

Technology Fact Sheet for Adaptation



Technologies in the arable farming

A.5. Breeding new variety of crops using marker assisted selection (MAS) ⁱ

1. Introduction	In order to yield high production, good varieties of crops which are adapted to local soil, weather and climate are necessary. New crop variety research and application is considered as of high results and low expense among many factors of crop production in the world. One of many methods of creation of new varieties is physical mutagens and this allows creating base materials with wide range of evolutions within short time period. Also, new variety creation can be shortened through effective selection of types in early stages of F_2-F_3, M_2 using marker techniques of protein and DNA. Selection techniques are widely used under the motto “using nuclear energy for peaceful purpose” by many countries.
2. Technology characteristics	New varieties with high yields that suit the local climate, hydrology, and soil conditions, tolerant to biotic and abiotic stresses are required to be generated through a combination of traditional adaptation selection methods with modern diagnoses, biotechnology, mutation and gene engineering methods. It generally takes 12-15 years to develop a new variety, which is too slow and expensive. To solve these problems, methods with DNA markers are required in selection programs. Despite high initial investment, protein and DNA marker technology can help to significantly reduce the selection work expense. Features that are envisioned by experts are evaluated at genetic level. Consequently research errors are minimized and the development of high productivity varieties can be done quickly. Variety generation process can be done with nuclear reactor and radiation to plant cells which lead to quick changes in plant genes. Selection of materials can be done based on estimated advantages and productivity. Consequently, new variety can be created based on biological and morphological features. New variety production can be done in a relatively short time and the expenses can be reduced.
3. Country specific applicability and potential	Some experiment fields, techniques and laboratory are available. However, the work will need a good laboratory, which is expensive to build and operate. Lack of resources limits the utilization of the technology.
4. Status of technology in country	About 30 % of wheat breeds planted in Mongolia are local varieties. The country started some research for new varieties using chemical mutation in order to get materials for selection. But application of physical mutagens and molecule markers is not done due to lack of

	equipment and laboratories.
5. Benefits and impact on the country development ✓ Economic (- Job creation; - Investment) ✓ Social (- Income generation; - Education; - Health) ✓ Environmental	Newer climate proofed varieties could be developed in a shorter span of time than conventional breeding programs. Saving time, money, resources and also timeliness in availability of required variety could be direct benefits. Job creation can be expected in breeding laboratories. New varieties of high yield wheat can increase yields and increase profits by 300-2000 USD per ha (2011 estimates). Food security would be improved through supplying wheat products of good quality. Farmers' income would be increased from the increased wheat production. This is an environmental friendly technology and improved vegetation will reduce risks of desertification.
6. Climate change adaptation benefits	New varieties with high yields and suitable for local conditions, tolerant to biotic and abiotic stresses are required to be developed a through combination of traditional adaptation selection methods with modern diagnoses, biotechnology, mutation and gene engineering methods under climate change and technology changes.
7. Financial Requirements and Costs	Calculation of expense is difficult. Firstly, investment is needed to build well equipped laboratories of molecule biology and reliable mutagens resources. Maintenance of laboratories and permanent operations require stable and permanent funding.
8. Institutional requirements	Intellectual investment, mutagen resources, and laboratory of molecule biology are required. Intellectual property rights system should be in place while new varieties are developed and introduced to agriculture.

ⁱ This fact sheet has been extracted from TNA Report – Technology Needs Assessment For Climate Change Adaptation– Mongolia. You can access the complete report from the TNA project website <http://tech-action.org/>