

1.4 Action Plan for Potato seed production system

1.4.1 About PSPS

Potatoes are Mongolia's "second bread" in terms of the scale of production and food value. In the past two years, Mongolia could meet 100% of national demand for potatoes. Limited accessibility to high quality potato seed is a perennial problem amongst many growers and is partly attributable to inefficiencies in various links of the seed production system. Third prioritized technology is potato seed production system which aims to enable sustainability and reliability of high quality of potato varieties in the country.

PSPS comprises components of development of varieties, producing mini tubers or elite seeds, multiplying seeds, and storage and delivery systems. Today, most mini tubers or elite seeds are imported from other countries. Some initial research and development of local varieties of potato which adapted to climate change has been conducted in research institutions of Mongolia. As a vegetative propagated crop, potato is highly vulnerable to a plethora of diseases that in turn drastically reduce the amount and quality of yields. In climate change scenarios more vectors and viral diseases are expected. Through technology transfer and diffusion, the research will be expanded to improve potato varieties which are resistant to diseases.

Production of potato mini tubers or elite seed can be done using aeroponics which is a more efficient technique to breed seed potatoes. The technique has potential to eliminate all but one generation of seed potato multiplication in the field, thus lowering costs and raising the plant health quality of the first field production generation.

Potato seed production system has three main steps:

- Produce mini tubers using aeroponics (a crop environment including nutrients,

temperature and moisture can be artificially created.)

- Produce potato seeds using mini tubers in greenhouses and at agriculture extension fields of *aimags* or seed producer's fields
- Deliver healthy potato seeds to local markets and farmers.

Producing potato mini tubers in aeroponics has high reproduction coefficient and requires less labour, time and financial resources than potato seed production in soil. The technology can improve the supply of good and healthy potato seeds and increase the potato production per area.

Initial research on growing potato tubers in aeroponic systems with optimal conditions in air has been carried out by the Mongolian National Agriculture Research Institute under the "Mongolian Potato Program" in the first period from 2008-2012. Mongolia has become the fifth country in Asia to pilot this technology. The results were promising and proved in local contexts. The technology will improve sustainable supply of potato seed of adapted potato varieties which will be free of viral diseases. Establishment of local production systems would save labour, time and cost.

Possible areas of research to improve productivity include optimizing nutrient solutions, plant density, number of harvests and harvesting intervals. Resources such as greenhouses and capacity building are required.

1.4.2 Target for PSPS

In 2011, 14 600ha of land was planted with potatoes and the harvest was about 200 000 metric tons. From 2010, potato growers have met 100 % of local demand of potato. However, adapted varieties and seed production is not sufficient. Mongolia has been piloted raising potato tubers in aeroponic system since 2008. PSPS will help to meet at least 80 % of national

demand with high quality potato seeds by 2016-2018. Potato production is expected to be increased at least 60% over the current level of production.

1.4.3 Barriers to the technology diffusion

Identification of barriers was done through stakeholder participatory process and other

methodologies including a desk review of literature. Interviews and surveys were facilitated by key experts. Several meetings were held with key resource persons who had conducted research on the subject and been involved in the piloting of related techniques and range of tools for barrier analysis. These barriers are described in Table 37.

Table 37: Key barriers identified for PSPS

Barrier sub/category	Key barrier	Brief description of barrier
Economic and financial	Inadequate availability of financial resources	Presently, much of these finances (especially for obtaining potato mini tubers and elite seeds) are met from a variety of sources such as donor-funded projects. Ideally, after initial years of assistance from various state and non-state sources, potato seed producers should have built up finance and operate according to the market principles. But it is often seen that the potato seed producers continue to depend on external sources to secure investments.
	High cost of equipment and materials	Currently, potato seed production depends largely on imports of seeds or mini tubers, aeroponic systems, greenhouses and other supplies. Cost of imported equipment and supplies are increased due to other factors such transportation, importation procedures and limited number of licensed importers.
Non-financial:		
Policy, legal, regulatory	Lack of subsidy policy for potato seed producers	Financial capacity of potato seed producers is limited and they cannot afford technology and equipment.
Human skills	Lack of skills and knowledge about aeroponic system	Aeroponic system is a new technique in Mongolia and only tested very recently. Potato seed producers and farmers have very limited knowledge and skills about climate technologies, potato varieties and advanced techniques such as aeroponics.
Institutional, organizational capacity	Limited producer and capacity of potato mini tubers	Aeroponic growing of potato is tested and demonstrated in a laboratory in the Agriculture Research Institute in <i>Darkhan</i> . Few researchers have gained knowledge and skills about the technology. Research on the potato seed growing using advanced techniques and aeroponic condition is limited.
Market failure	Underdeveloped local supply chain of potato seed production	There is a limited number of initial seed producers and formal and informal potato seed multipliers are not well coordinated at provincial and local levels. Storage capacity at provinces is limited and transportation process is not strongly established.

Network failure	Poor coordination between research organization, provincial agriculture extension centres, potato seed producers and farmers	Research results and outcomes are not disseminated to farmers and scaled up. Provincial agriculture extension centres do not sufficiently carry out demonstration of the promising techniques to local farmers due to financial resources
-----------------	--	---

In total, seven barriers were identified as key to the technology diffusion. The two most critical barriers identified for the diffusion of PSPS arise from financial and economic constraints for undertaking increased investments, namely inadequate availability of financial resources for such investments and the high risk of investments.

1.4.4 Proposed action plans for PSPS

The key measures have been identified by stakeholder consultations held in September 2012, to overcome the barriers discussed in the above section.

Table 38: Key measures identified for PSPS and aggregation for strategy formulation

No	Key measure	Priority (1- high, 2- med, 3-low)	Accelerating RD&D	Accelerating deployment	Accelerating diffusion
	Financial incentives				
1	Assuring adequate availability of financial resources	2	Medium	Medium	
2	Provision of long term and soft loans to potato seed producers	1	Medium	Long	Long
3	Tax exemption of imported aeroponic system and other facilities	1		Medium	
	Legislation and regulations				
4	Set up subsidy policy on application of environmentally sound and climate technologies	1	Medium	Long	Long
	Skill training and education				
5	Training of agriculture professionals on aeroponics and potato seed production	1	Short	Medium	
6	Training of potential potato seed producers	2	Short	Medium	
	Support R&D				
7	Expanding research capacity on potato varieties and advanced techniques including aeroponics	1	Medium	Medium	
	Market system support & financial services				
8	Invest infrastructure	2	Medium	Long	Long
9	Intensify supply chain of potato producers	3	Medium	Long	Long
	International cooperation				

10	Strengthen international cooperation of experience sharing and learning through different activities and networks	2	Short	Short	
----	---	---	-------	-------	--

Among ten identified measures, the highest priority ranked by stakeholders and key experts were financial measures including provision of soft loans and tax exemption and non- financial measures such as establishing subsidy policy for environmentally sound and climate technologies, training for professionals and supporting R& D.

Each measure has had time scale (short – 1-5 years, medium –up to 10 years, long- more than 10 years). Detailed information of each measure is given in Table 39.

Table 39: Prioritization and Characterization of acceleration measures for PSPS

Sector : Arable Farming / Agriculture							
Technology:		Potato seed production system - small and medium scales and long term					
Innovation Stage:		Deployment - Diffusion					
No	Key measure/ category	Priority 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	Assuring adequate availability of financial resources	2	Funding from different sources such as public and private sources is required. Research on potato varieties and agro-technical practices can be funded from the government and other donor agencies. At least 3 sites with complex aeroponic systems should be established in the western, the central and the eastern agricultural zones.	Ministry of Finance; Ministry of Industry and Agriculture, Research institutions at three agriculture zones	4-5 years	Initial capital investment costs are estimated about 120,000 USD (40,000 USD each location) from the government and international agencies.	Success: Increased number of laboratories which produce mini tubers; Decreased import of mini tubers or potato seed
2	Provision of long term and soft loans to potato seed producers	1	Arable farming fund can provide loans with low interest for 3-5 years can support farmers to be strong market actors. Micro-financial organizations can reach out poor farmers to be potato seed multiplier which is a part of supply chain of potato production. Farmer groups and companies can build storing facilities of medium and big scales using loans.	Ministry of Finance; Ministry of Industry and Agriculture, Bank and financial organizations	5-6 years	Revolving fund of about 1 million US\$ is required from the Government and private sources.	Success: Increased number of potato seed producers;
3	Tax exemption of imported aeroponic system and other facilities	1	Considering the importance of this technology, government should give import tax exemptions/relief and subsidiary on interest rates for loans for importers/ local producers of aeroponic system, equipment, and other supplies. Technical support and quality assurance should be given by researchers and engineers to local producers.	Ministry of Finance; Ministry of Industry and Agriculture, Bank and financial organizations	5-6 years	No additional cost. But the Government revenue will decrease.	Risk: Requirements and license obtaining information of potato seed producing and importing should publicly announced by the MIA through media and press in order to ensure on availability of such equipment should be provided through information campaigns. Success: Increased availability of imported PSPS equipment and facilities

	Legislation and regulations						
4	Set up subsidy policy on application of environmentally sound and climate technologies	1	Current subsidy policy of the government need to include Potato seed production using aeroponic, water saving and green technologies.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; Environment NGOs, farmers organization	10-20 years	It would require about 1-2 million US\$ per year from the government.	Success: Increased number of farmers who adopted PPS technology;
	Skill training and education						
5	Training of agriculture professionals on aeroponics and potato seed production	1	Theoretical and practical knowledge and skills should be given to students studying in the State University of Agriculture and other colleges on the subject.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; public and private colleges and universities	4-5 years	No additional cost is required.	Success: Increased number of skilled professionals and specialists
6	Training of potential potato seed producers	2	Knowledge and skills on mini tuber producing, seed multiplying, application of fertilizers and pesticide and other technical aspects can be provided by provincial agriculture extension centres and local training NGOs. Practical experience and field visits in the country as well as outside can be good witness of successful practices.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; Provincial agriculture extension centres; Training organizations;	4-5 years	It will require about 32,000 US\$ per year for 4 years.	Success: Increased number of potato seed producers using PPS technology;
	Support R&D						
7	Expanding research capacity on potato varieties and advanced techniques including aeroponics	1	Research by specialists and post graduate students can be extended focusing on the technology.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; public and private research institutions; researchers	7-8 years	It will cost about 300,00 US\$ in total for 5-6 years. This kind of research can be funded by National Science Fund, other national programs and international projects.	Success: Increased access to tested and proved potato varieties and potato seeds; Improved number of farmers who produce potato seeds using the technology;
	Market system support & financial services						
8	Invest infrastructure	2	Local infrastructure including road, proper storages, reliable and constant electricity and water supply system should be an essential focus of the Government to support local production system.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; Provincial government	10-15 years	It should be done through related infrastructure projects of the Government for long term period.	Success: Improved infrastructure at local level;

9	Intensify supply chain of potato producers	3	Awareness raising and coordination of different actors of the potato seed production system can be start of process. Local government can support and be bridge farmer groups and private companies to be part of supply chain of potato seed production system. Procurement, delivery, transportation and storing processes are necessary part of the supply chain system. Systematic and continuous supply of potato products to the bigger market in cities should be coordinated.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; Provincial government; farmer organizations	5-6 years	Coordination would not require additional funding. For capacity building please see measure #6.	Risk: Farmer groups including poor farmers can be strengthened through training and micro financial services. Success: Increased number of farmer groups/cooperatives with different actors of supply chain;
	International cooperation						
10	Strengthen international cooperation of experience sharing and learning through different activities and networks	2	Working professionals of companies and state agriculture organizations should be re-trained through short term programs and exposure trips to other countries.	Ministry of Finance; Ministry of Industry and Agriculture, Ministry of Environment and Green Development; national and international training organizations	3-4 years	In total, it would cost about 80,000 US\$ from the government and international donors.	Success: Increased number of skilled farmers, specialists and government officials;