Maize Genetics Cooperation Newsletter vol 84 2010

CRA-MAC
Unità di Ricerca per la Maiscoltura
Via Stezzano 24, 24126 Bergamo (Italy)

Valorisation of maize genetic resources

Losa, A, Chittò, A, Balconi, C, Motto, M, Redaelli, R

The continuous and significant loss of genetic variability in crops has become a main concern in many countries. Several researches were activated to maintain the existing variability and to identify new sources to be exploited.
In Italy the Ministry of Agriculture, in cooperation with CRA, funded in the past few years a project (Risorse Genetiche Vegetali, RGV) focused on the existing genetic resources for most plant species (cereals, fruits, flowers, forest trees, forage species and so on). The aims of this project were: i) to maintain and regenerate the germplasm present in the CRA structures, ii) to get a description of these materials from several points of view (morphological, biochemical, genomic, and so on), and iii) to find a possible valorisation and exploitation for the enlargement of the available genetic variability and the development of new products with innovative characteristics.
The genetic variability observed in Italian maize germplasm was found to be quite large, and to represent a good source of favourable alleles (Chittò et al., Maydica 45: 257-266, 2000; Hartings et al., Theor. Appl. Genet. 117: 831-842, 2008; Berardo et al., J. Agric. Food Chem., 57: 2378-2384, 2009). In the framework of RGV project, the activity for maize was focused on the characterization of a set of inbreds, collected and stored at the CRA- Maize Research Unit since the 1960s. These materials had never been described before in terms of agronomic performance, morphological parameters and chemical characteristics of the grain. In 2008, about 600 inbreds, both from Italy and foreign countries, were multiplied in the field, and the main descriptive parameters were recorded: GDD for male and female, plant height and structure, number of ears/plant and the height of their insertion point, leaf orientation, tassel structure. On the basis of these observations, a group of 53 inbreds were considered interesting for being introduced in breeding programs.
In 2009, the selected materials were multiplied in the field, selfed, and crossed to a tester line with good agronomic value. In parallel, a preliminary evaluation of their susceptibility to fungal pathogens was carried out by kernel infection with *Fusarium verticilloides*. After harvest, the ears' parameters were also collected. The future activity on these materials will include their chemical characterisation by NIRS, the dosage of mycotoxins in the infected ears, and the realization of agronomic trials with the hybrid seed combinations.
Bio-fuels such as bio-ethanol are becoming an interesting alternative to fossil fuels (Ragauskas et al., Science 311: 484-489, 2006). The use of agricultural biomass for the production of bio-fuel has drawn interest in many science and engineering disciplines. As one of the major crops, maize offers promise in this regard: in fact, the rapidly expanding information from genomics and genetics, combined with improved genetic engineering technologies, offer a wide range of possibilities for enhanced bio-ethanol production from maize (Torney et al., Curr. Opin. Biotechnol. 18: 193-199, 2007).
Two key parts of maize plants can be converted into bio-ethanol: the kernel, which is mainly made of starch (Jobling, Curr. Opin. Plant Biol. 7: 210-218, 2004), and the stover, which is predominantly made of lignin and cellulosic components (cell wall) (Grabber, Crop Sci 45: 820-831, 2005).
In 2009, 98 Italian and American maize inbreds were sown in the field, and random crosses were made among them with purpose to increase the genetic variability.

About 278 hybrid combinations were selected; they will be tested in a set of agronomic trials, in order to identify the most suitable genotypes, in terms of kernel yield and plant biomass, to be exploited for bio-ethanol production.