

1.3 Action Plan for Vegetable production system

1.3.1 About VPS

Vegetable production system with drip irrigation and mulches (VPS) aims to intensify vegetable production through a set of water saving techniques such as drip irrigation, low cost greenhouses or mulch. Drip irrigation is not only related to irrigation regime and techniques, it also includes fertilizer, pesticide and soil management and their proper application. Mulch is a product used to suppress weeds and conserve water in crop production and landscaping. As a whole system, the technology increases farming efficiency and other benefits to farmers.

Mongolia is experiencing water shortages and an increasingly dry climate due to climate change. Therefore, drip irrigation with plastic mulch can reduce water consumption, decrease labour intensity and increase production. Vegetable and other crops such as water melon, cucumber, tomato, and peppers can be planted in plastic mulch. Drip irrigation is based on the constant application of a specific quantity of water to soil crops. There is wide range of drip irrigation systems. However, locally suitable system for specific crop needs to be developed.

VPS can support farmers to adapt to climate change by allowing efficient use of water. This particularly useful in areas subject to climate change impacts (such as seasonal droughts), since VPS reduces demand for water and water evaporation losses (as evaporation increases at higher temperatures). Furthermore, fertilizer application is more efficient since it can be applied directly through the pipes and reach plant roots.

Mongolia has been piloting drip irrigation systems since 1997 and the suitability of this technology has been confirmed. The pilot projects demonstrated suitability and applicability for growing vegetables, berries and bushes in Mongolia. Currently, plastic mulches are used by a small number of Mongolian farmers to grow

crops such as peppers, water melon cucumber and tomato. Drip irrigation systems help farmers reduce water consumption for the production of vegetables and berries. Initial cost of equipment is high, however operating cost of irrigation can be lowered due to water saving. Small farms and families can use several small scale drip irrigation systems which each of them can be set up for 0.5 ha. Because of cold winter, irrigation equipment and mulches need to be stored inside storing facilities in winter. The storage space requirement is not big, so it can be solved by farmers and households.

1.3.2 Targets for VPS

Today farmers grow vegetables other than potato on about 8 000 ha of land. Presently, 11.8 percent of crop land is irrigated in the country. However, drip irrigation has been applied on only 100ha of arable land with support of international projects. Noticeably, water shortage due to climate change is becoming a significant challenge in all sectors, including agriculture. Wide application of drip irrigation would play a vital role in agricultural production, saving water and improvement of nutrition for the elderly, children and mothers.

VPS technology will be applied for vegetable farmers and aims to target at least 50% of farm land depending on availability of water resources and electricity for drip irrigation. The full deployment of the technology will require 9-10 years and is expected to be completed by 2023.

1.3.3 Barriers to VPS

As a result of stakeholder inputs, VPS with drip irrigation and mulches was identified as a market good. Ten barriers were identified including two economic and financial and eight non-financial barriers. Non-financial barriers identified for the Vegetable production system with drip irrigation and mulches, included policy, legal and regulatory, human skills, institutional and organizational capacity, market failure, cultural and behavioural, network failure and

technical barriers (Table 34).

Table 34: Key barriers identified for VPS

Barrier sub/ category	Key barrier	Brief description of barrier
Economic and financial	High cost of drip irrigation techniques, plastic materials and facilities	There is no manufacturing of drip irrigation and plastic sheets in the country and techniques and supplies are imported from other countries. For big farms cost per hectare of drip irrigation is estimated as high as 17 million <i>tugrugs</i> (12,000 US\$) including water wells and electricity source.
	Limited access to long term soft loans	Private enterprises, importers and vegetable growers have limited access to long term soft loans for drip irrigation techniques, facilities and greenhouse and mulch materials.
Non-financial:		
Policy, legal, regulatory	Lack of subsidy policy	There is lack of subsidy policy for encouraging farmers to use environmentally sound and climate technologies. Because of high cost of water saving techniques and materials, vegetable growers struggle to buy them.
Human skills	Limited knowledge and skills	Vegetable farmers do not have sufficient knowledge and skills to use water saving techniques such as drip irrigation, low cost and locally affordable greenhouse or mulches.
Institutional, organizational capacity	Lack of training and demonstration of drip irrigation and mulches pilots and experiments	Few research and practical experiments on vegetable varieties, irrigation norms, standards, soil characteristics, application of fertilizers and economic analysis have been done. Application of research and science in practice is very weak.
Market failure	Underdeveloped local market and value chain system	Many rural farmers are isolated from urban market and there are insufficient processing factories and storage to support the conversion of product increase into income growth. Current vegetable production system has a seasonal pattern. Also there is insufficient financial support to strengthen value chains at local level including vegetable processing factories, storage and others;
Social, cultural and behavioural	Lack of knowledge and attitude towards water saving behaviour	Traditionally, Mongolians use water free of charge, which has led to inefficient consumption and undervaluation of water. Farmers in local areas use open water resources such as rivers, springs or free wells.
Network failure	Poor coordination between key actors	Poor coordination between key actors including government, international and national projects and programs, research and farms and provincial agriculture extension centres exists in the country. Sustainability of project outcomes and scaling up of promising practices are not guaranteed with financial and human resources by international and national agencies. Research work is not tested in different regional areas through agriculture extension centres which are located in provincial levels.
Technical	Insufficient quality assurance	Quality assurance of drip irrigation techniques, mulches and supplies is insufficient. Farmers bear all risks and high cost.
	Inadequate investments into infrastructure facilities	Government invested inadequately into infrastructure facilities which can help expand market access, water resource and electricity etc. Current development of infrastructure is centralized in the capital and few cities.

1.3.4 Proposed action plans for technology VPS

Through consultative process with stakeholders key measures were identified and

their priority was estimated. Each measure is

important in different innovation stages and over different timescale during the technology development and diffusion (Table 35).

Table 35: Key measures identified for VPS 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	Tax exemption policy for importers of drip irrigation equipment, mulching supplies and facilities	1		Long	
2	Long term and soft loans for importers, local manufacturers, repair service providers of drip irrigation techniques and supplies and recycling factories of plastic waste from mulches	1		Long	Long
	Legislation and regulations				
3	Set up incentive policy to encourage farmers deploy climate and environmentally sound technologies	1	Long	Long	Long
	Skill training and education				
4	Systematic agriculture professionals' development about water saving technologies and Integrated water resource management	1	Long	Long	Long
5	Capacity building for vegetable farmers on agriculture practices and writing proposal from other financial resources	2	Medium	Medium	
	Mechanism and institutional arrangement				
6	Facilitate coordination between business and community groups who grow vegetables, transporters, process, store and retailers to support value chain at local level	2		Medium	Long
7	Organize integrated supply of drip irrigation techniques and supplies	2	Medium	Medium	
	Information and awareness raising				
8	Improve public awareness on water saving and community based environment monitoring	1	Medium	Medium	
	Support R&D				
9	Support research on crop production with drip irrigation and fertilizer application	1	Long	Long	

	Market system support & financial services				
10	Establish maintenance service of agriculture and drip irrigation techniques at provincial level	2		Short	Medium
11	Develop rural infrastructure such as road, power supply system and water resource, to improve access to water and electricity resources, which are required for drip irrigation	2	Long	Long	Long
12	Strengthen guidelines of quality assurance of imported and produced agriculture equipment and supplies	2	Short	Short	
	International cooperation				
13	Facilitate international links and experience sharing events	2	Short	Short	

Comment:

**time scale (short – 1-5 years, medium –up to 10 years and long up to 15-20 years)*

VPS technology development and diffusion requires thirteen key measures. Measures ranked as the highest priority for the VPS technology include financial measures such as tax exemption and soft loans for importers, and allocation of sufficient government funding; setting up incentive policy for climate and environment sound technologies; systematic HR development,

strengthening coordination between key actors, increasing public awareness, and supporting research and development. Detailed characterizations of measures are displayed in Table 36.

Table 36: Prioritization and characterization of acceleration measures for VPS

Sector : Arable Farming / Agriculture							
Technology:		Vegetable production system with drip irrigation and mulches - small and medium scales 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 policy for importers of drip irrigation equipment, mulching supplies and facilities	1	This measure will help to increase availability of equipment and supplies and competitiveness between importers. As a result, cost drip irrigation equipment and other supplies are expected to decrease.	The Government; Ministry of Industry and Agriculture; Arable Farming Support Fund; Ministry of Finance	8-10 years	Government through Arable Farming Support Fund – about 5 million US\$; International donors – 5 million US\$; Private – 5 million US\$	Risk: The government revenue will be dropped. Success: Increased number of farmers who use water saving technologies, including drip irrigation and mulches
2	Long term and soft loans for importers, local manufacturers, repair service providers of drip irrigation techniques and supplies and recycling factories of plastic waste from mulches	1	Importers and local manufacturers have limited financial capacity and current loans conditions are short term and with high interest rate. Long term and soft loans are needed for importers, local manufacturers, repair service providers of drip irrigation techniques and supplies and recycling factories of plastic waste from mulches.	Banks and financial institutions coordinated by the Government, Arable Farming Support Fund, and SME Support Fund;	10-20 years	Soft loan of 1 million US\$ is required from the government and international donors per year for 4-5 years. Total cost is about 15-16 million US\$. Mulches – about 1.3 million US\$; local manufacturing and service- 1.4-2.0 million US\$; drip irrigation system 12 million US\$.	Risk: Importers of equipment and supplies should be identified through appropriate and transparent process. Success: Increased number of imported equipment and supplies; More local manufacturer and service providers of water saving equipment and supplies
	Legislation and regulations						
3	Set up incentive policy to encourage farmers deploy climate and environmentally sound technologies	1	There is no incentive policy/ mechanism/ packages for adopting environmentally sound and climate technologies for farmers. Incentives can be financial and non financial.	The Government; Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Ministry of Finance	10-20 years	Subsidy for water- saving technologies is roughly estimated about 10-15 million US\$ from the government.	Risk: Efficient system of monitoring and evaluation is required. Success: Increased number of farmers adopting water saving technologies;

	Skill training and education						
4	Systematic agriculture professionals' development about water saving technologies and Integrated water resource management	1	Preparing farmers and agriculture specialists through systematic tertiary education is essential in future to apply scientific knowledge and practices in arable farming. Climate change adaptation and technologies need to be explicitly and intentionally included in curriculum of public and private colleges and universities.	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.	Success: Increased number of specialized agriculture and water specialists;
5	Capacity building for vegetable farmers on agriculture practices and writing proposal from other financial resources	2	Sufficient knowledge about proper application of mulches, herbicides and fertilizers along with drip irrigation should be given through frequent trainings by agriculture extension centres and local training centres to farmers. Training can be in different ways as indoors and field practices, audio and visual programs and exposure trips. Frequent training and awareness-raising is critical to successful deployment of technology and to achieve targets.	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 25 thousand US\$ in year from the government and international donors.	Success: Increased knowledge and skills of farmers on water saving technologies;
	Mechanism and institutional arrangement						
6	Facilitate coordination between business and community groups who grow vegetables, transporters, process, store and retailers to support value chain at local level	2	Coordination between key actors is weak. Poor farmers should be involved intentionally in supply chain process by government as well as other international and national agencies. Coordination between government, international and national projects and program, vegetable farmers and other market actors in value chain should be facilitated focusing on enabling market conditions for farmers.	Ministry of Industry and Agriculture; Local agriculture extension centres, private and public training organizations	8-10 years	No major cost	Risk: Remoteness from local to urban markets might prevent extension of vegetable products. Success: Increased number of farmer groups of vegetable production

7	Organize integrated supply of drip irrigation equipment and supplies	2	Arable Farming Support Fund can facilitate the obtainment drip irrigation techniques and supplies and can act as bridges between farmers and importers.	The government can identify private, consulting and dealer company through tender process.	8-10 years	Same as measure #2.	Risk: Transparency and efficiency of the Fund's operation should be ensured and periodical monitoring and evaluation can be done by NGO of farmers and individual farmers Success: Increased availability of drip irrigation equipment and number of farmers using drip irrigation
	Information and awareness raising						
8	Improve public awareness on water saving and community based environment monitoring	1	Water saving behaviour is very weak among the population. Mongolians use water free of charge which led today inefficient consumption and undervaluation of water. Farmers in local areas use open water resources such as rivers, springs or free wells. Demonstration projects are needed to implement.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; Local agriculture extension centres, Chamber of Trade and Industry and other Integrated water resource management organizations	7-8 years	Demonstration projects at three agriculture regions require about 240 thousand US\$ for 3-4 years.	Success: Increased knowledge and skills about water saving technologies.
	Support R&D						
9	Support R&D on crop production with drip irrigation and fertilizer application	1	Integrated water management, drip irrigation techniques, norms, regimes, and standards, fertilizer application and other soil tillage techniques should be defined for vegetable crops based on scientific knowledge and experiences from other countries and experiment and tests in the Mongolian context. Research outcomes and results need to be scaled up through provincial agriculture extension centres and local training centres.	Ministry of Environment and Green Development; Ministry of Industry and Agriculture; National Water Agency, Public and private research institutions; researchers, Agriculture extension centers	5 years	Research funding is about 40 thousand US\$ per year for 5 years from national funding and international sources.	Success: Water management, regime, irrigation norms and proper application of mulches and demonstration will be defined according to local environment.
	Market system support & financial services						
10	Establish maintenance service of agriculture and drip irrigation techniques at provincial level	2	There is no trade and repair service of irrigation equipment and mulch materials at provincial level.	Private enterprises and dealers	5 years	Private companies and dealers can establish their trade and maintenance service at provincial level with soft loans.	Success: - Increased availability of water saving equipment and supplies at provincial level

11	Develop rural infrastructure such as road, power supply system and water resource, to improve access to water and electricity resources using potential renewable energy	2	Infrastructure of water and electricity system is the main limiting factors to use irrigation technologies.	Ministry of Industry and Agriculture; Ministry of Energy; Provincial and <i>soum</i> governments;	10-20 years	Government will invest through long term strategy of rural development.	Success: Increased access to electricity and water resources.
12	Strengthen guidelines of quality assurance of imported and produced agriculture equipment and supplies	2	Quality of imported irrigation equipment and supplies are not sufficient. Quality standards and strict monitoring mechanism should be set up for equipment and materials of drip irrigation and plastic mulch materials	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 water saving technology equipment and supplies
International cooperation							
13	Facilitate international links and experience sharing 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 thousand US\$ every year from international funding.	Success: Increased number of researchers and agriculture professionals with advanced knowledge and skills