Technology Fact Sheet

Sector	Agriculture
Adaptation needs	1. Adaptation of agrophytocenoses to environmental changes. 2. Adaptation of seeds reproduction to the adverse impact of biotic and abiotic factors. 3. Adaptation to vulnerable prices in the seed production process.
Technology Name	**Micro-propagation of valuable genotypes by "in vitro" cultivation of plant cells and tissues**. [i]
How this technology contributes to adaptation	1. Possibility to reproduce a large number of descendants having valuable features and properties specific to the initial forms (parent body) in short time and on a very limited areas. 2. Selection and reproduction of new plant varieties resistant to drought, diseases and pests. 3. Revealing varieties with enhanced capacity to assimilate carbon dioxide and respectively, with higher productivity. 4. Obtaining virus-free plants in a series of species (potato, tomato, strawberry, tobacco, vine, fruit and floriculture). 5. Reducing costs for human resources and financial expenditures for the process of seeds and planting material reproduction.
Background / Notes, Short description of the Technology option sourced from Climate TechWiki, Seminars etc	Many species of plants (vine, fruit trees, bushes, strawberries, carnations, etc) reproduce both sexually- by seeds, and by vegetative propagation (by cuttings, tubers, bulbs, buds, rhizomes, etc). – Reproduction by seeds in these species is limited, expensive, takes a long time (getting a generation by seeds takes 3-10 years), and causes a high genetic diversity of offspring. This mode of reproduction, now is used more frequently in theoretical research and process improvement only. – In case of vegetative propagation the descendants feature great genetic uniformity and stability and the juvenile period (the period between germination and blooming) is much shorter. In terms of genetics, identical plants can be obtained only through cloned propagation. – Unlike multiplication by seeds, which are usually healthy, vegetative propagation is disadvantaged by the fact that different pathogens (viruses, viroids, fungi, etc.), are transmitted in the course of the cells division. – In order to obtain faster a large number of genetically stable, resistant to biotic and abiotic factors descendants, plant cells and tissues "in vitro" cultivation technique was developed in the 50-60-s of the last century. This method allows regeneration "in vitro" of plant organs (root, apex, reproductive organs) from an initial cell of the whole and even mature body, genetically similar to the one from which they descended. Thus, the "in vitro" culture allows multiplication of valuable genotypes in a relatively short period of time and in a limited space. To use this methods is used in areas that can be grouped according to the three complexes of research tasks aimed at improvement: a) broadening the genetic base of improvement by creating new original material, b) industrial cloned micro-multiplication of precious genotypes c) obtaining virus-free planting material.

	1. selection of donor plants, isolation of explants and obtaining a sterile well-bred culture. 2. Micro-propagation itself, when maximum amount of micro-clones is achieved. 3. rooting of multiplied shoots with their further adaptation to field conditions and, if necessary – depositing of regenerated plants at low temperatures (+2 o - 10oC). 4. Growing plants in greenhouses and preparing them for selling or planting in the field, and if necessary – depositing at low temperatures (2 a - 10oC).
Implementation assumption, How the technology will be implemented and spread across the subsector	The technology of valuable varieties by "in vitro" culture multiplication can be used by the Institute of Horticulture and Food Technology, Institute of Genetics and Plant Physiology of the ASM, the Moldova State Agricultural University, Research Institute for Field Crops "Selection", Institute of Botany of the ASM. The final product of this technology: 1. Obtaining of genetically identical clones of elite plants to be used for improvement and plant breeding; 2. Rapid and effective multiplication of new varieties of valuable plants; 3. Advantageous multiplication of highly productive genotypes of wood crops, wood decorative plants or vine rootstocks, as well as vine and fruit crops; 4. Multiplication in sterile conditions aimed at obtaining virus free planting material. 5. Preservation and multiplication of valuable genotypes, separated as initial form for specific improvement purposes; 6. Achieving energy savings compared to greenhouse crops. The crop obtained on 2500 sq.m, can be obtained on 10 sq.m if in vitro culture technique is employed.
Country social development priorities	• Reduce poverty • Create jobs • Expand institutional cooperation (R & D) both nationally and internationally • Improve product quality and food security • Improving the system of health care for people
Country economic priorities-economic benefits	• Reduced costs for human resources and energy resources related to organization and maintenance of seed plantations. • Reduce financial costs related to storage of seeds. • Stimulate economic activities with environmental impact • Increase financial support for the agricultural sector, the income of rural population inclusively. • Expand the market for selling agricultural products.
Country enviromental development priorities (environmental benefits)	• Increase biologic diversity and avoid erosion of germplasm. • Improving human health by excluding harmful effects of fertilizers, pesticides, as well as allergic effect of pollen. • More rational use of land (by reducing areas occupied by fields used for growing and multiplication of seeds. • Reduce GHG emission and global warming effect. • Maintain soil fertility and reduce erosion. • Reduce water and air pollution.

Social benefits	• More people in rural areas will be employed. • Improve health, increase birth rate and reduce mortality. • Increasing interest for implementation of modern biotechnologies and cultivation of other species and varieties of plants important to the national economy. • Reduce poverty
Other consideration and priorities (such as market potential)	• Increase knowledge transfer and exchange of know-how among farmers • Higher motivation for university education and employment in modern biotechnologies sector. • Expanding the market or seeds sales.
Capital costs for one unit of:	The laboratory for vegetal tissues cultures shall include: I. Chamber of inoculation, sampling and balances; II. Chamber for preparation of culture media III. Tissue culture growth chamber; IV. Washing – sterilization room; V. Special conditioned chambers (for research purposes); VI. Materials and chemicals storage; VII. Green House Laboratory endowment, approximate cost, thousand euro I. *Chamber of inoculation, sampling and balances* - 3 - Laminar flow hood for two operators, - Binocular magnifying glass (stereomicroscope) - Electronic analytical balance II. *Chamber for preparation of culture media* - 5 - Technical scale - ; - Refrigerators for solutions stock, - Freezer for storing the substances and solutions - Digital pH-meter - Oven thermostat 100 dm3 - Centrifuge 500 - 1500 rotations/min. III. *Tissue culture growth chamber* 8 - Conditioning chambers - Conditioning units - Termofrig - Enameled iron metal shelves, adjustable in four levels, - Ventilators - Humidifier. IV. *Washing – sterilization room* 4 - Time controlled autoclave - Water boiler; - Stainless steel sinks (double); - Sterilization oven - Soil sterilizer (oven) V. *Materials and chemicals storage* 3, 76 - Freezer - Refrigerator - Enameled iron metal adjustable shelves - Culture dishes - Dishes and glassware are specific biochemistry laboratories VI. *Other equipment, including reagents* 2 VIII. Green House 2 **TOTAL**- *for 5 laboratories = 27315 th euro*
Operational costs (without	*3persons x 2000 x 1 year* - 6 *Annual maintenance (energy, water, gas)* 1 *Occupied space, annually (100 sq. m)* 0,65 *7,76 th euro*

maintenance costs)	
Upscaling potential	The up-scaing potential is for 5 laboatories, to cover biotechnological needs in plant propagation for horticulture, forestry, viticulture, vegetable areas. The advantages of in vitro culture tissue are very big. For example, a raspberry meristem can yield 50,000 descendants, while cuttings can generate 20-30 offsprings per year from one plant; in fruit and forest crops this technology can produce up to one million plantlets per year. Given these advantages, since 1986, about 350 tissue culture laboratories and specialized industrial units were created in the U.S.A, of which 18 plants had annual production capacity of 20-25 million plants used as multiplication material. Later such units were created in Japan, England, Holland, France, Germany, Israel, Belgium, Canada, etc. C. Damiano (1980) recommended for productive purposes a space with five rooms (sterile room with five hoods for five workers, each with an incubation norm of 100-120 incubations per day, resulting in one million plants per year.)

[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/**