Plant breeding and sustainable agriculture - myths and reality

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Europe has been at the forefront of the development of new plant varieties with pioneers like the Svalöf Institute in Sweden and the Vilmorin family in France at the end of the 19th century. European plant breeders have also been among the first to preserve landraces with the initiative of Vavilov in the 1920s and the work of EUCARPIA in the 1960s. The work of the breeders has been encouraged by the development of a *sui generis* protection system of new plant variety, the UPOV Convention, since 1961.

There is an ongoing debate on the impact of modern varieties, including GMO, on sustainability. Four main areas need further consideration.

1. Modern varieties have decreased the diversity within crops

This is true if we measure the diversity by the number landraces at a country level. However it is doubtful that this criterion is the most relevant one. Indeed, if, to characterize diversity, social scientists use numbers of cultivars, the proportion of area planted to cultivars and the rate at which farmers are switching from one cultivar to another, biological scientists use rather genealogical indicators, analyses of morphological characteristics and indices of gene frequencies from analysis of bio-chemical or molecular markers. Not only do these indicators measure different phenomena, but also the empirical relationship between them is sometimes weak[i]. The example of the German Variety Catalogue provides an interesting example: in 1935, the number of wheat varieties, mainly landraces, dropped from 454 to 17 accepted cultivars and 54 accepted with reservation[ii]. The same situation occurred at the same period in France[iii]. This drop was mainly caused by name redundancy and phenotypical similarity. In addition, in the French situation, in the early 1960s, lines derived from exotic germplasm represented less than one third of the parents used in breeding programs but represented almost 50% in the 1980s[3.]

More recent studies, using DNA markers, give similar results: the comparison of the main varieties cultivated in the United Kingdom of barley, wheat, maize and potato and oilseed rape over the past 50 to 60 years shows that: barley genetic diversity was quantitatively unchanged with more diversity among varieties presently actively in commerce; similarly in wheat an overall increase in diversity over time was noted; in maize in Germany an increase was first noted with a subsequent decrease whilst in France no overall reduction was found; in potato a slight increase was found; in oilseed rape also an overall maintenance was shown[iv, v].

At an even more detailed level of analysis, the locus, the comparison of old and new collection of wheat from Albania, Austria, Nepal and North India shows that no significant differences were detected both in the number of alleles per locus and in the mean PIC values in all four regions. In other words, the genetic diversity has been maintained within hexaploid wheat since genebank activities started in the first half of last century[vi]. More recently, a CIMMYT study concluded: “The successful incorporation and re-mixing of genetic diversity from wheat relatives has created wheats containing more variation than has ever been available to farmers”[vii].

2. Modern varieties are not adapted to extensive agriculture

Most of the trials made on a scientific basis show that this is not correct, in both developed and developing countries. In fact the modern varieties in general out-performed local varieties as they use nitrogen more efficiently than their predecessors. They also have better tolerance/resistance to diseases[viii,ix,x,xi,xii,xiii,xiv,xv,xvi]. These local experiments have been globally confirmed recently[xvii]. The conclusion of the CIMMYT/USAID study reads as follows; “[…] The outcomes of the study strongly suggest that, over the past 40 years, there has actually been a decline in the relative variability of grain yields for both wheat and maize in developing countries […]. The benefits are not attributed to any particular theme or program. Instead, they reflect longstanding efforts in breeding for disease and pest resistance, drought tolerance, and improved cropping systems, to name a few. By reducing the fluctuations in maize and wheat grain yields, scientists have played a vital role in making modern crop technology attractive, accessible, and beneficial to farmers and consumers around the globe".

3. The protection of plant varieties in line with the UPOV 1991 Convention denies the right of farmers to use farm-saved seed

This is not correct and needs clarification[xviii,xix].

If farmers wish to use old varieties and landraces that they may consider more suitable for their conditions, there is no limitation on use of farm-saved seed. If they wish to grow modern protected varieties, according to the European regulations for the main crops such as cereals, pulses and oilseed rape, two cases have to be considered:

- Small farmers, producing less than 92 tons of cereals or equivalent in other crops may use farm-saved seed without any limitation on their own farms.
- Large farmers may also use farm-saved seed on their own farm but they have to pay royalties to the breeder of the variety. The level of royalty has to be discussed between the farmers and the breeder but it cannot be lower than 50% of a commercial royalty.

4. The coexistence of GM varieties and organic agriculture is impossible

In Europe the third largest country as regards organic agriculture, Spain[xx], is also the second country in Europe with the largest acreage grown to GM crops. The USA, country having the largest GM acreage, is also experiencing a large increase of organic agriculture[20]. The position of the IFOAM World Board in May 2002 is worth noting: "[…] The potential of GMO contamination does not alter the traditional approach of certifying organic as a "production method" rather than an end-product guarantee. Organic products are not defined or certified as being "free" of unwanted pollution […]. Therefore IFOAM does not support the introduction of *de minimis* thresholds for genetic contamination". Recently[xxi], it has been shown that good agricultural practices could achieve European Union GM labelling thresholds.

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