

Adaptation of lentil to low input conditions by natural selection on farm

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Introduction

The use of farm saved seeds is a means to reduce external input and it also allows for evolutionary adaptation to site specific conditions. To date little is known about the relevance of mechanisms involved and the development of biodiversity by on-farm management at multiple sites.

This experiment is carried out with lentil (*Lens culinaris* Medik.), an autogamous species. Recombination is limited to about 0-4% and depends on year, site, and genotype (Horneburg, 2006). Lentil production has almost ceased to exist in Central Europe, but lentils may still be found in gene banks and have remained a popular food.

Materials and Methods

Three old lentil (*Lens culinaris* Medik.) varieties were exposed to 10 generations of natural selection at three very different sites on-farm in rainfed conditions in Central and Northern Germany (Fig. 1). Two of the selection sites were on poor or marginal soils with a frequent shortage in water supply. At one of the sites all three varieties were selected during six generations for small and large seeds, respectively (Fig. 2).

Results and outlook

After four years of natural selection significant changes in agronomic, morphological, and phenological traits had occurred. For one variety natural selection had increased seed weight (Horneburg & Becker, 2008, Horneburg, 2003).

In the next steps the original population, generation 5, and generation 10 from all sites shall be investigated in field trials at the selection sites. Additionally the populations will be characterized by molecular markers to calculate overall biodiversity and the response to natural selection.

In field experiments with and without drought stress the importance of water supply as a cause for natural selection shall be assessed. Populations selected for small and large seeds, respectively, will be grown in field trials to investigate the correlation of seed size, agronomic performance, and fitness related traits.

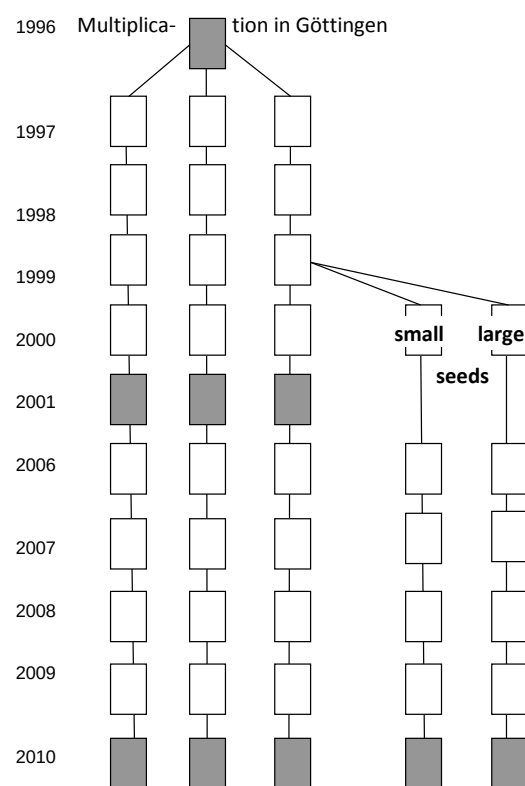


Fig. 1 Natural selection and calibration of three lentil varieties on farm at Schönhagen, Reinshof and Tangsehl. Calibration at Reinshof only.

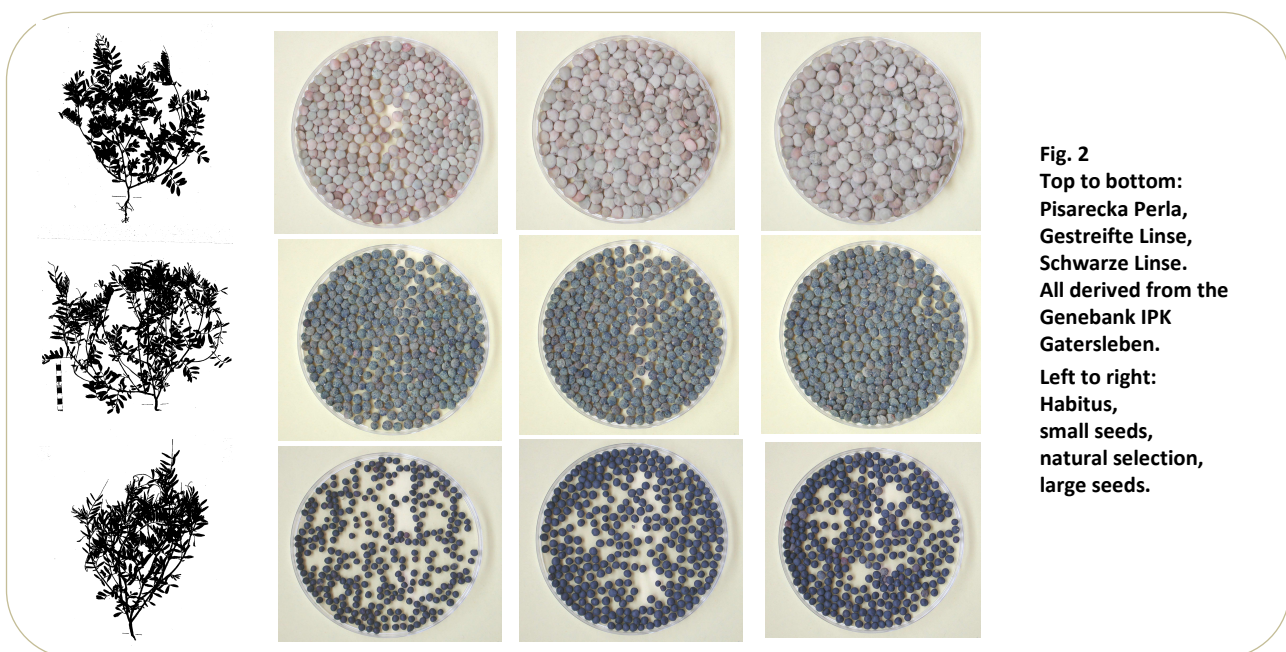


Fig. 2
Top to bottom:
Pisarecka Perla,
Gestreifte Linse,
Schwarze Linse.
All derived from the
Genebank IPK
Gatersleben.
Left to right:
Habitus,
small seeds,
natural selection,
large seeds.

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References Horneburg, B. (2006) Outcrossing in lentil (*Lens culinaris* Medik.) depends on cultivar, location, and year and varies within cultivars. *Plant Breeding* 125: 638-640. Horneburg, B. (2003) Standortspezifische Sortenentwicklung - eine Studie mit Landsorten der Linse. *Schriften zu Genetischen Ressourcen* 21. Available at <http://www.genres.de/service/publikationen-informationsmaterial/schriftenreihe/> Horneburg, B. & Becker, H.C. (2008) Crop adaptation in on-farm management by natural and conscious selection. A case study with lentil. *Crop Sci* 48: 203-212.

