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Genetic erosion by modern plant breeding: fact or fiction?

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Genetic erosion

Genetic erosion is the loss of genetic diversity due to various processes, including the modernization of agriculture and environmental changes. Because the extent of genetic erosion defines the work of genebanks, aiming to safeguard genetic diversity of crops and their wild relatives, the topic of genetic erosion forms part of CGN's research agenda.

Literature review

A comprehensive literature review of genetic erosion in crops was conducted to analyze diversity trends during the bottleneck caused by the modernization of agriculture. A reduction in diversity due to the replacement of landraces by modern cultivars was revealed. Once this replacement was completed, diversity levels became stable (Fig. 1).

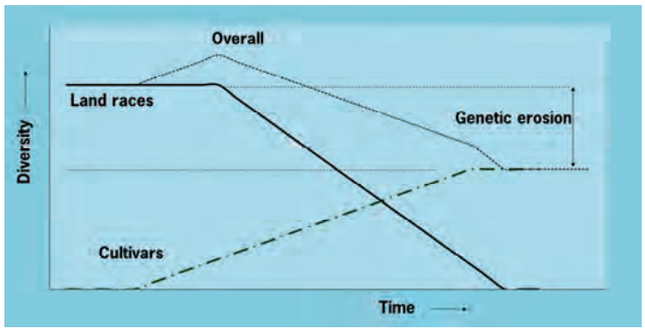

Fig.1 Crop diversity trends during the replacement of landraces by cultivars

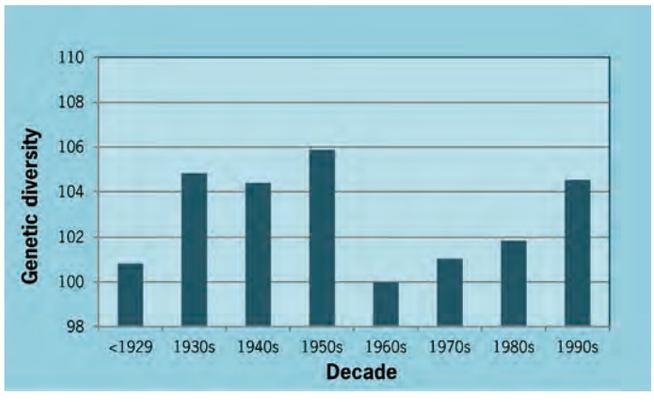

Fig. 2 Crop genetic diversity trends based on a meta-analysis of molecular data.

Meta-analysis

A meta-analysis was performed using molecular data from 44 publications on diversity trends in crop varieties. A small but significant reduction of 6% diversity was observed in the 1960s. Diversity slowly increased again in the period thereafter, probably due to the enhanced use of exotic germplasm (Fig. 2).

Diversity trends in vegetable cultivars

As field crops dominate the literature on genetic erosion, diversity trends were studied in vegetables, using lettuce as a model. A total of 225 seed catalogues issued during the period 1841-1999 by French and Dutch companies were examined for the presence of lettuce cultivars. The number of unique cultivars increased slowly until the 1960s, followed by a strong increase in the period thereafter. Simultaneously, the life span of cultivars decreased significantly. These findings may reflect the implementation of UPOV in 1961, the accelerated breakdown of disease resistances and the need for product diversification in response to consumer demands.

Conclusion

Our studies showed no genetic erosion in cultivars due to modern plant breeding.

References

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