

1.4. Action Plan for Technology 3: Crop Diversification and Precision Farming

1.4.1. Description of the Technology

Crop diversification (CD) is adding new crops or introducing cropping systems to a particular farm taking into account the different returns from value added crops with complementary marketing opportunities. Forty eight agro-ecological zones that have been identified in Sri Lanka is a major driver for crop diversification. Crop diversification increases nutritional security thereby balancing food demand in lieu of increasing food security. Increasing productivity in specific ecosystems is the only enabling option to meet increasing demand for food and non-food agricultural products. Crop Diversification coupled with Precision Farming (CD&PF) enables improving accuracy and efficiency of inputs. This can be achieved by matching inputs and practices based on precise needs of crops and eco systems and reduced use of water, fertilizer, pesticide, and labor while assuring quality of produce, productivity of natural resources and safeguarding environment. In livestock, precision techniques increases productivity through regulation of micro-environment, improving feed and fodder production, and timely veterinary care.

In the context of CC adaptation, Crop Diversification and Precision Farming (CD&PF) helps to build resilience in agricultural systems by increasing diversity and enhancing the capacity of crops to withstand climate-related shocks. Diversity serves as a buffer to increase the ability of agricultural systems to tolerate effects of rising climate variability and extreme events. The predominant position of rice cultivation could have negative impacts on food security in view of increased vulnerability due to inadequate crop diversity. Climate change impacts can influence crop growing conditions in a manner that reverses economic benefits of mass transformation to mono-crop systems thereby making diversification more attractive. Precision farming can complement crop diversification in securing a sustainable agricultural system. Precision farming could match agricultural inputs and practices based on crop specific needs in a specific eco system to optimize accuracy and efficiency of inputs. Precise application of inputs ensures avoiding overuse or under use of inputs protecting soil health and environment.

1.4.2. Target for the Technology Transfer and Diffusion

Target identified in the Technology Action Plan for Crop Diversification and Precision Farming is diversification of 80,000 ha of marginal lands presently cultivated with rice under major irrigation schemes, 100,000 ha of rice lands (from over 200,000 ha of rice lands) not cultivated due to water shortage in the minor (Yala) season and 75,000 ha of marginal lands under Plantation crops to other food crops and pasture cultivation over a 15-year period.

1.4.3. Barriers to the Technology's Diffusion

Ten (10) barriers having the potential for negatively impacting upon the success of technology transfer and diffusion of CD&PF have been identified. These barriers comprised of two from the economic/financial category and others mostly from policy, legal & regulatory, institutional, organizational capacity and network failures. Lack of attention for the development of the non-rice crop sector appears to be the root cause for many problems in this sector. List of key barriers and hierarchy classification for Crop Diversification and Precision Farming is given in table 1.12.

Table 1.12: List of key barriers and hierarchy classification for Crop Diversification and Precision Farming

Technology Name: Crop Diversification & Precision Farming (CD & PF)			
No.	Key Barriers Identified	Priority Rank (1 – 5)	Category of Barriers
1.	High risk of marketing due to seasonal production	1	Market failure/Imperfection
2.	Price fluctuation due to unstable import policy	1	Economic and financial
3.	Irrigation network designs not conducive for diversification	1	Other
4.	Lack of varieties and management packages suitable for diversification	1	Institutional and organizational capacity
5.	Under-developed marketing system– No penetration of rural markets and lack of timely and accurate market information	1	Network failures Information and awareness
6.	Inadequate post harvest technologies and processing infrastructure	1	Institutional and organizational capacity
7.	High cost of cultivation including labor cost	2	Economic and financial
8.	Fragmentation of land holdings	2	Policy, legal, and regulatory
9.	Unfavorable land tenancy arrangements for diversification from rice	2	Policy, legal, and regulatory
10.	Poor technical knowledge on the cultivation of new crops & precision farming	3	Information and awareness

1.4.4 Proposed action plans for Technology 3: Crop Diversification & Precision Farming (CD&PF)

Suggested actions under Crop Diversification and Precision Farming are categorized under 10 key measures and comprise of 20 sub actions (Table 1.13). CD&PF technology includes measures aimed at harnessing a range of technology components to enhance food production and improve efficient resource use.

The priority actions relating to the technology category addresses deficiencies in product marketing by removing price uncertainty and policy failures. These actions are based on the recognition of an available market for diversified crop products. However, access to the market would be handicapped by poor planning and coordination.

On the production side, actions are designed so as to improve technology supply by strengthening R&D and create a favorable environment for crop diversification under irrigation systems which are designed only for rice production. Need for improvements in the food technology and product development to increase demand for produce is also recognized. It is also proposed to remove structural constraints caused by poor tenancy arrangements and land fragmentation. Improving competitiveness of the produce by addressing cost escalation and by increasing productivity are also identified as areas requiring action.

The Proposed Action Plan for Crop Diversification and Precision Farming is provided in table 1.13.

FOOD SECTOR

Technology Action Plan for Technology 3

Table 1.13: Proposed Action Plan for the Crop Diversification & Precision Farming

Measure/Action 1: Lowering marketing risk arising from seasonal production					
Justification for the action: To enhance resilience & assure food security					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Develop and implement Crop forecasting and marketing advisory service	V. High	M/A DC&S M/Co-Op & IT	0-10 years	1.5 M Domestic	- Crop Forecasts and Price Reporting systems in place for all major crops within two years
ii. Develop value added techniques to preserve perishables	V. High	M/A M/T&R	0-10 years	2.5 M Domestic & International	- Over 10% of planned new processed products introduced and marketed annually
iii. Develop & implement technologies for off season cultivation	V. High	M/A M/I & WRMgt. M/Plantation Inds.	0-5 years	1.5 M Domestic	- 80% of planned technologies introduced within five years
Measure/Action 2: Contain price fluctuations due to volatile import policy					
Justification for the action: To prevent frequent price fluctuation due to volatile import policy					

Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Adopt transparent and stable tariff policy framework	V. High	M/A M/F&P M/Co-Op & IT	0-15 years	No Cost	- Long-term tariff bounds introduced
Measure/Action 3: Making irrigation network designs favorable for diversification					
Justification for the action: To persuade to adopt crop diversification					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Modify irrigation network design for greater flexibility	V. High	M/I & WRMgt. M/A	0-15 years	10 M International	- Area covered by the modified canal system and tanks at the end of the project period - At least 70% irrigation systems with modified schedules
Measure/Action 4: Developing varieties/Breeds and management packages suitable for diversification					
Justification for the action: To ensure food security and enhance resilience to Climate Chang vulnerability					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Develop and introduce suitable crops/pastures /varieties/Breeds and technologies	V. High	M/A M/LD M/I & WRMgt. M/Plantation Inds	0-10 years	10 M Domestic & International	- Over 80% of planned new crops/pastures/varieties/Breeds released at the end of the project period - Over 50% of planned technology packages

					developed & introduced within 5 years.
Measure/Action 5: Improving marketing system– Increase penetration of rural markets and providing timely and accurate market information					
Justification for the action: To increase farmers' income & food accessibility					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Improve the road connectivity and marketing network	High	M/ED	0-15 years	10 M Domestic & International	- 80% of planned KM Improved at the end of the project period - Road density in farming areas
ii. Develop marketing information and price reporting system	High	M/A M/Co-Op & IT	0-10 years	1 M Domestic	- Price information system introduced and operated within the project period
iii. Encourage appropriate public and private institutional arrangements	High	M/A M/Co-Op & IT	0-2 years	1 M Domestic	- 80% of planned supply chains developed in 2 years. - Over 80% of planned markets developed in 2 years
Measure/Action 6: Improving post harvest technologies and processing infrastructure					
Justification for the action: To Stabilize price fluctuation and ensure food security					
Action/Sub Action No	Priority	Responsibility for	Time	Cost (US \$) &	Indicators

	Rank	Implementation	frame	Funding Source	
i. Develop appropriate post harvest technologies including cold chain and cold storage facilities	High	M/A M/Co-Op & IT	0-15 years	5 M Domestic & International	<ul style="list-style-type: none"> - Over 80% of planned cold chains introduced and operated at the end of the project period - Volume of produce handled by cold chain network annually after 3rd year
ii. Develop food processing and support product promotion	High	M/A M/T&R	0-10 years	2 M domestic	<ul style="list-style-type: none"> - Volume of food marketed as processed products annually after 3rd year - Varieties of processed food available in the market
iv. Establish storage facilities for Onion/Grains	High	M/A M/ED	0-3 years	1 M Domestic	<ul style="list-style-type: none"> - 90% of planned of storage facilities established within 3 years
Measure/Action 7: Lowering cost of production including labour cost					
Justification for the action: To increase farmers' income					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Introduce and implement agricultural credit and insurance scheme	High	M/F&P M/A	0-15 years	3 M Domestic	<ul style="list-style-type: none"> - Integrated ag. credit and crop insurance system introduced within two years - No of beneficiaries annually
ii. Introduce appropriate mechanization	High	M/A	5-10 years	5 M Domestic & International	<ul style="list-style-type: none"> - 60% of planned mechanized farms after 8th year. - Over 70% of planned machinery units in operation after 8th year.

Measure/Action 8: Reducing fragmentation of land holdings					
Justification for the action: To encourage mechanization to reduce cost of production					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Modify the legal framework to favor land consolidation	Medium	M/A M/L& LD	0-5 years	0.05 M Domestic	- New land titling and tenancy law introduced within 5 years
Measure/Action 9: Making Land tenancy arrangements diversification friendly					
Justification for the action: To increase land productivity and there by productivity					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Amend tenurial arrangements	Medium	M/L M/A& LD	5-10 years	0	- Modified land tenure system introduced within 10 years.
Measure/Action 10: Raising technical knowledge on the cultivation of new crops & precision farming methods					
Justification for the action: To resist CC vulnerability and increase input use efficiency and secure food quality & safety					
Action/Sub Action No	Priority Rank	Responsibility for Implementation	Time frame	Cost (US \$) & Funding Source	Indicators
i. Wide use of information technology and electronic mass media for agricultural	Medium	M/A	0-10 years	4 M Domestic &	- Cyber extension systems in operation for all key crops within five years

extension				International	
ii. Training and awareness creation on precision farming methods and food quality & safety	Medium	M/A	0-10 years	0.5 M	- 15% of planned of training classes per year
iii. Develop/Improve integrated plant nutrient management packages	High	M/A M/Plantation Inds	0-10 years	1 M Domestic & International	- Over 50% of planned crops covered by IPNS within five years - % of farms adopting IPNS per year
iv. Develop/Improve integrated pest and disease management technologies	High	M/A M/Plantation Inds	0-10 years	2 M Domestic & International	- 60% of planned crops covered by IPM practices within five years - % of farms adopting IPM per year
Total Cost of the Technology 3				Approx: US \$ 61.05 million	

V. High = Very High; M/A - Ministry of Agriculture; M/I & WRMgt. - Ministry of Irrigation and Water Resource Management; M/L & LD - Ministry of Land and Land Development; M/ED - Ministry of Education; DC&S - Department of Census and Statistics; M/Co-Op & IT - Ministry of Cooperatives & Internal Trade; M/F&P - Ministry of Finance & Planning; M/T&R - Ministry of Technology and Research