Technology Fact Sheet for Adaptation

Technologies in the arable farming

A.7. Integrated Nutrient Management[1] in Mongolia [i]	
1. Introduction	Soil is a fundamental requirement for crop production as it provides plants with anchorage, water and nutrients. A certain supply of mineral and organic nutrient sources is present in soils, but these often have to be supplemented with external applications, or fertilizers, for better plant growth. Fertilizers enhance soil fertility and are applied to promote plant growth, improve crop yields and support agricultural intensification. Fertilizers are typically classified as organic or mineral. Organic fertilizers are derived from substances of plant or animal origin, such as manure, compost, seaweed and cereal straw. Organic fertilizers generally contain lower levels of plant nutrients as they are combined with organic matter that improves the soils physical and biological characteristics. The most widely-used mineral fertilizers are based on nitrogen, potassium and phosphate. Environmental concerns and economic constraints mean that crop nutrient requirements should not be met solely through mineral fertilizers. Efficient use of all nutrient sources, including organic sources, recyclable wastes, mineral fertilizers and bio-fertilizers should therefore be promoted through Integrated Nutrient Management[2].
2. Technology characteristics	The aim of Integrated Nutrient Management (INM) is to integrate the use of natural and man-made soil nutrients to increase crop productivity. INM aims at optimal use of nutrient sources on a cropping-system or crop-rotation basis. This encourages farmers to focus on long-term planning and make greater consideration for environmental impacts. INM relies on a number of factors, including appropriate nutrient application and conservation and the transfer of knowledge about INM practices to farmers and researchers. In addition to the standard selection and application of fertilizers, INM practices include new techniques such as deep placement of fertilizers and the use of inhibitors or urea coatings (use of area coating agent helps to retard the activity and growth of the bacteria responsible for denitrification) that have been developed to improve nutrient uptake. Key components of the INM approach include: 1) Testing procedures to determine nutrient availability and deficiencies

[1] Source: http://climatetechwiki.org/content/integrated-nutrient-management

[2] Roy, R. N., A. Finck, G. J. Blair and H. L. S. Tandon , 2006, Plant nutrition for food security, FAO Rome, 2006.

	in plants and soils. Systematic appraisal of constraints and opportunities in the current soil fertility management practices and how these relate to the nutrient diagnosis, for example insufficient or excessive use of fertilizers. 2) Assessment of productivity and sustainability of farming systems. Different climates, soil types, crops, farming practices, and technologies dictate the correct balance of nutrients necessary. Once these factors are understood, appropriate INM technologies can be selected 3) Participatory farmer-led INM technology experimentation and development. The need for locally appropriate technologies means that farmer involvement in the testing and analysis is required. Harsh climatic conditions are a major cause of soil erosion and depletion of nutrient stocks. By increasing soil fertility and improving plant health, INM can have positive effects on crops in the following ways: 1. A good supply of phosphorous, nitrogen and potassium has been shown to exert a considerable influence on the susceptibility or resistance of plants towards many types of pests and diseases 2. A crop receiving balanced nutrition is able to explore a larger volume of soil in order to access water and nutrients. In addition, improved root development enables the plant to access water from deeper soil layers. With a well-developed root system, crops are less susceptible to drought 3. With appropriate potassium fertilisation, the freezing point of the cell sap is lowered, thus improving crop tolerance to frost.
3. Country specific applicability and potential	Agriculture has developed intensively in Mongolia in the last 50 years, but proper nutrient management technologies, to maintain and improve soil fertility, which have been absorbed by crops during their growth are missing. Especially in the last 20 years, organic fertilizer application has been ignored, which causes ecological degradation and negative effects on crop production. According to a soil fertility survey done in 2008-2010, 70.7% of crop land has soil with humus less than 2.5%. Mongolia has about 370,000 ha of arable land (wheat is grown on 310,000 ha; potato- on 15,000 ha; other vegetables on 10,000 ha; animal forage on 25,000 ha and oil plants on 10,000 ha). It is estimated that in total 40,900 metric tons of mineral fertilizers (NPK)and 2,300metric tons of rhizobacterial fertilizers are needed to keep yield stable and high.The technology can be applied in 15 out of Mongolia's 21 *aimags*. About 5-8 years would be required for the technology introduction and application.
4. Status of technology in country	Application of fertilizers has been little practiced in Mongolia in the last 20 years. Recently, the agricultural campaign "*ATAR*-3" supported by the Government has helped some farmers to use fertilizers in small scales in order to improve soil fertility and increase crop production. But currently, mineral fertilizers are being used more in cereal growing. Integrated Nutrient Management is required for cereal farms in order to ensure sustainable and organic agriculture production.
5. Benefits and	INM appropriate to local conditions of climate, soil and crop varieties will

impact on the country development ✓ Economic (- Job creation; - Investment) ✓ Social (- Income generation; - Education; - Health) ✓ Environmental	be developed and tested. Increased crop production will be more sustainable and can support food security at the local as well as national level. Locally available natural and biological materials can be used as organic fertilizers through composting. Production of organic fertilizers can create an income source for farms and workers. INM empowers farmers by increasing their technical expertise and decision-making capacity. It also promotes changes in land use, crop rotations, and interactions between forestry, livestock and cropping systems as part of agricultural intensification and diversification. A largely untapped source of potential fertilizer is urban waste however it requires more detailed research to be a viable option.
6. Climate change adaptation benefits	INM enables the adaptation of plant nutrition and soil fertility management in farming systems to site characteristics, taking advantage of the combined and harmonious use of organic and inorganic nutrient resources to serve the concurrent needs of food production and economic, environmental and social viability.
7. Financial Requirements and Costs	Estimated costs for key components of the INM are listed below 1) Testing of current soil conditions and appraisal of current management- about 60,000 USD. 2) Identify appropriate INM technologies for specific contexts (at least 10 contexts in 3 agriculture regions) – 250,000 USD 3) INM technology experimentation and development – 500,000 USD. 4) Nationwide application of INM - 8.6 million USD. **The total required funding is estimated at about 30.1 million USD**
8. Institutional requirements	Agrochemical tests of soils should be done once every 5 years according to the Agriculture Law (16.6). Testing and systematic appraisal of soil fertility during INM should be applied. Research institutions and laboratories will be involved in technology development. Stable supply of mineral and organic fertilizers will be required. The Government needs to support fertilizer producers. Farmers' participation and their knowledge are essential for success.

[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/**