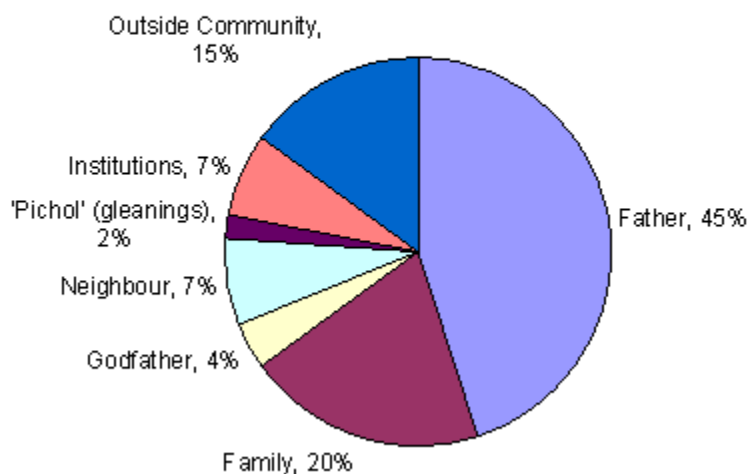


FAO Guatemala supports Participatory Variety Selection as an extension methodology to scale up the dissemination and adoption of desirable maize varieties among indigenous groups in Sololá Department (Guatemalan Highlands).

The importance of improved maize varieties in meeting the food security needs of Guatemalans is outstanding. In a recent survey of families in the Guatemalan Highlands, it was found that 100% of households consumed an average of 318 grams of maize per day, mostly in the form of tortillas. Yet, the outreach of ICTA-improved maize varieties among poor households in the Western Highlands is very scarce, with more failing than successful initiatives to date. These improved varieties (lower and apparently more yielding) could represent a good asset for resource-poor families cultivating very small landplots in steep hillsides: they could produce more grain for those food insecure farmers. However important maize may be in the farmers' diet, the daily amount of maize consumed is far from sufficient to meet energy requirements and, as an example, the Department of Sololá, where the Kaqchikel, K'iche' and Tz'utujil indigenous groups make up about 94% of the population, suffers very high chronic undernutrition rates (73% of children between 8-11 years) and severe poverty prevalence (32% of extreme poverty and 76% of poverty) . In Sololá, improved varieties of maize have made little headway due to the continued reliance on landraces obtained primarily through family (Figure 1).

FIGURE 1
SOURCE OF LOCAL SEED LOTS



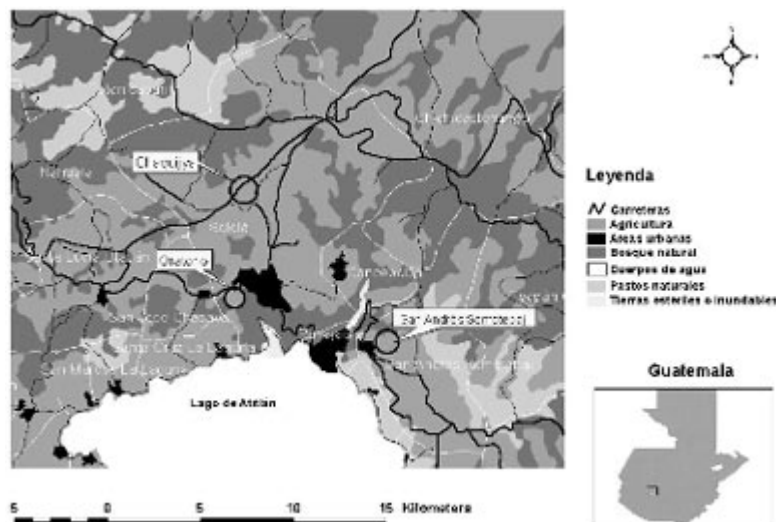
However, local landraces of maize have particularly long growing seasons, suffer from lodging (bending over of plants) due to their high stalks, and have low yields. FAO, through the Special Programme for Food Security (SPFS), in conjunction with the Guatemalan Ministry of Agriculture, Livestock and Food (MAGA), the Institute of Agricultural Science and Technology (ICTA), and supported by a PhD candidate of Wageningen University (The Netherlands), developed a participatory maize selection trial to improve the availability of suitable landraces for the local farmers in the municipality of Sololá.

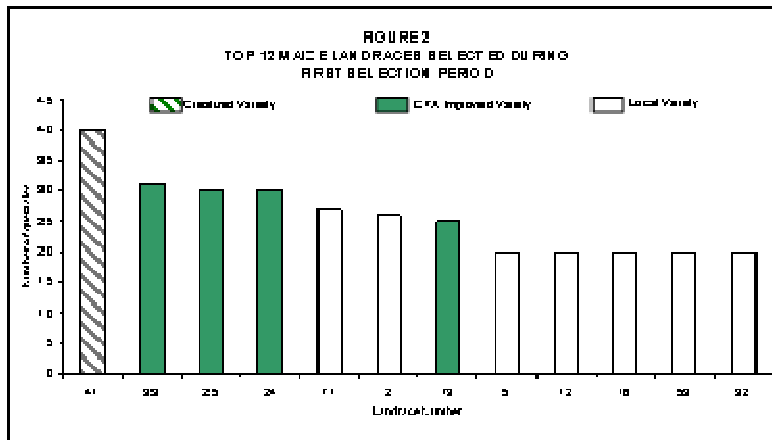


Picture 1: Germplasm diversity of local maize varieties in Sololá

Germplasm of 68 local varieties was collected from 38 Kaqchiquel families originating from two different communities in the municipality: Chaquijyá and Oratorio (see Map 1). Seven improved maize varieties developed for Guatemalan highlands by ICTA supplemented the local germplasm in the trial. In total, 75 varieties of maize were planted in each of four different plots of land at various locations and altitudes (3 plots in Chaquijyá and 1 plot in San Andrés Sametabaj, between 1,800 and 2,400 masl). The experimental design of the trial was developed by ICTA to control for environmental effects. The trial took place during the 2003 May-December growing season and the maize crops were maintained by farmers in a manner consistent with local practices.

Map 1. Study Area in Solola Department (SPFS Guatemala is working here since 2000)





To carry out the participatory selection, a group of men and women from these two communities where SPFS is working visited the plots in September and October. Using their own evaluation criteria, they observed unmarked maize plants and selected their first, second and third most preferred varieties by depositing bills valued at 10, 5 and 1 quetzals (the local currency) into baskets next to each variety. In total, 56 different landraces received at least 1 point. In discussions with the farmers, they explained that selections were based upon such aspects as plant precocity, flowering precocity, the height of the plant and the size and colour of the stem, the latter features mostly appreciated by women.

As shown in Figure 2, of the top-12 landraces chosen by the group, four were improved varieties provided by ICTA, and a fifth was a creolized

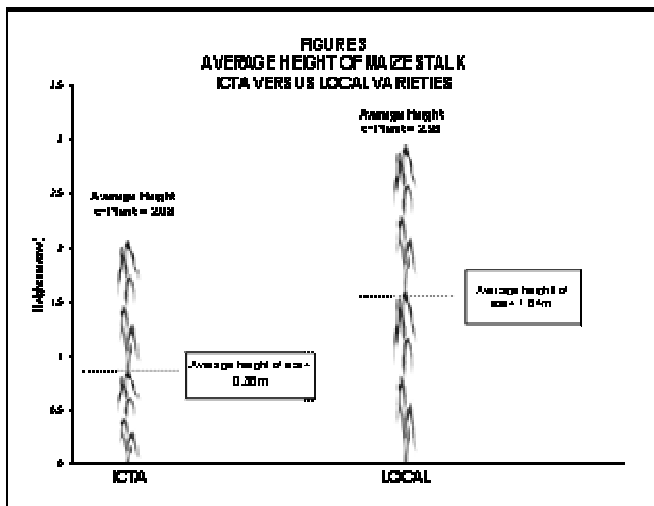
Variety adapted over several years by a local innovative farmer. As a result of the trial, local farmers took great interest in learning that the improved varieties of maize provided by ICTA held many of the attributes that they valued, including taste. Indeed, a number of farmers were quite interested in acquiring improved varieties of corn for their next crop season, what highlights a remarkable aspect of this practice as a participatory extension methodology to disseminate improved varieties amidst local communities.

In a third meeting with the group held during the harvest of the maize, the 12 varieties receiving the most points during the initial selection (top-12) were reviewed again. This time, ears of maize were presented, in both raw and cooked forms (corn on the cob). This discussion highlighted that the size of the ears was an important aspect valued by the community.



Throughout the trial, data for each maize landrace was collected on such attributes as date of flowering, size of ear, plant height, number of kernel rows and net production of maize.

This data was reviewed and analyzed in order to investigate whether the attributes selected by the farmers indeed resulted in the best plants and the highest yields. Analysis of variance (ANOVA) and t-statistic tests were performed to compare data from different variety groupings: Local varieties, ICTA varieties, the top-12 selected varieties, and grouping by color of kernel (white, yellow and black). Many variables, such as ear size, stem size or number of rows per ear showed no significant difference between groups. However, plant height and net yield were differed significantly between groups of maize landraces.



RESULTS

Plant height is a particularly salient characteristic for maize in the highlands. Traditionally, high winds have bent maize stems, prohibiting growth or making the ears susceptible to rot damage and rodent infestation. In the participatory selection of varieties, the group confirmed the importance of shorter maize stalks by selecting, amongst their top-12 varieties, shorter landraces. The difference between the top-12 varieties and the 'unselected group' (varieties not among the top-12) was 37 cm and was significant at the 5% level. Comparing the group of local

plants against ICTA plants was even more telling; local plant height averaged 2.95 m, while ICTA improved varieties averaged only 2.08 m, a significant difference of 87 cm (Figure 3). Moreover, the location of the ear on the stalk differed between the local and ICTA varieties. ICTA ears, on average, grew lower on the stalks and therefore provided more protection against lodging than the local landraces.

All statistical tests were performed at the 5% significance level.

Naturally, net production, or grain yield, is another critical determinant in the selection of landraces. This was confirmed by the survey results (Figure 4). In net yield terms, the group's top-12 varieties did not perform significantly better than the unselected group. Moreover, local varieties actually outperformed ICTA varieties in net yield, averaging 1.35 metric tons per hectare versus 0.98 tons per hectare for ICTA

This result was significant with $p=1.4\%$, and is subject to a more refined analysis for environmental effects.



Picture 3: Participatory Selection Event in San Andrés Sametabaj

CONCLUSIONS

Figure 4
What do you like about your current variety?

| <i>Type of response</i> | <i>Frequency</i> |
|------------------------------|------------------|
| Grain consumption quality | 34 |
| Yield | 26 |
| Minimal lodging, precocity | 4 |
| Resistance to weather damage | 3 |
| Others | 3 |

Overall, the participatory plant breed selection process yielded a number of important observations and results. The Kaqchikel group learned about the benefits of ICTA varieties and at the same time confirmed the success of their own selection criteria and their use of creole germplasm. FAO, MAGA and ICTA have discovered certain attributes that may

appear in creole varieties, such as productivity and stability, and have verified that efforts to reduce plant height through improved varieties have not gone to waste. On the contrary, these efforts have been approved through the participatory trial. Indeed, the link between productivity and plant height in the Guatemalan highlands merits further research.

Several deductions might be made from these production results. Local varieties do not appear to be less productive in this region than ICTA varieties. One consideration is that in years with more lodging, the height advantage of the ICTA varieties would become relevant for yield. In this particular trial season, lodging was not prominent. A multi-year trial may shed more light on these results. However, the interesting possibility is that ICTA and local varieties have characteristics, which, if combined would be complementary to one another. If this is true, a blend of local and scientific seed selection practice would seem appropriate. Farmers could be trained on participatory selection practices to perform them independently and take advantage of local crop diversity. Collaboration between local innovators and ICTA would build on and expand farmer's skills to observe yields and other characteristics and select seeds based on these attributes. Both farmers and the scientific community have an incentive, based on our results, to combine scientific and traditional seed selection methods and varieties.