sensory evaluation of a set of upland rice varieties was organized in a village of eastern India. The objectives of this study were (1) to document the process of rice preparation at the farm level for raw and parboiled rice, (2) to estimate the influence of the two modes of preparation on rice quality and identify the best varieties in each case, (3) to collect information about quality characteristics that determine varietal acceptability by female and male farmers, and (4) to relate the preferences with the physico-chemical properties of the varieties determined in laboratory.

Materials and methods

Fifteen modern upland rice varieties and a local check (Brown Gora, widely grown by upland farmers) were tested. The test was conducted in 1998 in the village of the Korahar district of Hazaribagh, Bihar, India. These varieties had been previously tested for their agronomic values in a participatory varietal trial conducted in the same village (Courtois et al., *submitted*).

Raw rice

For each variety, two kilos of sun-dried paddy of good quality were used. The paddy was dehulled and milled using a *dhenki*, a big wooden bar moving up and down around an axis. The *dhenki* was operated by two women, one of them moving the *dhenki* with her leg, the other shuffling the paddy grain after every stroke of the *dhenki*. All the varieties were dehulled and milled by the same two persons under the same conditions. The times necessary for completion of dehulling and milling, and the milling recovery (percentage of milled rice weight on rough rice weight) were recorded. The head rice recovery (unbroken grains) was not quantified but estimated visually (milled rice appearance).

Before cooking, one kilo of cleaned rice was washed with water. Aluminum vessels called *bhudeli* were used to cook each variety separately. All *bhudeli* were of the same capacity. The women suggested using 3 liters of water to cook 1 kg of raw rice. The *bhudeli* with water was kept on the fire up to the boiling point, when the washed rice was added. The cooking test was done by pressing the cooked rice between thumb and index finger. The same woman did the cooking test for all varieties. The cooking time of each variety was recorded. The excess water was drained and the cooked rice was displayed on a *pattal* (leaf mat) for sensory evaluation.

Parboiled rice

As decided by the women, 2.5 kg of paddy were soaked in 3 liters of water in a tin container for 18 hours. A common belief is that the soaking of paddy should be done in the evening rather than during daytime, with the excess water drained in the morning, to avoid the heat of the day. A temperature that is too high would induce the soaked paddy to ferment, leading to poor rice quality, high breakage, and bad odor (Bhattacharya 1985). The soaking of paddy in water started at 4:00 p.m. and the water was drained at 10:00 am the next day. After decanting the water, the soaked paddy was steamed on the fire. During the steaming process, the tin containing the soaked paddy was covered with a gunny bag to avoid loss of heat. When the husks of the paddy started cracking, the container was taken off the fire. The steamed paddy was spread in the shade on a mud floor for drying. The paddy was dried in the shade for 48 hours with intermittent mixing. It was then exposed to the sun for complete drying. An indigenous technique was used to test the proper drying of paddy. Twenty to 30 grains of paddy were dropped on a hard floor. The grains were crushed underfoot by rotating the heel. If this removed the grain husk, the rice was considered to be well dried and ready for dehulling. For dehulling and milling, 2 kg of cleaned paddy were used and the same process as for raw rice was followed.

More water is needed to cook parboiled rice than to cook raw rice. The women suggested adding 7 liters of water to cook 1 kg of parboiled rice. For the subsequent operations, the same process was followed as for raw rice.

Sensorial evaluation

A protocol for the practical organization of the sensory evaluation was designed following the recommendations of Amerine, Pangborn, and Roessler (1965) and Del Mundo (1991) and adapting them to the realities of an eastern Indian village.

Twenty-four farmers (12 women and 12 men) participated in the sensory evaluation. A hedonic scale was used. The farmers were asked to indicate whether they liked (score 1) or disliked (score 0) the varieties for milled grain appearance, cooked rice appearance, odor, color, texture (soft/hard), stickiness, taste, and overall acceptability. The samples were numbered and randomized to limit the "first-sample bias." The raw rice and parboiled rice were evaluated on different days to limit the testers' fatigue.

Physico-chemical characterization of the samples under laboratory conditions

The tests were performed at the technology laboratory of the Central Rice Research Institute, Cuttack, India, for raw rice and in N.D. University of Agriculture and Technology, Masodha, Faizabad, India, for parboiled rice. The parameters measured for raw rice were milling recovery, head rice recovery, grain length and width, alkali value, volume-expansion ratio, kernel-elongation ratio, and amylase content. For parboiled rice, hulling and milling recovery and grain shape were measured.

Statistical analysis

For rank comparison, Spearman's coefficient of correlation was used when only two rankings were compared. A Kendall coefficient of concordance was used, as described in Siegel (1956), when more than two rankers were involved. The mean comparisons were performed using a Student's *t*-test.

Results and discussion

Milling

No difference between the two modes of preparation was observed for milling time (table 1). Raw rice took significantly less time to cook as compared to parboiled rice. Milling recovery was significantly higher for parboiled rice in comparison to raw rice. There was no significant difference between farmers' practices and laboratory method for raw rice but recovery was higher with farmers' practices for parboiled rice. The lower coefficients of variation in the case of parboiled rice indicated a buffering effect of parboiling across varieties for recovery, which explains why parboiling is considered an excellent means to recover poor-quality samples.

Sensory evaluation

The method of rice preparation had a great impact on the ranking of the rice varieties for all traits, as shown by the nonsignificant and sometimes negative rank correlations between the two sets of

Table 1. Comparison of the Milling Properties and Cooking Time of Raw and Parboiled Upland Varieties Prepared by Farmers, Korahar, Bihar, India, 1998

Variety	Milling time (minutes)		Recovery farmers' practices (%)		Recovery laboratory (%)		Cooking time farmers' practices (minutes)	
	Raw	Parboiled	Raw	Parboiled	Raw	Parboiled	Raw	Parboiled
Brown Gora	19	30	70	71	58.5	75.0	11.0	23.0
RR139-1	16	17	63	77	62.3	80.0	8.5	33.5
RR151-3	18	19	69	72	67.3	75.0	10.0	17.0
RR151-4	22	19	57	74	67.5	80.0	8.0	20.5
RR166-645	15	23	65	74	59.5	76.3	11.0	23.0
RR203-16	15	17	63	73	56.0	76.3	11.0	22.0
RR2-6	27	18	70	72	60.5	76.3	13.0	33.0
RR265-1	20	15	70	72	76.5	77.5	8.5	22.0
RR347-166	20	17	66	74	73.5	7.38	15.5	23.0
RR348-5	30	17	71	72	66.3	78.8	9.0	23.0
RR348-7	13	16	69	74	51.0	77.8	13.0	32.0
RR352-1	16	24	66	72	64.0	76.3	14.0	27.0
RR354-1	20	23	59	75	69.8	77.5	16.0	29.0
RR50-5	18	20	67	71	67.8	80.0	13.0	34.0
RR51-1	19	18	66	72	58.8	75.0	10.0	26.0
Vandana	17	19	74	70	72.0	76.3	13.5	25.0
Mean	19.1	19.5	66.6	72.8	64.4	77.0	11.4	25.8
SD	4.4	3.8	4.5	1.8	6.9	1.9	2.5	5.1
t raw/parboiled	0.28ns		7.11**		4.29**		12.04**	

Note: ** = significant at the 1% level; ns = not significant.

scores (table 2). The preferred varieties in terms of acceptability were RR151-3, RR352-1, and RR354-1 for raw rice, and RR50-5, RR352-1, and RR354-1 for parboiled rice. For breeding purposes, it was interesting to identify varieties that could perform well under both preparations. RR352-1 and RR354-1 scored quite well in this respect.

The farmers were also asked to indicate the four varieties they liked the most (high score indicated high preference) and the four varieties they liked the least (this time high scores indicated high dislike). By this means, only one variety, RR354-1 recorded a good score for both raw and parboiled rice (table 3), being liked by 67% of the farmers as parboiled rice and 58% of the farmers as raw rice. RR151-3 and RR352-1 were appreciated by the farmers as raw rice but not as parboiled rice. Inversely, RR2-6, RR166-645, and RR265-1 were liked by the farmers as parboiled rice but not as raw rice.

For raw rice as well as parboiled rice, the rank correlations among characteristics scored by farmers were very strong and positive (table 4) except for stickiness, for which they were also positive but more seldom significant. This means that there is probably no need to ask the farmers to score all these traits. The acceptability or the choice of the three or four most preferred varieties should be enough to represent the group of traits. A simplification of the testing procedure an important in order to facilitate the integration of participatory approaches in the formal breeding system and to sustain farmers' participation.

Table 2. Sum of Scores Given by 24 Farmers for Cooking Quality Characteristics of Upland Rice Varieties, Korahar, Bihar, India, 1998

Variety	Milled rice appearance		Cooked rice appearance		Odor		Color		Texture (soft/hard)		Stickiness		Taste/ flavor		Accept.	
	Raw	Par.	Raw	Par.	Raw	Par.	Raw	Par.	Raw	Par.	Raw	Par.	Raw	Par.	Raw	Par.
Brown Gora	1	11	5	13	2	11	2	7	2	10	8	12	10	13	4	9
RR139-1	4	10	18	19	13	18	17	21	13	17	11	20	15	20	12	16
RR151-3	17	1	20	9	18	10	20	9	18	8	16	10	17	9	18	6
RR151-4	17	16	16	19	12	23	17	19	13	15	10	22	18	18	16	19
RR166-645	4	11	11	18	11	17	6	8	12	10	9	13	11	16	9	18
RR203-16	8	6	13	14	9	16	14	15	5	12	8	15	13	15	13	11
RR2-6	8	13	9	21	8	23	12	23	6	17	8	19	9	20	8	20
RR265-1	19	18	13	18	10	16	13	21	12	18	9	19	13	16	9	18
RR347-166	21	6	20	17	17	17	21	17	14	14	12	16	14	13	12	12
RR348-5	1	22	19	20	13	17	16	20	15	16	15	15	17	14	15	16
RR348-7	1	13	7	16	6	16	4	19	5	14	11	13	8	14	6	13
RR352-1	22	10	20	21	20	20	18	20	17	17	16	21	21	20	17	22
RR354-1	12	23	15	24	14	23	19	23	16	20	7	22	18	22	17	24
RR50-5	21	16	14	24	15	21	15	22	10	22	11	19	14	22	14	21
RR51-1	9	7	11	14	12	12	16	10	7	13	13	15	13	11	11	13
Vandana	12	2	15	9	15	11	19	5	16	8	11	8	12	9	12	6
Rank correl. raw/parboiled	-0.12		0.10		0.12		0.20		0.06		-0.19		0.26		0.23	

Notes: Par. = Parboiled rice; Accept. = Acceptability; Varieties with high scores are the preferred ones.

Table 3. Preferences of Farmers for the Various Varieties in the Sensory Evaluation Conducted in Korahar, Bihar, India, 1998

Variety	Most liked*		Least liked*	
	Raw	Parboiled	Raw	Parboiled
Brown Gora	0	0	13	5
RR139-1	4	0	2	8
RR151-3	16	0	1	15
RR151-4	8	6	2	2
RR166-645	1	10	10	1
RR203-16	3	9	4	0
RR2-6	1	11	14	0
RR265-1	2	10	3	0
RR347-166	8	2	1	7
RR348-5	7	6	2	3
RR348-7	3	2	15	11
RR352-1	14	0	1	7
RR354-1	14	16	2	1
RR50-5	4	4	4	4
RR51-1	3	3	1	3
Vandana	0	0	1	13

*Farmers were asked to give the codes of the four varieties they liked most and the four varieties they liked lease. However, some of them gave only 1 or 2 scores.

Table 4. Correlations between Farmers' Ranks for Quality Traits of Raw and Parboiled Upland Rice Varieties (Women's and Men's Rankings Pooled Together), Korahar, Bihar, India, 1998

Trait		Milled rice app.	Cooked rice app.	Odor	Color	Texture	Stickiness	Taste
Milled rice app.	Raw							
	Parboiled							
Cooked rice app.	Raw	0.59*						
	Parboiled	0.55*						
Odor	Raw	0.72**	0.85**					
	Parboiled	0.68**	0.88**					
Color	Raw	0.60*	0.84**	0.88**				
	Parboiled	0.60*	0.87**	0.88**				
Texture	Raw	0.46	0.76**	0.80**	0.83**			
	Parboiled	0.50*	0.87**	0.87**	0.85**			
Stickiness	Raw	0.18	0.47	0.45	0.29	0.20		
	Parboiled	0.29	0.62*	0.66**	0.48	0.52*		
Taste	Raw	0.58*	0.87**	0.71**	0.72**	0.72**	0.28	
	Parboiled	0.53*	0.83**	0.72**	0.71**	0.74**	0.39	
Acceptability	Raw	0.67*	0.81**	0.82**	0.79**	0.75**	0.23	0.90**
	Parboiled	0.52	0.81**	0.87**	0.75**	0.77**	0.39	0.91

Opinions of women and men farmers were similar, with significant to highly significant correlations between their rankings for milled rice appearance, cooked rice appearance, texture, color, and taste (table 5). The only traits for which their agreement was weaker was stickiness and, to lower

Table 5. Correlations between Women and Men Farmers' Mean Ranks for Cooking Characteristics of Raw Rice, Korahar, Bihar, India, 1998

Trait	Spearman rank coefficient of correlation
Milled rice appearance	0.97**
Cooked rice appearance	0.57*
Odor	0.45
Color	0.75**
Texture	0.55*
Stickiness	0.22
Taste/flavor	0.54*
Acceptability	0.83**
Most liked	0.88**
Least liked	0.95**

Note: Sample size was 12 women and 12 men.
* = Significant at 5% level.
** = Significant at 1%.

extent, odor. In terms of overall acceptability, there was no difference in women and men farmers' opinions on the tested varieties nor in their final choices of the varieties they liked most and least.

Laboratory analysis versus sensory evaluation

The ranks given by farmers for the various quality traits were compared with the ranks of the same varieties for the main chemical properties of raw rice measured in the laboratory: alkali value, volume expansion, amylase content, and elongation ratio. Elongation ability was negatively correlated with stickiness $r = -0.55$, significant at the 5% level) but that was the only significant case. In the samples tested, amylase content did not seem to have any link to farmers preferences for texture $r = -0.14$) or stickiness $r = 0.04$).

It is unexpected to see so few relationships between consumer preferences and measurable chemical properties, since these are standard parameters used by all chemistry laboratories. However, for the varieties included in the evaluation, the variability for some traits was limited and therefore consumers had difficulty assessing differences.

Field performance versus grain quality

There was little relationship between farmers' field ranking and grain quality for parboiled rice, as shown by the very low coefficients of correlation for rank and a negative one for the ranking based on yield (table 6). The relationship was stronger and positive for raw rice. There was no particular reason why the rankings should be correlated, but a strong negative correlation would complicate the breeding work. These results confirm that participatory varietal selection should not stop after harvest. Since a compromise might be necessary, at least for parboiled rice, the trade-off between criteria for agronomic performance and cooking quality applied by farmers has to be assessed.

Table 6. Correlation Between Field Ranking and Yield, and Farmers Preferences based on Grain Quality, Korahar, Bihar, India, 1998

Variety	Farmers field ranking	Ranks based on observed yield	Most liked *		Acceptability ***	
	(1)	(2)	Raw	Parboiled	Raw	Parboiled
Brown Gora	15.0	10.5	15.5	14.0	16.0	14.0
RR139-1	12.0	16.0	7.5	14.0	9.0	8.5
RR151-3	4.0	2.0	1.0	14.0	1.0	15.5
RR151-4	2.0	10.5	4.5	6.5	4.0	5.0
RR166-645	6.0	8.0	13.5	3.5	12.5	6.5
RR203-16	10.0	12.0	10.0	5.0	7.0	13.0
RR2-6	8.0	13.5	13.5	2.0	14.0	4.0
RR265-1	13.0	13.5	12.0	3.5	12.5	6.5
RR347-166	3.0	3.0	4.5	10.5	9.0	12.0
RR348-5	11.0	6.5	6.0	6.5	5.0	8.5
RR348-7	16.0	15.0	10.0	10.5	15.0	10.5
RR352-1	7.0	5.0	2.5	14.0	2.5	2.0
RR354-1	5.0	9.0	2.5	1.0	2.5	1.0
RR50-5	9.0	6.5	7.5	8.0	6.0	3.0
RR51-1	14.0	4.0	10.5	9.0	11.0	10.5
Vandana	- 1.0	1.0	15.5	14.0	9.0	15.5
Rank correlation with (1)			0.35	0.03	0.57*	0.06
Rank correlation with (2)			.027	-.034	0.45	-0.28

* Ranked from 1 (most liked) to 16 (least liked); results of a participatory varietal trial conducted in Korahar in 1998 wet season.
** Ranked from 1 (highest yield) to 16 (lowest yield).
*** Ranked from (most acceptable) to 16 (least acceptable).

Conclusions and recommendations

Grain quality is an important selection criterion (Juliano and Villareal 1993). Sensory evaluation with farmers allows us to assess varietal preferences under conditions of food preparation very close to that of the final consumer. For the set of varieties tested, men and women seemed to share the same opinions. The physico-chemical analysis did not indicate much power to predict the results of farmers' rankings. The methodology was satisfactory although quite costly in terms of organization time. It is important to define which of the two modes of preparation (raw rice or parboiling) is most prevalent in the target area, since they lead to different varietal choices. A simplification of the ranking system by reducing the number of ranked traits is possible.

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Incorporation of Users' and Gender Perspectives in Farmer-Led Participatory Plant Breeding on Maize: Experiences from the Western Hills of Nepal

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Abstract

Maize production is the main source of livelihood for the farmers of the western hills of Nepal. However, farmers have very limited access to improved varieties of maize, suitable to their local requirements. They cultivate a number of maize varieties maintained locally through continuous selection for preferred traits. An initial survey of the two project sites in the Gulmi district of western Nepal suggests that farmers apply a number of criteria to the selection of a particular maize population to suite their production environment and to meet their family requirements for different uses of maize. However, the survey results show that the differences among farmers in the preference for and selection of a particular maize variety are not very strong. The report discusses the ways these differences have been analyzed and incorporated into the design of participatory plant breeding for the improvement of local maize varieties by the farmers.

Introduction

Maize is the first most important food crop in the hills of Nepal in terms of both area and its contribution to household food security. It occupies about 0.8 million hectares (about 35% of the total cultivated area); 78% of this is in terraced hill farming, which produces over 1.3 million tonnes per annum (CBS 1999). The productivity of maize, however, is quite low (1.7 tonnes/hectare) and, as a result, there is high incidence of food-deficit households in the hills of Nepal. One of the major contributing factors to this low yield is the poor performance of farmer-maintained maize varieties. Farmers' access to new seeds and varieties is extremely poor and, at the same time, a majority of farmers tend to keep their own seed without replacing it for years. It is estimated that nearly 90% of the total seed requirements for cereals and other food crops in the country is met by the traditional seed-supply system (Cromwell et al. 1993; Joshi 1995). Since maize is an open-pollinated crop, even new varieties rapidly get contaminated with the undesired traits of local varieties. On the other hand, most of the new varieties developed so far neither fit well with local environments nor meet farmers' diverse needs. Therefore, it is increasingly being realized that breeding must be carried out in the target environment with the full participation of farmers so that the users' perspective is well reflected in the new varieties developed.

The environments where maize is produced in the hills of Nepal are very diverse in terms of topography, soil types, and use of production resources. There are also differences between farmers and farming communities in terms of access to resources (i.e., wealth) and food culture, which is governed largely by ethnicity. These differences exist not only between wider agroecological zones but also between farming families in the same village. For these reasons, farmers require a large number of varietal options to fit into diverse production niches and to meet the varied consumption

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requirements of the farming families. Similarly, because of differences in gender roles and gender needs, there are also requirements for different maize varieties within the same household. Previous studies (Acharya and Bennet 1981; Bajracharya 1994; Shrestha 1998) suggest that women play important roles in agricultural activities and are responsible for major farming decisions. Because of these gender differences, different family members usually have different varietal needs and behave differently toward new crop varieties. The consideration of users' and gender perspectives in the process of variety development, therefore, is vital.

Local Initiatives for Biodiversity Research and Development (LI-BIRD), in collaboration with the Systemwide Program on Participatory Research and Gender Analysis (PRGA), is conducting research on a farmer-led participatory maize-breeding approach that incorporates users' and gender perspectives in developing farmers' preferred maize varieties. The two research sites, namely Darwar Devisthan and Simichaur, are located in the Gulmi district of the western hills of Nepal. This paper draws upon the work and experience of researchers in this collaborative project and discusses the findings regarding the analysis of this research and its subsequent incorporation into the research process.

Methods and sources of information

Various sources of information have been used in the report. These include focus-group discussions (FGDs) conducted during participatory rural appraisals, participatory gender analysis, and household baseline surveys undertaken at the Darwar Devisthan and Simichaur research sites at the inception of the project. Separate FGD sessions were held with different groups of farmers, categorized by gender, wealth, and ethnicity. There were two categories under gender—male and female; three categories under wealth—rich, average, and poor; and three categories under ethnicity—Brahmin/Chhetri/Jogi (BCJ), Gurung/Magar/Newar (GMN), and Kami/Damai/Sarki (KDS). The categorization of farming-household wealth was done by the farmers themselves, using their own perceptions and knowledge of wealth of these households. The ethnic categorization was done by researchers on the basis of sociocultural similarities.

The participatory gender analysis involved the analysis of gender roles and decision-making patterns in the production and utilization system for maize. A sample of 30 selected households was facilitated in doing their own gender analysis by using a pictorial set of a man, woman, and child, and maize grains, to indicate their roles. Similarly, a detailed household baseline survey was conducted to collect detailed and widely representative information, which also served as a major source of information for this report. It involved a questionnaire survey of 100 households (40 at Darwar Devisthan and 60 at Simichaur) selected using a stratified random sampling technique.

Analysis of users' and gender perspectives in maize farming

Users' perspectives in maize production and utilization

The perspective of users in maize production and utilization was analyzed using two socioeconomic variables: ethnicity and the wealth categories derived from participatory wealth ranking. The analysis of gender perspectives, on the other hand, utilized information from male- and female-headed sample households that were included in the household baseline survey. Of the total sample households surveyed, 19% were female headed. These are mostly *de facto* household heads, i.e., women have taken charge of managing the farm while men work off-farm away from home for several months, mostly in India.

Characteristics of heads of households

The characteristics of the heads of maize-growing households are presented in table 1. The family members who make major farming decisions are mature, with an average age of 50 years. Their literacy rate is much higher (81%) compared to the national literacy rate (39.6%). However, a majority of them (47%) are either barely literate or have a primary-level school education. The family member making the main farming decisions is younger and more illiterate in the average and poor wealth categories, in the KDS and GMN ethnic households, and in female-headed households.

Characteristics of maize-growing households

The characteristics of the maize-growing households are presented in table 1. The maize-farming families are relatively larger than nonfarming families, with an average of seven members per family. The family size is, however, relatively smaller in the average and poor wealth categories and in the KDS and GMN ethnic households than in other households. This implies that the family labor available to these households is less than in other households. Though farming is the major occupation for the households of the two research sites, family members of 72% of the farming households are engaged in off-farm activities to earn additional cash income for the family. The percentage distribution of these households across wealth categories and male- and female-headed households is similar. The percentage of households with family members engaged in off-farm activities, however, is slightly higher in the GMN and KDS households than in the BCJ households.

Maize is the main livelihood crop for the farmers of the research sites. The maize production in the area is subsistence-oriented and production is largely for self-consumption. The self-produced food, however, is not adequate to meet household food requirements. About 86% of the farming household experiences food deficits from less than one to 11 months of the year, and the average length of food self-sufficiency is only about seven months. The degree of food deficiency varies among the different household categories. The average time of food self-sufficiency is lower in average and poor households, in BCJ and KDS ethnic households, and in female-headed households. Only a small proportion of the households (10.4%) sell maize. The proportion of households selling maize is similar across households of different ethnic categories but is lower in the average and poor households and in male-headed households. A high proportion of the households (61%) purchase maize to offset their food-grain deficit. The differences in the proportion of households purchasing maize is highly significant ($p < .0001$) across wealth categories but not significant across ethnic categories and across male- and female-headed households. There is virtually no market influence on farmers' choice of maize varieties.

Access to farm resources

In general, farmers are smallholders with an average maize-growing *bari* land holding of 0.4 hectare, scattered over an average number of 2.3 parcels (table 1). (*Bari* represents rainfed upland where a maize-based cropping system is dominant.) The average holding size and the number of parcels of *bari* land decrease with the wealth of the farming household. The differences in *bari* land holdings are highly significant across wealth categories ($p < .0001$). Similarly, the variation in number of parcels of *bari* land per household is also significant ($p < .05$) across wealth categories. These differences in *bari* land holdings and the number of *bari* parcels per household are not statistically significant across either ethnic categories or male- and female-headed households.

Table 1. Characteristics of Maize Growing Households at Darwar Devisthan and Simichaur in Gulmi District, Nepal

Characteristics	All	Gender categories		Wealth categories			Ethnic categories		
		Male	Female	Rich	Medium	Poor	BCJ	GMN	KDS
Age of household head (years)	50.1±1.1	51.4±1.7	44.4±2.1	52.6±2.4	49.3±2.4	48.1±2.8	49.6±1.6	56.4±5.1	47.6±5.0
Education of household head (%)									
Illiterate	19.0	12.3	47.4	6.0	23.3	29.0	15.0	10.0	60.0
Just literate/primary education	47.0	48.1	42.1	57.1	43.3	40.0	45.0	80.0	30.0
Secondary education	21.0	24.7	5.3	14.3	23.3	26.0	24.0	10.0	10.0
University education	13.0	15.0	5.3	22.2	10.1	6.0	16.3	0.0	0.0
Food self-sufficiency (month)	7.2±0.3	7.3±0.4	6.8±0.6	8.9±0.5	7.6±0.5	5.3±0.4	7.5	9.3	3.3
Wealth class (% household)									
Rich	35.0	26.0	32.0	35.0	0.0	0.0	40.0	30.0	0.0
Medium	30.0	29.6	32.0	0.0	30.0	0.0	31.3	40.0	10.0
Poor	35.0	34.6	37.0	0.0	0.0	35.0	29.0	30.0	90.0
Family size (number)	6.7±0.4	7.2±0.4	4.9±0.5	7.8±0.5	6.1±0.5	6.2±0.7	6.9±0.4	5.4±0.9	6.7±1.0
Resource ownership									
Bari land (ha/household)	0.4±0.04	0.4±0.1	0.3±0	0.6±0.1	0.4±0	0.3±0	0.4±0.1	0.4±0.1	0.2±1
Parcel of bari land (Mean)	2.3±0.1	2.4±0.2	1.9±0.3	2.8±0.3	2.2±0.2	2.0±0.1	2.4±0.1	2.5±0.7	1.6+0.3
Buffalo (number)	2.6±0.1	2.7±0.2	2.05±0.2	3.2±0.2	2.6±0.2	1.2±0.1	2.7±0.2	2.2±0.3	1.6±0.2
Cattle (number)	2.4±0.2	2.4±0.3	1.5±0.5	2.7±0.4	2.1±0.4	2.2±0.4	2.5±0.3	1.8±0.4	2.0±0.0
Goats (number)	2.5±0.2	2.6±0.3	2.2±0.2	2.6±0.4	2.1±0.2	2.7±0.4	2.7±0.2	2.0±0.5	1.2±0.2
Poultry (number)	5.5±0.6	6.0±0.7	2.3±0.6	5.4±1.2	6.5±1.5	5.1±0.9	4.3±0.7	8.1±1.5	6.0±1.6
Livestock unit per household	2.8±0.2	3.0±0.2	1.9±0.2	3.8±0.4	2.7±0.2	1.8	3.0±0.2	2.4±0.4	1.4±0.2
Off-farm labour (%)	72.0	71.6	74.0	71.4	73.3	71.4	70.0	80.0	80.0
Sell maize (%)	10.4	9.1	16.0	20.0	3.4	6.3	12.0	-	11.1
Purchase maize (%)	61.0	60.3	64.3	31.0	74.0	84.0	60.3	44.4	100
Cultivation of improved variety (%)	13.0	8.3	39.0	13.3	12.0	13.3	16.2	0.0	0.0
Changing seeds for the last 5 years (%)	38.6	38.0	42.0	35.0	35.0	44.4	37.3	40.0	44.4
Participated in training (%)	8.2	8.8	6.0	15.2	7.0	3.0	10.4	0.0	0.0
Participated in educational tours (%)	6.0	7.4	0.0	9.0	7.0	3.0	7.5	0.0	0.0
Received information on improved technology for maize production (%)	15.1	16.0	12.0	23.0	21.0	3.0	19.0	0.0	0.0

Note: Ethnicity is represented as BCJ = Brahmin/Chhetri/Jogi; GMN = Gurung/Magar/Newar; KDS = Kami/Damai/Sarki.