- Considering the slow genetic gain in mass selection method particularly in the farmers' field, crossing programmes were also initiated with the active participation of farmer researchers. Five crossings were made during the first year and one additional cross in the second year. Crossings were done between *Thulo Pinyalo* and lodging resistant elite varieties, and also between different lodging resistant elite varieties. The F₁ seeds were grown during 2000 season. It has been planned that the materials will be advanced and improved using mass selection method in later generations. This will be continued in third and fourth years as well. By the end of the fourth year, the population is expected to have reasonable homogeneity. The product will be tested in wider areas during the fifth year, and its scaling up in the sixth year.

2.12.1.3 Additional breeding initiatives resulting from the project

- The following two new breeding initiatives, not planned in the project proposal, have been undertaken spontaneously- one by National Maize Research Programme (NMRP) and another by the farmers themselves at both the research sites.

- **a. NMRP's initiatives:** National Maize Research Programme (NMRP) planned for an alternative approach to address the problem in their breeding programme. NMRP has used selfing method, as a fast track to tackle the lodging problem. Cobs from the best plants of *Thulo Pinyalo* were selected from farmers' field during 1999 summer. Selfing was done at NMRP, during 1999 winter and 290 best ears were selected. The selected S₁ progenies were evaluated at the project site during 2000 summer. Considering the insufficient variation among the S₁ families, scientists decided to self the S₁ progenies once again during 2000 winter season in order to increase the variation in S₂. The selected S₂ progenies will be evaluated at the project site during 2001 summer and the best progenies will be recombined at NMRP, during 2001 winter using the remnant seed. The evaluation and recombination work will be repeated once again before testing the population as a variety in the farmers' field.
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- **b. Farmers' breeding:** One new activity has been initiated in the second year in order to strengthen farmers' breeding programme involving 100 farmers from each of the project sites. Rampur Composite, widely adapted popular variety of Nepal, was tested under PVS programme. This variety performed very well at the project sites also. Farmers liked this variety due to good yield, non-lodging character, attractive ear (good grain filling), flint grain and attractive orange-yellow grain colour. Seeds of this variety have been given to the farmers. As discussed in programme planning meeting, farmers planted the seed of Rampur Composite in the middle of the *Thulo Pinyalo* plots and detasselled Rampur Composite before pollen shading. This ensured total cross-fertilisation between Rampur Composite and *Thulo Pinyalo*. Farmers then selected seeds from the plants with desirable characteristics. In future, best progenies from the heterogeneous population would be selected by farmers themselves and develop varieties of their need. All the participating farmers have been given training on mass selection technique. Farmers' breeding strategy/ method, trait of interest and selection pressure, influence of socio-economic, ethnic, and gender classes in breeding activity will be studied and documented.

2.12.2 Variety Selection Programme

Considering the long gestation period of the variety improvement programme, variety selection programme was also initiated to compliment the variety improvement activities as well as to provide farmers a quick options to select varieties of their choice from the readily available stock of new improved varieties. A number of activities have been conducted under this programme, such as;

- Observation Nursery – To introduce and identify farmer preferred CIMMYT bred exotic maize lines suitable for the mid hill condition.
- Coordinated Varietal Trial (CVT) - To identify farmer preferred superior maize varieties for the mid hill condition.
- Varietal display - To compare and display the performance of different improved as well as existing local varieties of maize.
- Participatory Variety Selection (PVS) - To identify farmer preferred superior maize varieties for the mid hill condition.
- Informal Research and Development (IRD) - To identify farmer preferred superior maize varieties for the mid hill condition.

These activities were conducted in collaboration with National Maize Research Programme (NMRP) of Nepal Agricultural Research Council (NARC) and International Maize and Wheat Improvement Centre (CIMMYT).

The project has already produced very interesting and promising results, both in terms of process as well as product (Table 5), for example;

- Farmers are advancing and improving six F₁ populations of maize
- Farmers tested more than 75 different genotypes of maize and identified five genotypes as superior to their existing varieties

- A total of 607 farmers received training on mass selection and seed selection method, of which more than 50% were female.
- About 200 farmers are improving their local variety on their own
- Farmers are capable to plan the project activities, organize Farm Walk, Focus Group Discussion, monitoring and evaluation, and selection of tested varieties.

2.12.3 Socio-economic studies

- The following studies were conducted to collect socio-economic information required for the planning and implementation of the project activities.
- Socio-economic baseline survey of the project site
- Gender analysis of roles and decision making patterns in maize production and utilisation

2.12.3.1 Socio-economic baseline survey

- The main objective of the baseline socioeconomic survey was to establish a benchmark information useful in planning, and monitoring and evaluation of the research activities of the project implemented at the two research sites. Both PRA techniques and household survey were used to collect baseline data for the project. A stratified random sampling technique was used to select representative households for household survey. Wealth ranking was used as a basis for stratification. The total number of households included in the household survey was 40 at Darbar-Devisthan project site and 60 at Simichaur (see baseline report by Shrestha, *et.al.*, 2000 for detail information).

- The survey findings reveal that farmers of the research sites have poor access to farm resources (see Annex-V for detail information). These farmers are largely smallholders with an average maize-growing *bari* land holding of 0.31 hectare, scattered over an average number of 2.3 parcels. The difference in *bari* land holding and number of *bari* parcels per household is significant ($p < .000$ and $p < .05$ respectively) only across wealth categories. The average livestock unit, the major source of manure for maize production, is 2.8. The distribution of livestock unit is significant across wealth ($p < .000$) and ethnic ($p < .01$) categories. In overall, though not statistically significant, the KDS ethnic group and the female-headed household own comparatively less farm resources than other categories.

- Farmers have very limited access to improved maize varieties suitable to their needs as well as to the local environment. Only 13% of the farmers reported growing improved varieties of maize; however, they know the value of changing their old seeds. Similarly, farmers' access to technical services and information on technology is also poor. Only about 3% of the maize-growing households reported participating in agriculture-related training, and only 6% participated in educational tours. About 39% of the households reported exchanging their seeds during last five years with other farmers. Likewise, about 15% of the households reported receiving information on improved technology for maize production.

Farmers have been found to grow about eight different types of maize varieties. However, a majority of the households grow one to two varieties of maize (46.5% to 45.5%, respectively) in a season (see Annex-VI). Only about 8% of the total maize-growing households grow more than three varieties per season. Of these varieties, *Thulo Pinyalo* alone covers more than 75% of the maize area. The varietal diversity maintained at household level, therefore, is low (see figure in Annex-VII).

The ANOVA result shows that the difference in the number of maize varieties grown at household level is significant ($p < .05$) across wealth categories but not significant across ethnic categories and between male- and female-headed households. However, a majority of the farmers (67.9%) grow to suit different types of land, and this is true across all wealth and

ethnic categories and between male- and female-headed households. The ANOVA result suggests that the number of maize varieties grown at household level is not significantly related to the size of the *bari* land but is highly significantly related to the number of parcels of *bari* land the farmer is planting to maize ($p < .000$). Similarly, the survey reveals that farmers' knowledge about maize is poor (details in Annex-VIII).

2.12.3.2 Gender analysis

- Women supersede men in their involvement in all three major functions of maize production and utilisation: namely, (1) production, (2) household utilisation and marketing, and (3) seed management (details in Annex-IX). Their involvement is particularly high in the application of compost and farmyard manure to the maize field; seed processing, treatment, storage, and preparation for sowing in the next season; and intercropping of maize with beans, cowpeas, pumpkins, and other crops.

The results of the gender analysis show that women are also the prime decision makers in the family and their contribution to decision making in activities related to maize production and utilisation is higher than that their male counterparts in the family (details in Annex-X). Their contribution to decisions is particularly high in the selection of crops for intercropping with maize, deciding on date and time of weeding and earthing-up in the maize fields, and in most of the activities related to utilisation and marketing and seed management.

2.12.3.3 Implication of socio-economic studies

- A number of considerations have been made in the design and process of the research programme as suggested by the analysis of the users' and gender perspective of maize production and utilisation. These include:
 - Reinforcing modification in breeding objective and selection of breeding materials to suite farmers' trait preferences. The breeding strategy focuses on to improve the production performance of a widely grown maize variety, *Thulo Pinyalo*, rather than creating a large diversity of maize varieties. However, looking at the diversity in the farming community, attention has also been given to meeting the specific needs of the niche environment through a participatory variety-selection program, which provides farmers with a choice from a large number of maize varieties.
 - Considering the important role of women in maize production and utilisation, women constitute 41% of the members of Farmers' Research Committee.
 - Selection of farmers to carry out maize breeding and other research activities has given due consideration to the selection of farmers and farming households that equally represent wealth, ethnic and gender categories.
 - Based on the findings of the survey on the distribution of maize-breeding knowledge among farmers, field-based training was provided to the research farmers in order to supplement farmers' knowledge with practical scientific breeding knowledge. Attention was given to representation of different categories of farmers, including women. Fifty-seven percent of the total trainees were women. This consideration will also be made in future farmers' training programs.
 - The initial survey indicated that farmers use multiple criteria for the selection of a particular maize variety. Farmers may give different weights to these criteria to suite their individual needs and resources. With this in mind, the collection and analysis of users' and gender-differentiated data have been built into the research process to ensure that users' and gender perspectives are incorporated into the participatory breeding program.

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2.13 Farmers Training on Mass Selection

- A training programme on simple plant breeding 'Mass Selection' was organized at both of the project sites during both 1999 and 2000.

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- **Objective:** Help participating farmers to be able to use simple plant breeding technique of 'mass selection' to improve or maintain variety and to produce quality seed.

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- **Participants:** The training module was prepared for the participating farmers. Some interested and enthusiastic non-participating farmers were also included in the training with the anticipation of their participation in the research programme in future. Considering the role of women in maize production and utilisation revealed in the socio-economic studies, about 50% of the trainees were purposively selected from women farmers.

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- **Resource person:** The training was given by M. Subedi (Plant Breeder), S. Sunwar (Asst Plant Breeder) and D. Paudel (Asst Agronomist) with support from H.P. Paudel (Community Organizer), B.B. Paudel (Community Organizer), and N.K. Khatri (Community Organizer) of LI-BIRD. Leading breeder farmers were also involved as resource persons in the second year. Mrs Lal Kumari Basnet from Simichaur and Mr Chet Man Khatri from Darbar-Devisthan shared their experiences in detasseling and crossing maize with the participants. Sharing of the experience particularly the anxiety, skepticism, and doubts of breeder farmer stimulated participants' interest in the subject matter, and thereby helped in convincing other farmers. It was observed that farmers understood the scientific processes easily and quickly when they hear from farmers.

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- **Training method and materials:** During the training, emphasis was given on interaction and discussion. It was tried to explore what they know about the subject matter before describing by the trainer. This process led very good discussion among the participants, and the agreement and argument helped in better understanding of the subject matter. This process also provided opportunity to assess the level of knowledge base of the participating farmers in the subject matter. The training was given with the help of plant sample, figures, posters, practical examples, and field visit. A training manual has been developed for the farmers. It has been tried to use less text in the manual and explain the subject matter through pictures. The manual was validated by farmers during the second year. During the process of field validation, comments and suggestions were sought from both male and female farmers. A total of 11 farmers reviewed and gave their comments/ suggestions on the manual, of which 4 farmers reviewed before, 3 farmers reviewed during, and 4 farmers reviewed after the training. Farmers reported that the manual is clear and easy to understand, however there were some minor comments for the clarification of specific words/ sentences.

- **Topics covered:** The details of the training modules have been presented in separate training manual (Subedi *et al.*, Draft) and list of topics covered in Annex-XI.

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- The processes adopted in the organization and management of the training programme during 1999 and 2000 have been outlined and compared (Table 6), which indicates that the training programme was successful in

- ◆ meeting the gap in farmers knowledge base
- ◆ stimulating farmers' interest,
- ◆ empowering farmers
- ◆ achieving participatory learning
- ◆ capacity building of farmers
- ◆ providing equal opportunity to females farmers

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- **Table 6.** The processes adopted in the organization and management of the training programme in Darbar and Simichaur during 1999 and 2000

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	• 1999	• 2000
• Who initiated?	• FRC approved the researchers' proposal during programme planning meeting	• Farmers found the training useful. FRC requested researchers to provide the training again.
• Objective	• To provide simple seed selection technique to participating farmers	• To provide simple seed selection technique to farmers. • Strengthen farmer breeding
• Management	• Training time and venue was fixed jointly by FRC and researchers	• FRC fixed the time and venue for training
• To whom?	• Training provided to participating and few non-participating farmers of the project area only.	• FRC requested to provide training for more number of farmers (both participating and non-participating) than in 1999. • Due to the strong pressure from the farmers of the adjacent village outside the project area, VDC and FRC requested researchers to provide the training to them. Two separate sessions of training was organized in the village, which was 1.5 hrs far (on foot) from the project area.
• Participant selection and information	• By FRC on the request of researchers	• By FRC
• Session organisation	• Male and female farmers in same session	• Upon the request of female farmers, the training session for male and female farmers was organised separately
• Resource person	• Researchers from LI-BIRD	• Researchers from LI-BIRD and innovative breeder farmers of the project sites

2.14 Monitoring and Evaluation

- The M&E of the project activities are done in gender and user differentiated groups adopting participatory methods. Stakeholders have been involved in all stages of the evaluation process, i.e. from defining evaluation criteria to actual implementation of the evaluation study. Different perspectives of the stakeholders have been integrated to give a holistic picture about the effectiveness of the project. Stakeholders differentiated feedback and reactions about the effectiveness of the project have been collected.

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2.14.1 Clarification and sharing of project objectives with stakeholders

- Project objectives were shared and clarified to different potential stakeholder at different occasions prior to village workshop. The project objective were also shared in detail and clarified to all stakeholders (both male and female farmers, local leaders/ VDC representatives, researchers from NMRP, extensionist from DADO) during village workshop. Later the project objectives were shared and clarified to agriculture experts of Gulmi-Arghakhanchi Rural Development Project (GARDP). Queries and questions of all stakeholders were answered and clarified. Stakeholders' view was also shared, and their comments and suggestions have been duly incorporated in work programme. These stakeholders have continuously been involved in research planning, implementation and monitoring and evaluation activities of the project.

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2.14.2 Participatory crop monitoring and evaluation process

- Systematic monitoring and evaluation (M&E) component is built into the project design, which includes, FW, FGD, and Post harvest evaluation. Crop monitoring activities were organized at the maturity stage of the crop. Different categories of farmers, FRC, VDC representatives, Scientists NMRP, Outreach Officer from NARC, Agricultural Expert from Gulmi-Arghakhanchi Rural Development Project (GARDP- an EU funded development

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project working in Gulmi and Arghakhanchi districts), Extensionist from District Agriculture Development Office, and Plant Breeders, PVS agronomist, Sociologist and Community Organizers of LI-BIRD were involved in the Farm Walk. Farmers and scientists jointly observed, discussed, and evaluated the tested lines. While the Farmers, FRC, VDC representatives, researchers from LI-BIRD carried out the FGD and post harvest evaluation, LI-BIRD facilitated FRC to organize the Farm Walk and carry out the evaluation of the field activities. The FRC took the leadership in planning (decide date for monitoring at both sites), informing all stakeholders through LI-BIRD's site based staff, and conducting farm walk and Group discussion in both of the sites.

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2.14.3 Farm Walk (FW) and Focus Group Discussion (FGD)

- Farm Walk (FW) was organized once at the maturity stage of the crop and FGD was organized twice, first at the maturity stage and second after post harvest evaluation of the crop. During the FW farmers were facilitated to evaluate the lines and this was followed by FGD to discuss the good and bad traits of the observed varieties/ lines, compare the new genotypes with existing varieties and then identify better genotypes. The monitoring and evaluation process was organized in the following way:
 - The farmers were pre-informed about the program.
 - The farmers were given a form and requested to evaluate the varieties, and facilitated to rank and note down the name of outstanding varieties/lines considering the trait of their concern.
 - The farmers were grouped into two different groups (male and female groups) and the response of male and female farmers were collected separately. The selection criteria of both male and female participants were similar except for plant height.

It was observed that the female farmers give priority to plant height in order to produce more fodder yield. Since these are fodder deficient areas, dried stover of maize constitute major proportion of the animal feed particularly during winter season. Limited supply of rice straw due to very low proportion of *khet* land (less than 5% in these VDCs) in the region has greatly increased the value of maize stover as livestock feed. Women are particularly responsible for managing the livestock feed, for which they have to travel long distances and spend lot of time in collecting and carrying the fodder/forage, particularly during the fodder lean period, i.e. from winter through to the onset of monsoon. This is the reason why women farmers were particularly interested in the fodder yield than other parameters.

However, at Simichaur, the KDS group gave priority to yield and yield attributing traits, like size of the cob and number of cobs per plant etc. The KDS group is the socially and economically dis-advantaged group and constitutes poor segment of the community. They are largely food deficit and do not have sufficient food-grain production. This is the reason why the farmers of this group selected the traits directly related to yield.

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2.14.4 Post harvest evaluation

- FGD was organized involving FRC, farmers and site based technical staff to collect farmers' response on the post harvest traits of the selected lines. It was done one month after the crop harvest in order to allow farmers a sufficient time to evaluate the post harvest performance of the maize lines under test. The pre-harvest evaluation of these genotypes was done at late dough stage of the crop. Some of the genotypes selected during FW at pre-harvest stage were rejected after post harvest evaluation. Some of the genotypes having large cob were also rejected by the farmers due to unacceptable grain colour (dull and dirty white) and grain types (dent). Farmers are aware that grit recovery in dent grain type is less and flour recovery is high, while farmers' preference is just opposite. Farmers preferred to have more grit recovery from their variety. It was also revealed from the FGD that they prefer yellow grain colour than white. Farmers reported that they judge the variety based on the following post harvest criteria,
 - Grain colour

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- Grain type/ grit recovery
- Cob size
- Phenotypic appearance
- Disease reaction
- Taste

2.14.5 Effect of crop monitoring and evaluation programme on the breeding programme of stakeholders

- In addition to the information on project's research activities, the participants also received a good opportunity to study about the genetic make-up of existing varieties /landraces, socio-economic settings of the project sites and the geo-physical situation of the region. During the process, future work was also discussed and different stakeholders planned to launch additional activities. These include:
 - NMRP initiated a breeding programme to address the lodging problem in *Thulo Pinyalo* in their breeding programme by using selfing method, an alternative fast technique to secure higher genetic gain.
 - 200 farmers initiated their own breeding programme to address the problem by crossing Rampur Composite and *Thulo Pinyalo*.
 - FRC of Darbar Devasthan decided to make one cross between Rampur Composite and *Thulo Pinyalo*.

2.14.6 Evaluation by grass-root stakeholders

- The view of FRC, VDC representatives, and some leading farmer breeders were collected in the second year of project period. This study was done in less organized and more informal manner. The objective of this study was to understand farmers' perception about the project and consolidate their feedback to refine the project activities. The grass-root stakeholder were requested to provide their views on:
 - programme content
 - programme implementation process
 - product (farmers preferred varieties)
- An attempt was made to explore the stakeholders' views on whether this project is working on farmers' research agenda/ question or not? Whether they feel that this project is beneficial to farmers or not? Whether they feel that this project is likely to produce some good output or not and so on.
- All the grass-root stakeholders were satisfied with the programme content and implementation process. They opined that the project is working in pertinent problem of the farmer in the area, so the project output will be beneficial to the farmers. Considering the performance of some improved maize varieties, farmers were optimistic about the project output. However, they also expressed the difficulty in making conclusive statement based on the one-year results. Besides, the effect of breeding programme is yet to be realised by the farming community at large. Some of the female respondents were concerned about the low fodder production due to low plant height of most of the improved varieties.

2.14.7 Project evaluation by all stakeholders

- Focus Group Discussion and interview was organized to collect the view of all stakeholders, viz. FRC, participating and non-participating farmers (both male and female), VDC representatives, researchers from NMRP, and extension/ development workers (DADO and GARDP) at the end of the second year of the project (Annex-XII). Checklist was developed to collect respondents' views on the process, product, monitoring and evaluation aspect, and strength/ weakness of the project (Annex XIII). The objective of this study was to understand the stakeholders' perception about the project and consolidate their feedback to refine the project activities. Major feedback from the stakeholders is presented below.

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- ***About the process of project implementation:*** The stakeholders were positive and satisfied with the project implementation process. The project objectives, roles and responsibilities of different partners were clear to all stakeholders. The respondent opined that the responsibilities were well distributed among different partners. The scientists from NMRP re-inforced to establish formal collaboration with NMRP in order to increase the effectiveness and impact of the output at large. The respondents expressed satisfaction about their roles and responsibilities, and willingness to participate and contribute to the project in future also.
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- The respondents reported that the formation of FRC was very effective in implementation of the project activities particularly seed distribution, discussion and communication. The FRC members reported the following benefits of FRC.
 1. They have learned technical skills
 2. They have learned to work in group and manage organisation
 3. They have realised that it is easy to implement field activities through such group
 4. Lesson learned can be used in similar other programmes
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- Similarly, participating farmers (both male and female) realised that they had better access to input (seed) and information due to the formation of FRC in the community. They also feel that it is easy to contact and comfortable to discuss with FRC members. All the responded reported that implementation of the project activities were accomplished easily through FRC. Participating male farmers of both Darbar-Devisthan and Simichaur, and VDC representatives of Simichaur opined that the FRC is one of the important factors for the success of this project.
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- The future plan to sustain FRC was explored with FRC members, participating farmers (both male and Female), and VDC representatives. FRC members are planning to create office and raise funds (collect membership fees and seek support from various other organisations) for minimum office support, formed various subcommittee (advisory committee) and groups (women's group and seed producers group) to organised different activities at village level. Similarly participating farmers (both male and female) expressed their commitments to participate and provide support to FRC's programme as and when required. VDC representatives also reported that the FRC is doing commendable job for the community and it is good to sustain FRC to organise various other development activities in the village. Intrigued by the working mechanism and performance of FRC, VDC is thinking to implement development activities through FRC (or similar groups). At present VDC is trying to link FRC with other donor agencies to seek funding to support various development activities of the village. The VDC representatives even committed to provide some financial support, if required.
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- However, the non-participating farmers (both male and female) showed their ignorance in many of the aspects mentioned above. They were aware of implementation of the project in the village, and existence of the FRC in the village, but were not clear about the project objective, as they just know that the project is for the improvement of maize. They were not clear about the project implementation process also. Lack of adequate knowledge about the project activities is the reason for not participating in the project activities. They realised that not being proactive in showing concern and interest is the other reason for not participating in the project activities. However they are willing to participate in future, and at present they are sharing the improved seed and information with the participating farmers. They feel that the participating farmers are doing good job for the community, as they are disseminating the information and taking risk of testing new varieties for the community.
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- Regarding female representation in FRC, the FRC members opined that female members in the committee made easy to motivate and consolidate female farmers' participation in the project
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activities. Intrigued by this realisation, they have decided to involve female members of the community in other future programmes as well. Participating farmers also shared similar opinion. They also feel that the contribution of female in agriculture is more than male members, so it is good to involve female in the process. It is also easy to share and discuss with female than male members of the community.

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- The field based research staff, who used to work with the formal system in the past, opined that the communication with the community is better. This has helped to understand the local situation and orient their activities and dealings with farmers accordingly.
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- The scientists from NMRP expressed that they had not enough experiences about participatory approach. They were impressed by the process of participatory approach, and the quality of outcome. Intrigued by the approach they also started breeding programme to address the problem of the area, and included the local varieties in the formal trials.
- ***About the product:*** Stakeholders view on the tested lines was explored. All the stakeholders were optimistic on the development of suitable maize lines. FRC and participating farmers (both male and female) were found to have considerable knowledge about the promising lines. Though the VDC representatives were aware of the good promise of some of the tested varieties, could not particularly name the promising ones. However they were able to indicate the promising varieties with the name of participating farmers who grew the variety and/or by recognising the parcel where the variety was grown.
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- It was also tried to explore whether the stakeholders realise any changes in the maize production due to the inception of the project. Pre-harvest seed selection practice and increase in production due to cultivation of new non-lodging maize varieties in the village has been perceived by FRC, participating farmers (both male and Female) and VDC representatives as major changes in the maize production in the area. Increased interest of the farmers in group-work was also mentioned by FRC and participating male farmers as the positive change in the community. The non-participating farmers mentioned the cultivation of new maize varieties in the village as the changes in maize production in the area.
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- ***About monitoring and evaluation aspect of the project:*** All the respondents expressed that evaluation of the potential product (variety) and implementation process by the farmers themselves is one of the positive aspects of the project. The field based research staff opined that involvement of farmers in monitoring and evaluation activities has increased the capacity of FRC in planning and implementing various activities.
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- ***About strength/ weakness of the project:*** Farmers leadership in the project, flexible working approach, encouragement to female farmers, training on practical problems, frequent monitoring of project activities, and working style/ attitude of researchers were opined by FRC as the strength of the project. Participating farmers (both male and female) and FRC appreciated the project for involving and encouraging females, providing training on pertinent issue, involving them in variety evaluation and selection process, working on the farmers research agenda, and capacity of researchers to mobilise the farmers as the strength of the project. The field based research staff appreciated the project for working on the important research problem of the very important crop, involving farmers in goal setting, ensuring lead role of farmers, flexible working style, encouraging females, providing training on pertinent issue, and providing basket of choices to farmers.
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- Similarly, Scientists from NMRP acknowledged the project for identifying farmers problem and working in important crop of the region, mobilising the farmers in the project activities, trying to link with national programme (NMRP), using methodologies which are practical and easy for the

farmers, multiple approaches and options adopted to address the problem, and involving farmers even in research. While extension agencies (DADO and GARDP) opined that working directly with farmers, providing basket of choices to farmers, and providing technical support to the farmers through site office as major strengths of the project.

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- FRC pointed out that some farmers were in loss while testing new variety, and working with low number of farmers as the weakness of the project. Female farmers reported the views of their male counterpart that ploughing was difficult after field experimentation due to soil compaction as a result of frequent visit to the experimental plot. High expectation from the project within a short time frame, and lack of training and exposure visit to site based staff were reported as weakness of the project by the field based researchers. The NMRP researchers opined that the problem, which requires long time to address has been planned to achieve in short period. While extension agencies (DADO and GARDP) opined short project period as the weakness of the project.
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- It was also tried to explore whether the stakeholders learned any new thing from the project. FRC realised that working in group is easy and effective. They opined that farmers have acquired new technical knowledge and increased the confidence to work/ contribute in research. Confidence in technical rigor of seed production using mass selection techniques is one of the major learning for the participating farmers (both male and female). While working directly with and in the community, field based researchers had the better understanding of the social context and local problem, and thereby increased competence in mobilising the community in project activities.
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- Finally, suggestions to improve the content and process of the project were also sought from the stakeholders. All of the grass-root stakeholders showed their concern about the short project period and suggested to increase the project duration. FRC suggested to support farmers until the project objective is achieved. They have requested to extend the project duration and area, and develop resource persons capable to work in the community after the termination of the project. Participating farmers (both male and female) suggested to increase project duration and not to leave on the half way. VDC representatives suggested to increase project duration, expand project area, and organise training for more farmers. Field based researchers also endorsed farmers' concern about short project period. Scientists from NMRP opined that the project activities are going on right direction. Further they suggested to establish a Letter of Agreement between LI-BIRD and NMRP for formal collaboration in this project. The extension agencies (DADO and GARDP) showed their concern about short project period and suggested to increase the project duration required for such project.

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3 INTERMEDIARY IMPACTS

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3.1 Effects on Formal Breeding Process (Feedback to research)

- National Maize research Programme (NMRP) has initiated breeding programme to improve the popular local maize variety, i.e. reducing lodging problem in *Thulo Pinyalo* maize variety. This will go parallel to the farmer-led breeding programme and will provide the basis for comparison. In this way, farmers' research agenda has been included in the formal sector breeding programme.
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- The participatory processes also provided opportunity to interact with farmers and understand the farmers' criteria and utilise them in formal sector research programme.
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3.2 Effects on farmer acceptance (Adoption)

- A high level of farmers' acceptance of the tested varieties has been found. Farmers have identified five varieties, viz. Rampur Composite, Pop-22, *Resunga* Composite, Hill Pool (Yellow)

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and Hill Pool (white), and asked seed of those selected varieties. However, it is too early to predict about the final acceptance. The farmers are still involved in selection of materials obtained from their crossing programme and yet to develop new maize varieties to suite their need.

3.3 Effects on farmer-held diversity

- Farmer held diversity has increased. Five maize varieties has been increased in the farmer held maize diversity in the village in 2 years time. In addition, some potential lines have been identified, which may contribute to the maize diversity in the area, for example.
- Farmers are advancing and improving six F₁ populations of maize
- Farmers tested more than 75 different genotypes of maize and identified five genotypes as superior to their existing varieties

3.4 Effects on farmer breeding/seed processes (technical/social)

- Farmers' seed selection skills have enhanced. Large number of farmers in the project area have started pre-harvest selection of seed using mass selection technique with their specific criteria. This will have a positive impact on local crop development process of the farmers. Moreover, the quality seed produced by using an improved seed selection procedure is expected to result positive impact on local seed supply system and household food security.
- In addition, 200 farmers have initiated their own breeding programme to incorporate the good traits of *Thulo Pinyalo* in Rampur Composite. Similarly, FRC of both sites have planned to form Seed Producers' Group to produce seed within the village, and supply within and outside the village. This will strengthen local seed supply system.

3.5 Effects on how local people are organized to manage crop development for breeding/selection and seed supply issues

- Farmers' Research Committee (FRC) was formed to plan, implement and evaluate the project activities with minimum contribution from the researchers. At present, FRC is successfully organizing farmers' meeting, Farm Walk, and Focus Group Discussion. Farmers' participation in different project activities increased from 98 in 1999 to 369 in 2000 (Annex-III). Farmers have gained confidence in project planning, implementation, and evaluation. As a result, new organizations are being evolved at farmers' level. FRC of Darbar Devasthan formed two committees. **Advisory Committee** has been formed under the coordinatorship of VDC Chairperson to provide advisory role to FRC, and **Women Group** is formed to consolidate women farmers' concerns in the research. FRC of both Darbar-Devasthan and Simichaur have decided to form **Seed Producers' Group**. All these committees have been formed by FRC on their own initiative without any help from LI-BIRD researchers. This was not even discussed with researchers prior to the formation of these groups.

3.6 Effects on how formal research organizations organize breeding (effects on breeding organization and on seed supply organization)

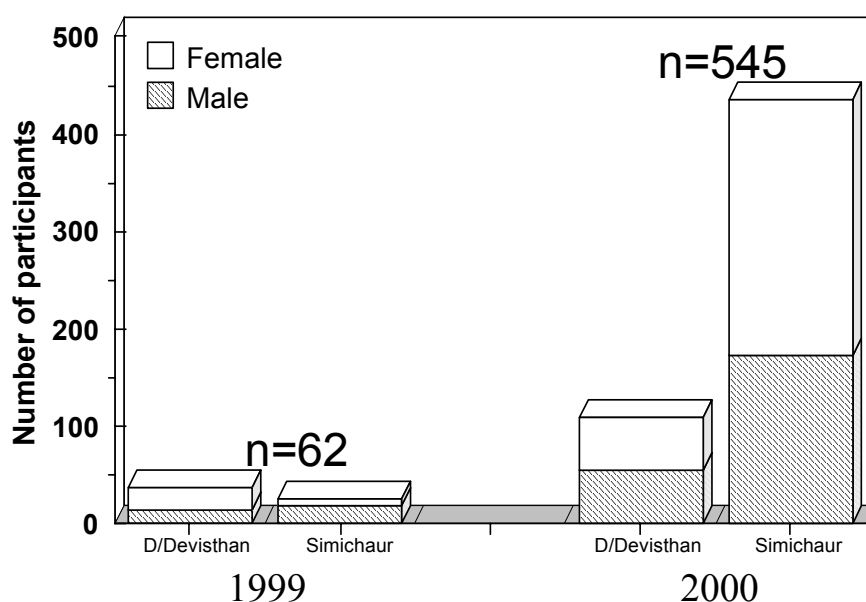
- Maize landraces collected from the project area has been included in the breeding programme of NMRP. In addition, NMRP has initiated work on developing lodging resistant varieties initiated for the project area. In this way, research station started to work on farmers' agenda (Institutionalisation).

3.7 Effects on farmers' capacity building

- *through involvement in the process*: Farmers involvement in the project management process has helped to increase their capacity as they learned the skills of research management and other technical information shared during different stages of project implementation. For example, farmers have learned how to develop annual programme within these two years. The process initially led by researchers was gradually and increasingly handed over to farmers. Farmers agreed to prepare the annual work

programme for the third year independently. Similarly, involvement of farmers in the programme management and decision making process has increased the sense of ownership. In two years time, farmers are now capable to plan the project activities, organize Farm Walk, Focus Group Discussion, monitoring, evaluation, and selection of tested varieties.

- *through training*: One day training on "Mass selection" was organized for the farmers. The training was given at both the sites just before the tasselling of maize in the farmers' field. Farmers liked the training programme and reported that the content is useful to them. This is reflected by the sheer increase in the number of participant from 62 in 1999 to 545 during 2000 (Fig. 1). With this learning, 200 farmers have initiated their own breeding programme and other farmers are utilizing the knowledge and skills gained seed selection.



- **Figure 1.** Number of farmers participated in the training programme during 1999 and 2000.

Lal Kumari, a lady farmer, presented paper in an international symposium

Mrs Lal Kumari Basnet is one of the enthusiastic FRC members and was participating in one of the population improvement (*Thulo piyanlo* x *Ganesh-1*). She agreed to do it in 500 square meter. This was done without consultation with her husband. When the project staff asked her to detassel *Thulo Piyanlo* plant she was worried whether grains will set after removing tassel. During the training it was told that detasseled plants would be pollinated from adjacent plants. Since all fellow farmers also agreed to remove tassel, she also did reluctantly. Every day early in the morning she used to visit her plot and opened up each cob by nail to check whether grains had set or not. She was worried about her husband because she has done this in large area and she has nothing to fall back on for food security. She expressed her fear, curiosity and dilemma in recent International Asian PPB meeting in Pokhara, Nepal. She is now great motivating factor for other farmers.

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3.8 Effects on empowerment

- The implementation process was designed in a way to help empower the farmers. Greater involvement of farmers in different processes and activities led greater understanding and confidence in various aspects of project planning, implementation, and evaluation.
- Farmers are now confident about the process of setting breeding objective
- Farmers are confident about the breeding programme and technology
- Farmers who were involved in project activities during the first year are helping to convince new farmers about the programme
- FRC of two research sites decided themselves (without consulting and seeking advice from researchers) to make reciprocal visit and exchange of experiences
- FRC is planing to developing local resource persons for technical support
- Farmers have started their own breeding initiatives in improving maize production
- Farmers have formed Seed Producers' Group to produce quality maize seeds within the village

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4 PUBLICATION

- Following publications/reports have been prepared during this period of the project.
- *Site selection report of farmer-led participatory maize breeding programme for the middle hills of Nepal* by M. Subedi and PK Shrestha, 1999.
- *Users' and gender perspectives of maize production at Darbar-Devasthan and Darbar-Devasthan research sites in Gulmi district of western Nepal: findings of a baseline socio-economic survey* by PK Shrestha, M Subedi, D Paudel, and S Sunwar, 2000
- *Training Manual on Mass Selection Technique* by M Subedi, S Sunwar and R Gautam, Draft.
- Following papers were presented in the International Symposium on Participatory Plant Breeding and Participatory Plant Genetic Resource Enhancement held in Pokhara, Nepal during 1-5 May 2000
 - *My experience in crossing maize* by Ms Lal Kumari Basnet (breeder farmer).
 - *Role of farmers in setting breeding goal* by M Subedi, PK Shrestha, S Sunwar, and A Subedi.
 - *Incorporation of users' and gender perspective in farmer-led plant breeding on maize: Experience from the western hills of Nepal* by PK Shrestha, M Subedi, D Paudel, and S Sunwar.
- *Consolidating farmers' role in participatory maize breeding in Nepal* by S. Sunwar, LK Basnet, CM Khatri, M Subedi, PK Shrestha, and A Subedi, 2000. Poster presented in International seminar on "Uniting science and participation in research" held in Nairobi, Kenya during 6-11 November 2000.
- *Experience in implementing of farmer-led participatory maize breeding programme for the middle hills of Nepal.* Training note by M Subedi, S. Sunwar, and PK Shrestha, 2000.

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5 IMPLICATIONS TO WORK PLAN

- Project period is too short for this type of activities as all the stakeholders showed their concern about the project period. Commitment to support for reasonable duration required to achieve the output is necessary to maintain the enthusiasm of stakeholders in the project.

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- New activities and initiatives emerge while implementing a process-led project like this. It is necessary to support these activities and initiatives in order to empower farmer, farmers' capacity building, support the project output, and for sustained project impact. However this type of unplanned activities require resources on both human and financial, and this need to be built in to future project.
- Formal research organisation (NMRP) has planned an alternative approach to address the problem in their breeding programme. This is an example of complementary action between GO and NGO. This activity will be included in the project in future.
- 200 farmers have initiated their own breeding programme. Participating farmers will be supported in future with the relevant information and training, and their breeding strategy/ method and socio-economic/ gender influences/considerations will be studied and documented.
- Some of the new varieties have performed well in the area. Scaling up activities will be planned in future in order to facilitate adoption at farmers level.

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