

1.2 Action Plan for System of Wheat Intensification

1.2.1 About SWI

Wheat flour is a major staple food for Mongolians. During the transition period of 1990-2000, the wheat system struggled to survive due to financial and management issues. As a result of government investment in recent years, Mongolia was able to increase its total wheat production and meet grain demand for the past two years. However, there is an urgent need for adaptation technologies in wheat production system to minimize potential losses in wheat production, because future climate change impacts and environment degradation can hinder the development of sustainable and resilient wheat production systems.

SWI consists of conservation tillage and holistic plant management, with an emphasis on wheat root management to achieve economically, ecologically and socially sustainable agricultural production. Conservation tillage ensures permanent soil cover and minimal soil disturbance, slow water flow, reduces the amount of soil erosion. In the pilot project on conservation tillage in Mongolia, tillage operations were significantly reduced for cropping (Silke H and others, 2006).

Holistic plant management consists of nutrient and water management, root treatments, and crop rotation. Crop rotation is the practice of growing a series of dissimilar types of crops on the same piece of land in sequential seasons. Crop rotation can generate various benefits to the soil and eliminates the build-up of pathogens and pests that often occur when the same species is continuously planted on the same piece of land for multiple years. It can also improve soil structure and fertility by alternating deep-rooted and shallow-rooted plants.

In the 1980s, several experiments on crop rotations were conducted in Mongolia using different combinations and rotations of crops including fallow, wheat, oats, barley and peas. But the experiment did not continue during the transition period from 1990-2010. Today more research and experiments in crop rotations are needed. Incorporation of livestock in crop rotation cycles is possible when forage plants are planted. But in Mongolia crop farms do not have the appropriate knowledge and skills for crop rotation, including seeds of legume varieties which can grow well and produce high yield under the Mongolian soil and climate conditions. More research on rotation systems in irrigated planting has only started recently in Mongolia.

SWI through conservation tillage and holistic plant management is a technically viable alternative to the current crop production practices in Mongolia and provides prospects for future sustainability.

1.2.2 Targets for SWI

System of wheat intensification will target at least 80% of the grain producers who are permanent farmers dealing with grain production. The technology transfer and diffusion will require at least 8-9 years and will be completed by 2021. By 2021, about 300 thousand ha (60% of the total) of crop land will be farmed by conservation tillage and rotation system of SWI technology. The full deployment of this technology will ensure national grain security and environment benefits.

1.2.3 Barriers to SWI

Economic and financial and non-financial key barriers were identified with key experts and stakeholders.

Table 31: Key barriers identified for SWI

Barrier sub/ category	Key barrier	Brief description of barrier
Economic and financial	High cost of techniques and supplies	The wheat system requires herbicide, fertilizers, seeds of legumes, harvesting techniques. There are few importers of techniques and supplies, and no manufacturing in the country. Importing companies' capacity is limited and cannot meet the demands of grain producers. If legumes are used as rotated crop, additional technique will be required to install in current harvesting machinery.
	Limited financial capacity of grain producers and importers	Limited financial capacity of grain producers to provide up payment to importers: Grain producers struggle to pay loans within given short period because national flour mills have been saturated with grains and the Government procurement and subsidy provision is delayed due to political and macro-economic reasons.
Non-financial		
Policy, legal, regulatory	Lack of incentive policy	There is no incentive policy for grain producers to apply climate adaptation technologies. Presently, subsidy per metric tons of wheat from the Government exists. Now national demand has been met in the past 2-3 years, so the Government needs to focus on more environmentally sound and climate technologies such as conservation tillage, drip irrigation, rotation and etc.
Human skills	Insufficient human resource and professionals	Many private companies engaged in cereal growing do not have professionals with an understanding of soil, environment and agriculture sciences.
	Limited knowledge on the technology and practices	There is limited knowledge and skills to use techniques, crop rotation, fertilizers and herbicide. Long term impacts of chemical usage are not known by farmers.
Institutional, organizational capacity	Lack of adaptive research and foundation research capacity	Demonstration and experiment of environmentally sound and climate change adaptation technologies are not well considered and underdeveloped. Follow processing options and long-term consequences of using fertilizers and herbicide are not available within the country context. Especially, environmental impacts are ignored and not studied yet in detail.
Market failure	Low quality of agriculture techniques and supplies	Farmers do not have sufficient confidence in the application of new techniques and technologies.
	Limited access to international market	During the last two years, Mongolia produced more grain than national demand. However, the government and private enterprises struggled to sell the surplus due to lack of skills and experience to access to international market. Mongolian grain products are not known by international consumers.
	Inadequate infrastructure	At provincial level there is no supplier of agriculture techniques, herbicide and others and maintenance service of techniques. These lead to high costs and considerable risks to grain producers to buy advanced techniques and materials.
	Lack seed bank of legumes	Legumes seeds availability is limited to supply grain producers because legumes are not planted as rotated crop in large scales. Therefore legumes production market is not developed in the country.

Social, cultural and behavioural	Conflict between animal husbandry and arable farming	Animals graze on cropland during non-growing season. Conservation tillage requires vegetation coverage throughout the year. Not all crop land can be protected with fences.
	Low demand of legumes	Demand of legumes at local market is low because Mongolians are not used to consuming legumes for food and use as animal forage. Access to international and other countries markets is limited to export legumes.
Information and awareness	Inadequate information about legumes	Population including herders lack information and knowledge of legumes benefits.
Network failure	Poor coordination between key actors	Poor coordination between key actors, such as grain producers, Arable Farming Support Fund ²⁹ , importers, State inspection agency, Ministry of Environment and Green Development, research organizations as well as provincial agriculture extension centres exists in the country.
Technical	Lack of standards for imported techniques and supplies	There is lack of standards for imported techniques, supplies and chemicals as well as for export market. Grain producers who bear all risks are not satisfied with the quality of imported techniques and herbicides. Standards for accessing international and other countries markets are not known.

1.2.4 Proposed action plans for SWI

Through consultation workshops in (Table 32) to overcome the barriers described September and December 2012 with stakeholders for SWI. and key experts, measures have been identified

29. State fund belongs to Ministry of Industry and Agriculture and aims to coordinate Arable farming affairs and implement related policies and program

Table 32: Key measures identified for SWI and aggregation for strategy formulation

No	Key measure	Priority (1- high, 2- medium, 3-low)	Accelerating RD&D	Accelerating deployment	Accelerating diffusion
Financial incentives					
1	Tax exemption for importers of SWI equipment and supplies	1		Medium	
2	Soft loans to importers through Arable Farming Support Fund	1		Long	Long
3	Allocate Government financial resources to buy legumes for State Emergency Pre-positioning Fund and State Animal Forage Fund	1		Long	Long
Legislation and regulations					
4	Set up incentives for the application of environmentally sound and climate technologies	1	Long	Long	Long
5	Amend current Law on Land fee and Law on State Reserve Fund	2	Short	Short	
6	Set up rigorous system of evaluation and adaptation which ensure to promulgate new policies for education, research and extension.	1	Medium	Medium	
7	Enforce quality assurance and standards within the legal framework	2	Long	Long	Long
8	Develop a national program to support legumes planting	2	Medium	Medium	
Skill training and education					
9	Capacity building for grain producers	1	Short	Medium	
10	Systematic HR development plan of agriculture specialists	1	Long	Long	Long
Mechanism and institutional arrangement					
11	Establish professional consulting service at local level	2	Medium	Medium	
Creation of stakeholder networks					
12	Improve business regulation and legal framework for coordinated procurement	1	Short	Short	
Information and awareness raising					

13	Increase demand of legumes through awareness raising about legumes benefits to human and animals.	2	Short	Short	
Support R&D					
14	Support research and development of crop rotation options, crops, varieties and fertilizer, irrigation and herbicide optimum applications	1	Medium	Medium	Medium
Market system support & financial services					
15	Establish maintenance service of agriculture machineries and equipment at provincial level	3	Short	Medium	
16	Support storage facilities for winter season to keep supplies	3		Medium	
International cooperation and IPR ³⁰					
17	Facilitate international links and learning events	2	Short	Short	

Fourteen key measures were identified to ensure successful SWI technology development and diffusion. Time scale of each measure implementation have been defined in category of short (1-5 years), medium (up to 10 years) and long (up to 15 years) terms. In Table 32, each measure's role is indicated in different innovation stages like accelerating research, development and demonstration; accelerating deployment.

The key measures which are the highest priority (because these measures are the most emerging and foundational actions for the

technology in Mongolia) include financial measures (including tax exemption and soft loans for importers, and allocation of sufficient government funding); setting up incentive policy for climate and environment sound technologies; establishing rigorous system of evaluation and adaptation; improving business regulation for integrated procurement, capacity building and professional human resources development; and supporting research and development of the SWI technology. Detailed characterizations of measures are displayed in Table 33.

30. Intellectual Property Rights

Table 33: Prioritization and Characterization of acceleration measures for SWI

Sector : Arable Farming / Agriculture							
Technology: SWI - Large scale and long term							
Innovation Stage: Research and development, Deployment and Diffusion							
No	Key measure/ category	Priority (1- high, 2- med, 3-low)	Why is it needed?	Who?	When (0-5 years, 5-10 years, 10-20 years)	How much will it cost?	Risks and indicators of success
	Financial incentives						
1	Tax exemption for importers and local manufacturers of SWI equipment and supplies	1	Cost of SWI equipment and supplies are high. The measure will help to reduce cost and increase availability of equipment and supplies.	The Government; Ministry of Industry and Agriculture; Ministry of Finance	8-10 years	Government – about 2.0 million US\$; International donors – 1.0 million US\$; Private – 4.6 million US\$ (with 30 % pre-payment & soft loan)	Risk: Government revenue will decrease by 1.6 billion <i>tugrugs</i> (1.2 million US\$) per year. Success: Increased number of farmers who procured SWI equipment and supplies;
2	Soft loans to importers through Arable Farming Support Fund	1	Financial capacity of private importers is limited.	Banks and financial institutions coordinated by the Government & Arable Farming Support Fund.	10-20 years	The Fund needs 10.6 million US\$ for revolving cash fund from government and international sources. (Herbicide cost -2.1 million US\$, sprayer cost is 2.5 million US\$, seedling machine -3 million US\$, legumes seeds – 600 thousand US\$, legumes equipment – 2.4 million US\$).	Risk: Importers of equipment and supplies should be identified through appropriate and transparent process. Success: Increased number of imported equipment and supplies;
3	Allocate Government financial resources to buy legumes for State Emergency Pre-positioning Fund and State Animal Forage Fund	1	Legumes market system is not developed in the country. The nutrition value of legumes is high for animal and human than other cereals. So the state reserve funds need to procure harvested legumes.	State Emergency Pre-positioning Fund and State Animal Forage Fund	10-20 years	Animal Forage fund requires 0.7-1.0 US\$; State Emergence Pre-Positioning Fund requires 2 million US\$ from the Government.	Risk: Reserve material management should be done properly. Success: Better preparedness for disaster including zud, earthquake and others;

	Legislation and regulations						
4	Set up incentives for the application of environmentally sound and climate technologies	1	There is no incentive policy/mechanism/packages for adopting environmentally sound and climate technologies for farmers	The Government; Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Ministry of Finance	10-20 years	The government spends about 30 million US\$ for providing wheat subsidy. This subsidy can be reviewed within the current parliamentary term (2012-2016) or new financial resource of at least 20 million US\$ from the government.	Risk: Efficient system of monitoring and evaluation is required. Success: Increased number of farmers adopting climate technologies;
5	Amend the current Law on Land Fee and the Law on State Reserve Fund	2	Using legumes as rotation crop requires legal enabling environment.	The Ministry of Industry and Agriculture will initiate a law proposal and submit it to the Government and the Parliament	2-3 years	No additional cost	Risk: Financial resources should be indicated in the law and related documents. Success: endorsed laws and supporting resolutions by the Government
6	Set up rigorous system of evaluation and adaptation which ensure to promulgate new policies for education, research and extension.	1	There is lack of legal and structural framework for climate change adaptation technologies	The Government; Ministry of Environment and Green Development; Ministry of Industry and Agriculture;	3-4 years	Establishing system and structure would require about 400 000 US\$ from the government and international agencies	Success: Legal and structural foundation of proposed measures to promulgate new policies for education, research and extension will be established.
7	Enforce quality assurance and standards within legal framework	2	Quality of imported equipment and supplies are not sufficient. Review of current standards and improvement is required.	The Government; Ministry of Environment and Green Development; Ministry of Industry and Agriculture; State Inspection Agency	10-20 years	No additional cost.	Success: Improved quality of imported and manufactured SWI equipment and supplies
8	Develop a national program to support legumes planting	2	In order to supply the population with legumes food products, reduce animal loss in winter and restore soil fertility, a national legumes program is required to develop based on legal enabling environment.	The Government; Ministry of Environment and Green Development; Ministry of Industry and Agriculture; local governments;	10-15 years	No additional cost is required for development of a national program.	Risk: Financial resources for the program implementation should be secured by local governments. Success: Approved national program and planning at provincial and soum level;

	Skill training and education						
9	Capacity building for grain producers	1	Grain producers do not have sufficient knowledge and skills about SWI technology practices. Training package should be developed and appropriate trainers can be identified.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Local agriculture extension centres, private and public training organizations	8-10 years	Annual budget would be about 20 thousand US\$ each year from the government.	Risk: Demonstration of proved promising practices is required. Success: Increased knowledge and skills of farmers on SWI technology;
10	Systematic human resource development plan of agriculture specialists	1	Knowledge and skills about climate and environmentally sound technologies is not sufficiently taught to students. Curriculum of climate change adaptation and technologies should be developed and endorsed for public and private universities and colleges who prepare agriculture specialists.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Ministry of Education and Science; Public and private educational institutions	10-20 years	No additional budget for curriculum development.	Risk: Young professionals with job and opportunity are required to be supported to apply their knowledge through research funding and jobs. Success: Increased number of skilled agriculture specialists;
	Creation of stakeholder networks						
11	Improve business regulation and legal framework for coordinated procurement	1	Private importers have limited financial capacity and struggle to access to international markets	The government can identify private, consulting and dealer company through tender process.	8-10 years	Same as measure #2.	Risk: Transparency of tender process and monitoring by the government and public should be ensured. Success: Centrally coordinated procurement of equipment and supplies;
	Information and awareness raising						

12	Increase awareness raising about climate technologies and other related factors such as legumes benefits to human and animals.	2	Farmers and population do not have sufficient knowledge about climate technologies benefits.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Local agriculture extension centers,	4-5 years	It will require about 10 000 USD each year.	Success: Increased nutritional status of children and people.
	Support R&D						
13	Support research and development of crop rotation options, crops, varieties and fertilizer, irrigation and herbicide optimum applications	1	There is a lack of R&D and no access to tested and proved techniques and practices of crop varieties, conservation tillage, holistic management and other advanced practices in Mongolia. R&D is background of successful adoption of the technology and should be carried out in the western, the central and the eastern regions of cropland.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Public and private research institutions; researchers, Agriculture extension centers	5 years	Research funding is about 70thousand US\$ per year from national funding and international sources.	Success: Crop varieties adapted in local context and resilient to climate change; proper water, fertilizer and herbicide application norms and regimes, tested and proved practices of root treatment and others.
	Market system support & financial services						
14	Establish maintenance service of agriculture machineries and equipment at provincial level	3	There is no repair service of agriculture machineries and equipment at provincial level. Farmers need to get repair service at least at provincial level.	Private enterprises and dealers	5 years	Private companies and dealers can establish their maintenance service at provincial level with soft loans.	Success: - Decreased cost of equipment and machineries maintenance;
	International cooperation and links						
15	Facilitate international links and learning events	2	There is lack of knowledge and skills to adopt climate technologies by grain producers, private enterprises and government officials. International experiences are important to learn and apply in the country context.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Public and private research institutions, universities and colleges;	5-7 years	Exposure trips for international experiences can cost about 10-15 thousand US\$ in year from the government. Post graduate studies in national and international educational centres requires about 20-25 US\$ every year from international funding.	Success: Increased number of researchers and agriculture professionals with advanced knowledge and skills