

University of Hohenheim
Institute of Plant Breeding, Seed Science and Population Genetics
Department of Plant Breeding
Prof. Dr. sc. agr. A.E. Melchinger



**Assessment of different methods of farmer-participatory
selection in diversified pearl millet [*Pennisetum
glaucum* (L.) R. Br.] populations at three pilot sites in
Niger**

This work was financially supported by the Eiselen Foundation Ulm
and by the McKnight Foundation

Diploma-Thesis

by

Stefan Haffke
Auwärterweg 15
70567 Stuttgart-Möhringen
Hohenheim, September 2010

ABSTRACT

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a protogynous, hermaphrodite, cross pollinating, diploid ($2n=14$ chromosomes), annual C4 grass and the sixth most important cereal in the world. It plays a fundamental role for food security in the semi-arid to arid Sahel of West and Central Africa (WCA), where it is the major source for energy and proteins for about 500 million people. In WCA pear millet is grown on approximately 15.7 million ha and Niger, Nigeria, Mali, Chad, Burkina Faso and Senegal are the major pearl millet producing countries.

The present study aims at developing an initial strategy for efficient farmer-participatory pearl millet improvement. Specific research questions were (i) after two cycles of selection using different on-farm and on-station selection methods, which method was most efficient for enhancing yields; (ii) what are the advantages and disadvantages of the various selection methods used; (iii) which agro-morphological traits changed during the selection; (iv) do farmer-selected varieties adapt beyond their sites of selection; (v) what is the extend of genotype x environment interaction (GxE) in on-station *versus* on-farm trials and what are the implications of the observed GxE for participatory pearl millet improvement?

The study was initiated by ICRISAT in 2006 at three pilot sites in Niger. Site-specific base populations were created in the off-season 2006/07 using materials selected by farmers in the rainy season 2006. In 2007, two to four farmers per site did on-farm simple mass selection (SMS) in subsamples of the populations. In 2008, five different selection methods were applied: on-farm SMS, on-farm mass selection with parental control (SMC), on-farm full-sib family (FSF) selection, on-station FSF selection, and combined FSF selection (on-station and on-farm). In 2009, multi-location selection progress trials were conducted both on-farm and on-station.

Results showed that two cycles of SMS can significantly increase grain yield in individual cases, depending on the selection efficiency of the participating farmer-breeder. The more sophisticated FSF and SMC weren't more efficient than SMS. Farmer selection resulted into shorter and more compact panicles, shorter plant height, better panicle exertion and in some cases higher grain yield. Biplots combining on-station and on-farm data revealed for two pilot sites that on-farm selected varieties performed better on-farm while on-station selected cultivars performed better on-station, underlining the importance of testing breeding materials on-farm. Certain varieties selected on-farm were performing above-average and achieved high farmer preference indices also at other sites, indicating the potential adaptability of farmer-selected cultivars beyond their site of selection. As two seasons were insufficient to reliably measure selection progress in the highly variable Sahelian environments, it is recommended to continue the selection for two or three more cycles to derive final conclusions regarding the best strategy for participatory pearl millet improvement in WCA.