



**Figure 2. Farmers' perceptions of causal relationships for low productivity of maize in the mid-hill region of Gulmi and Arghakhanchi districts, Nepal**

*Pinyalo* were explored with the farmers' group in order to understand and tackle the problem. Farmers perceived the following as the causes of the problem:

- The very tall plant stature of this variety is the main reason for lodging. Farmers reported it having as high as 27 leaves in one plant. In field observations, the plant height of *Thulo pinyalo* was found to be as high as 5.1 meters. Ear height has been found to be more than two meters under good growth conditions. The weight of the tassel and cob at such a height contributes to the extensive lodging of the thin-stalked *Thulo pinyalo*, even under mild wind pressure.
- *Thulo pinyalo* attains luxurious growth in fertile land, which is one of the reasons for lodging.
- Disease and insects attack the stem.
- The lodging is greater after prolonged rainfall followed by winds. According to farmers, they face substantial yield reductions even with mild winds, as very weak plants lodge under such conditions and fall on other, nonlodging plants. This phenomenon occurs in cycles and can affect large areas.
- The plants are more prone to lodging during the tasseling stage because of the increased weight at the top of the plant.
- Yield is inversely related to lodging. Yield losses due to lodging in this variety are as high as 85% in the worst season. *Thulo pinyalo* produces more grain than high-yielding varieties (HYVs) in a normal season and less if there is a lot of rain and wind.
- Lodging is greater in wet areas at lower elevations than in flat areas at the top of the hills.
- Lodging does not occur every year. However, there is no distinct pattern. High winds during tasseling contribute to severity of the problem.

Several possible options were discussed with the farmers to achieve the goal. The options that could be implemented within the project framework and which farmers considered possible to imple-

ment, considering their resources (time), knowledge, and skills, were chosen by the farmers' group. There were mainly three types of activities: a mass-selection program, a crossing program, and a participatory variety selection (PVS) program.

## Refining the research process

The involvement of farmers in analysis of researchable problems helped change the researchers' perceptions of the problem (table 4) and redefine the goal of the maize-improvement program. The redefinition of the breeding goals of the maize-improvement program provided guidelines for refining the research process that had been proposed initially. A multiple approach (mass selection, crossing, screening of improved/pipeline varieties, and PVS) was taken to address the problems, some of which had not been considered before. Farmers liked the mass-selection technique because they perceived it as a simple method and as a possible option to improve specific traits, keeping the desirable traits of the variety intact. The crossing program was chosen in consideration of the slow genetic gain in the mass-selection method, particularly in farmers' fields. Considering the long gestation period of the variety-improvement program, which may delay the delivery of benefits to the farmers, the variety-selection program was planned. This would provide farmers with access to new, improved genetic materials to test in diverse farming situations.

A farmers' research committee was formed at each site in order to empower farmers and to ensure farmers' leadership in the project. It was decided that the committee would be equally responsible for the planning, implementation, and monitoring of project activities. The committee works as an interface between farmers and researchers. It is expected that involving farmers in the planning and

**Table 4. Changes in Researchers' Perceptions after Involvement of Farmers in Problem Analysis**

Parameters	Researchers' perceptions	
	Before farmers' involvement	After farmers' involvement
Varietal intervention	Low	Low and limited
Landraces	Low yielding and inferior	Despite good yield potential—low production due to lodging
Problem	Low yield	Lodging
Extent of problem	Not known	Yield loss: 15%–85% depending upon severity
Contributing factors of the problem	Not known	Tall plant and ear height Thin stalk Wind pressure
Ethno-perception	Not known	Local landraces are well fitted in different niches Widely grown <i>Thulo pinyalo</i> has all good traits but prone to lodging
Varietal requirement	HYV	Lodging-resistant variety
Objective	Increase access to genetic materials Provide mass-selection training to farmers	Improve <i>Thulo pinyalo</i> for lodging resistance Provide mass-selection training to farmers

implementation process will help in capacity building and increase the farmers' sense of ownership in the program.

Farmers are very supportive and cooperative in the project area. However, in some technical matters farmers' had different perceptions and attitudes, which changed along with the time. For example, farmers perceived that plants with short height could not produce good yields, that detasseling leads to total sterility in maize, etc. In the beginning, this made it difficult for researchers to facilitate some of the field activities, such as crossing, demonstrating short-statured varieties, etc. Later, the farmers found that their perceptions were not correct, and their faith in the researchers increased, leading to better understanding, cooperation, and collaboration. Some farmers who were not positive about the program in the beginning are the strongest members of the team now.

## Conclusions

Involvement of farmers in the planning process resulted in the development of more specific breeding objectives, which were more focused on the farmers' perceived needs. It has helped to refine the context and process of the participatory plant-breeding program and has given farmers a leading role in the decision-making process.

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# Sensory Evaluation of Upland Rice Varieties with Farmers: A Case Study

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## Abstract

As part of a participatory plant-breeding project with methodological objectives to improve rainfed rice in eastern India, an evaluation of sensory characteristics was conducted with farmers in a village of Bihar. Twenty-four farmers (12 women and 12 men) evaluated 15 upland rice varieties as raw rice and parboiled rice for milled and cooked rice appearance, color, odor, texture, stickiness, taste, and overall acceptability. The rice samples were milled and cooked by the women farmers following their ordinary practices. One variety recorded good results with both raw and parboiled modes of preparation. The preferences of women and men farmers did not differ significantly. The rankings based on preferences were compared with the rankings of the varieties for various physico-chemical characteristics measured in the laboratory. Most correlations were not significant, indicating that, for the set of tested varieties, these parameters were poor predictors of farmers' preferences. The rankings based on preferences were compared with farmers' field rankings, and the correlation was positive for raw rice and negative for parboiled rice. Farmers' trade-off between field performance and grain quality is therefore important to assess for at least parboiled rice. The results of this first sensory evaluation experiment will be used to simplify the methodology and to improve varietal evaluation in the formal breeding process.

## Introduction

In eastern India, rainfed rice represents a major component in the diet and income of millions of resource-poor people. In these harsh environments, the rate of adoption of modern rice varieties is low. Subsistence agriculture is still quite important, although market integration is slowly progressing (Pingali 1997). In these transition systems, grain quality and taste strongly influence the adoption of modern varieties. The main source of variation in grain quality is the variety, although environment and genotype-x-environment interactions also affect grain quality. Different grain types, and therefore different varieties, are needed for self-consumption, market sale, and various preparations or to pay wages in kind. For plain rice, precooking practices influence the varietal choices. Among the most common is parboiling, which is an age-old practice in some regions of eastern India, where rice is partly cooked before being air-dried and then sun-dried to improve its nutritional, cooking, and storage attributes. Preferences may vary across income levels, various social groups requiring various varieties.

Quality tests for breeding lines are routinely conducted by scientists in the laboratory. In the frame of a participatory plant-breeding project with methodological objectives started in 1997 under the collaborative program with the Indian Council of Agricultural Research (ICAR) and the International Rice Research Institute (IRRI) (Courtois et al. 1999), we developed a methodology to evaluate the grain quality of rice varieties in collaboration with farmers. To test the methodology, the

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