Technology Fact Sheet

Sector	Agriculture
Adaptation needs	1. Better adaptation to low temperatures during sowing and early vegetation season of plants. 2. Adaptation to drought conditions. 3. Adaptation to vulnerable prices in the process of first generation hybrid seed production.
Technology Name	**Application of anthers culture and "in vitro" isolated pollen methods to obtain and use double haploid lines in plant breeding.** [i]
How this technology contributes to adaptation	1. Enhancement of plant breeding for resistance to different stress factors (cold weather during the first growing season, drought, etc.) by obtaining "pure" or inbred, absolutely homozygous lines as "in vitro" cultures. 2. The possibility to detect valuable mutations at the level of haploid and further - diploid cell may facilitate obtaining of lines resistant to drought, low temperatures, various pathogens, with many valuable features in the main species of crops. 3. The possibility to remove certain inappropriate individuals at early stages of selection, due to the *hemizygot* state of haploids that allow expression of all genes, including unfavorable recessive genes. 4. The possibility to rapidly create, by method of androgenesis, of *androsterile* analogues - female genitor lines in the process of first generation hybrid seed production. 5. The possibility of fixing the heterocyst revealed in the first and further hybrid generations. 6. The possibility of reproducing a large number of descendants, which possess valuable features and properties specific to the initial form (parent body) in a short time and a very limited area. 7. Selection and breeding of new plant varieties resistant to drought, diseases and pests. 8. Reducing the costs for human and financial resources while creating varieties of pollinated plants and obtaining the initial material for breeding cross-fertilized plants.
Background / Notes, Short description of the Technology option sourced from Climate TechWiki, Seminars etc	The current system of production of hybrid seed of first generation (F1) is based on development of inbred lines, which, by using a conventional method, are obtained as a result of controlled self-pollination of the original form (variety, population, hybrid) for 5-8 consecutive generations. The genetic research carried out in early '60s of the last century have demonstrated the possibility of obtaining "pure" or double haploid inbred lines in a number of species, including maize, by androgenesis in "in vitro" culture. Androgenesis is the transformation of a haploid cell of the male gametophyte into a mature plant with a gametal number of chromosomes. Androgenesis may be induced through "in vitro" culture of anthers or pollen at a certain stage of development. In order to obtain normal plants, perfect homozygote, haploids diploidize. The fact that the double haploid lines, which are absolutely homozygotic, can be obtained during two generations, while using conventional methods inbred lines are obtained in at least 6-8 generations justify the increased interest of breeders to haploid method. So, the haploid method determines an important reduction of the selection process duration.
Implementation	The technology of "in vitro" culture for obtaining double haploid lines will be used in

assumption, How the technology will be implemented and spread across the subsector	the Institute of Crop Husbandry "Porumbeni", Institute of Genetics and Plant Physiology of the ASM, the Moldova State Agricultural University, Research Institute for Field Crops "Selectia". The final product of the technology: a) double haploid lines valuable from agronomic point of view can be used directly in production, as commercial varieties in self-pollinated plants and plants with vegetative reproduction. b) haploid lines derived from heterozygotic plants of cross-fertilized species, which necessarily originate from a single gamete, will have a completely different genotype due to re-combinations and large number of genes. c) first generation hybrid seeds will be used by farmers to obtain high yields of crops. The expected scientific results will be published in scientific papers, radio and television, so that farmers, PhD candidates, students will be informed and will make efficient use of knowledge gained from practical implementation.
Country social development priorities	• Improving the living standards of population • Increasing the number of jobs on the labor market • Expanding institutional cooperation (R & D) both nationally and internationally. • Improving the human health care system
Country economic priorities-economic benefits	• Reduce human and energy costs related to organization and care of experiments in the field conditions • Reduce financial costs related to storage of seeds • Stimulate economic activities with environmental impact • Enhance financial support in the agricultural sector, and subsequently the income of rural population. • Expanding the market to sell agricultural production.
Country environmental development priorities (environmental benefits)	• Increase biodiversity and avoid erosion of germplasm. • Improve human health by excluding harmful effects of fertilizers, pesticides and even the allergic effect of pollen on human health. • More rational use of farm land (by reducing the areas used for research and multiplication of seeds purposes. • Preserve fertility and reduce soil erosion. • Reduce GHG emissions and global warming
Social benefits	• More people will be engaged in research and innovation • Increased interest for the implementation of modern biotechnology methods and cultivation of other species and varieties of plants important to the national economy. • Reduce poverty
Other consideration and priorities (such as market potential)	• Increasing knowledge transfer and exchange of know-how among farmers • Stimulate interest for getting higher education and possibility of employment in modern biotechnologies • Expanding the market for selling seeds
Operational costs (without	Salaries for staff *3 persons x 1200 euro x 1 year*=- 3 600 euro

maintenance costs)	*Annual maintenance (energy, water, gas)* 1400 euro Toal=5000 euro
Upscaling potential	Double haploid lines, absolutely homozygotic, can be obtained within two generations, and relatively homozygotic inbred lines are obtained by the conventional method in at least 6-8 generations. By using double haploid lines and controlled fertilization segregating generations are eliminated, what considerably shortens the improvement program. It has been stated that 100 double haploid plants have genetic variability equal to that shown by the 6000-7000 F2 diploid plants. Given the recessive characteristics, 100 haploids equals to 10 000 diploid plants in F2.

[i] This fact sheet has been extracted from TNA Report - Technology Needs Assessment for climate change adaptation - Republic of Moldova. You can access the complete report from the TNA project website **http://tech-action.org/**