

Extension of Vetiver Grass Cultivation in Highland

Highland Research and Development Institute

(Public Organization)

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Highland Research and Development Institute (Public Organization), HRDI was established by the Government of Thailand to support and strengthen the Royal Project Foundation's research and development activities and extend its success in sustainable highland development to other highland areas throughout the country. The focus of HRDI lies on sustainable economic, social and environmental development of Thai highlands. According to the Royal Decree on the establishment of HRDI, Thai highland refers to an area with altitude over 500 meters (gradient 16–75%). Thailand has approximately 62.22 million rais of highland or 53 percent of total areas of 20 provinces including Chiang Mai, Chiang Rai, Mae Hong Son, Phayao, Lamphun, Phrae, Nan, Lampang, Tak, Phetchabun, Phitsanulok, Loei, Sukhothai, Kamphaeng Phet, Kanchanaburi, Uthai Thani, Suphan Buri, Ratchaburi, Prachap Khiri Khan, and Phetchaburi covered 3,829 clusters in 14 main river basins and 128 distributary river basins. Most of highland communities situated in the areas of water source forest which about 88 percent of them confront with difficulty accessibility, thus it cause governmental authorities cannot monitor these communities inclusively. Moreover, shifting cultivation, continuing of deforestation, agricultural method with inappropriate use of chemical, surface soil erosion, decadent agricultural land and contaminant caused by livelihood of local people surrounding natural resources are still the major problems of highland development. Therefore, HRDI gives precedence to highland problem solving with river basin management system in order to improve livelihood of highland people as well as rehabilitate and conserve abundant watershed forest.

Operational Areas of HRDI

At present, HRDI extends the Royal Project achievement to operational areas divided by 6 main river basins including Ping, Nan, Salawin, Kok, Khong and Mae Klong covered 70 areas with 593 clusters. HRDI's operations have conducted in 4 projects: the Royal Project Extension Project, Expansion of the Royal Project Model for Sustainable Opium Eradication Project, Knowledge Transfer and Capacity Building Program for Highland Communities, and Watershed Conservation Project, an initiative of Her Majesty the Queen. HRDI manages these

projects by using river basin management under 5-years-model scheme of the Royal Project Extension (2012-2016) which consists of 6 strategies:

1. Research
2. Career Development and Capacity Building of Personnel and Community
3. Natural Resources Conservation and Rehabilitation
4. Development of Logistic System, Communication, and Marketing
5. Development of Infrastructure and
6. Efficient Management.

Table 1. Target Operational Areas of HRDI

Main River Basin	Operational Areas (Clusters)	Areas (km ²)
Kok	138	378.54
Khong	114	282.16
Ping	555	5,361.64
Nan	96	445.88
Salawin	284	2062.09
Yom	22	35.99
Mae Klong	16	433.75
Total	1,232	9000.04

Operation of Vetiver Grass Extension

1. Areas Analysis

HRDI' operational areas located in the altitude over 500 meters (gradient 16–75%) which are the areas of valleys and foothill with high slope. Therefore, proper soil and water conservation systems are very necessary for agriculture in order to prevent surface soil erosion, increasing soil fertility and reducing chemical draining into water resources. Results of farmer's land use planning survey are used to determine appropriate methods of vetiver grass extension activities.



Vetiver grass extension activities can be divided into 2 methods as following;

1.1 Vetiver grass extension in farmers' agricultural land which located in high gradient areas according to the analysis result of farmers' land use planning survey

1.2 Vetiver grass extension in communities' public areas such as pond, well, road shoulder, and road tending to be collapsed by using participatory approach of communities and related organizations such as Land Development Department, school, local Administrative Organization, and Non-Formal Education Center in order to encourage communities to acknowledge the advantages of vetiver grass in conserving soil and water

2. Process of Vetiver Grass Extension

2.1 Conducting meeting to establish farmers' understanding, organizing knowledge transferring training on vetiver grass cultivation, organizing study visit on the successful site of vetiver grass cultivation and utilization and distributing learning media of vetiver grass cultivation to farmers

2.2 Supporting vetiver grass seedling production by providing management cost for set up seedling center inside the communities in order to prevent difficult transportation for seedling from outside operational areas especially in rainy season

2.3 Supporting vetiver grass cultivation learning center in farmers' agricultural land by providing areas analysis, designing vetiver grass cultivation system in order to fit with soil and water conservation's conditions of each individual area and farmer, and providing management cost as following;

1. Vetiver grass cultivation with monoculture such as field rice and maize which rather confront with problems of lack fertility soil, low productivity, soil erosion, and over use of chemical, so HRDI transfers the Royal Project's knowledge on legume cropping system to farmers and encourage them to utilize legume cropping system to their maize fields, make compost piles, cultivate vetiver grass to block the slope of land added with row of pineapple trees and also cultivate vetiver grass as buffer zones

2. Vetiver grass cultivation in fruit tree plot with semicircle shape to block the slope of land distance from root approximately 1.50 - 2.00 meters, when the fruit trees grown up, vetiver grass will decompose to be organic matter in soil

3. Vetiver grass cultivation surrounding vegetable patch for prevent soil from erosion and keep its moisture

4. Vetiver grass cultivation surrounding pond or reservoir's edges in order to prevent soil erosion, reduce chemical and contaminant draining into water

2.4 Vetiver grass extension in the operational areas of the Royal Project Extension Project by utilizing communities' participatory approach

1. Vetiver grass extension in farmers' agricultural land which located in high gradient areas by working with farmers to do area survey and design cultivation system to suit with area conditions and types of crop

2. Vetiver grass extension in communities' public areas such as pond, well, road shoulder, and road tending to be collapsed by using participatory approach of communities and related organizations, organizing annual campaign accompanied with natural resources conservation activities such as reforestation, dam building in order to raise awareness of natural resources and environment conservation

Encouragement for Farmer Participation

1. Supporting infrastructure such as reservoir, water distribution system to groups of farmer in exchange with setting up their own soil and water conservation system
2. Supporting fruit tree seedlings such as mango, longan, and pineapple collaborated with vetiver grass cultivation in their agricultural land in order to generate more income from selling fruits as well as supporting seedlings of wild tree, community forest, and fast-grow tree
3. Supporting meal, materials for training and launching environmental conservation campaign such as clean village award, reforestation activities, vetiver cultivation, dam building and other participatory activities
4. Supporting vetiver grass seedling production center for distributing to farmers in the operational areas and surrounding communities so that farmers can receive seedlings anytime they required

Achievements and Benefits Generated from Vetiver Grass Extension in Highland

Vetiver grass extension in the operational areas of HRDI operates with participatory approach and regularly consultancy monitoring to reach the best achievement and benefit evaluated as shown below:

1. Quantitative Results

Vetiver grass extension in communities with risk to crisis and demonstration and learning of vetiver grass cultivation in farmers' land can be seen in the table below.

Fiscal Year	Vetiver Grass Extension (Seedling)	Areas (Hectare)	Vetiver Grass Cultivation Learning Center	Study Visit to Learning Center (Number of Farmer)
2009	1,631,500	52.21	-	-
2010	1,646,400	52.68	1	-
2011	2,206,000	70.59	1	315
2012	3,179,400	101.74	2	971
2013	2,546,000	81.47	5	1,153
2014	2,082,000	66.62	26	2,157
Total	13,291,300	425.32	26	4,596

2. Qualitative Results

Besides, advantages on soil and water conservation, prevention of surface soil erosion, increasing of soil fertility and reducing chemical draining into water resources, HRDI's vetiver grass extension activities also generate other benefits as following:

1. According to fertility analysis of soil from maize cultivation with legume cropping system areas in the Royal Project Extension Project Pang Dang Nai in 2009, it was found that organic matter (OM), nitrogen (N), phosphorus (P), potassium (K) in soil increase which in maize cultivation with red bean (*Vigna umbellata*.) cropping system together with vetiver grass and pineapple cultivation for soil conservation has organic matter 5.18 %, maize cultivation with red bean and lablab bean (*Dolichos lablab* Linn.) cropping system has organic matter 4.36 %, maize cultivation with red bean cropping system and vetiver grass cultivation for soil conservation has organic matter 4.13 % and maize cultivation solely has organic matter only 3.60 % as shown in the table below.

Experiment	Soil Analysis Results				
	pH	organic matter (OM,%)	nitrogen (N,%)	phosphorus (P,ppm)	potassium (K,ppm)
T1: Maize cultivation solely	5.70	3.60	0.18	13.67	120.25
T2: Maize cultivation with red bean and lablab bean cropping system	5.62	4.36	0.21	34.33	79.00
T3: Maize cultivation with red bean cropping system and vetiver grass cultivation for soil conservation	6.00	4.13	0.21	24.00	271.50
T4: Maize cultivation with red bean cropping system and vetiver grass and pineapple cultivation for soil conservation	5.88	5.18	0.26	14.50	141.25

Moreover, increasing soil fertility as in the maize cultivation with legume cropping system experiment result in higher productivity of maize 1 kilogram per rai and farmers can gain more profit around 600 USD per hectare per year.



According to this experiment in the Royal Project Extension Project Pang Dang Nai, HRDI extends its successful results to other operational areas to utilize maize cultivation with legume cropping system together with vetiver cultivation to increase organic matter, reduce soil erosion covered 360 hectares in 2014.

3. Analysis result of general water chemical quality test during 2011 – 2014 at the Royal Project Extension Project Pang Dang Nai revealed that chemical contaminated into water resources was reduced as shown in the table below.

Analysis Results of WQI (General Water Quality Index) Fiscal Year 2011-2014

Center	Year	Water way	Sample collecting point	WQI*		Problems/Causes		
				Amount	Value of WQI	Micro organism	Chemical	Heavy metal
Pang Dang Nai	2011	E-go Creek	source of river	86.92	good			
		E-go Creek	middle part of river	78.47	good		DO (3.97 mg/l)	
		E-go Creek	end of river	90.04	good			
	2012	Maejorn Creek	source of river	83.41	good			
		Maejorn Creek	middle part of river	82.45	good			
		Maejorn Creek	end of river	86.18	good			
	2013	E-go Creek	source of river	81.78	good			
		Maejorn Creek	middle part of river	84.48	good			
		Maejorn Creek	end of river	73.6	good			
	2014	Maejorn Creek	source of river	82.46	good			
		Maejorn Creek	middle part of river	81.06	good			
		Maejorn Creek	end of river	81.66	good			

3. During 2009-2011, farmers of the Royal Project Extension Project Huay Pao received blood test for find out chemical remaining in blood and the analysis results indicated that chemical level in their blood in normal and safe level were increased as the table below.

Operational Year	Level of Huay Pao Farmers' Blood Test in 2009-2011 (percent)			
	Normal	Safe	Risk	Dangerous
2009	9	21.5	36.5	34
2010	25	36.5	30.5	8
2011	52.5	31.5	12	3

These results can prove that vetiver grass help reduce chemical in famers' blood as cultivating vetiver grass in agricultural areas can prevent farmers from using chemical pesticide in their farmland and avoid the vetiver grass from chemical pesticide.

4. As a result of promoting maize cultivation with legume cropping system with vetiver grass and pineapple cultivation for soil conservation and reduction of residues burning in upland areas of Pang Dang Nai village where field crops mainly grown, this community gained many awards from various agencies which brought self proud to all villagers. Their awards is listed as follows;

1. Overcome community capacity evaluation standard of air pollution and smog management and outdoor burning (Standard Community and No burning Village Project Award 2012)

2. Honorable Mention Award in Provincial Level of "Green Community Award" for Smog Crisis Solving Project in Upper Northern Provinces Group 1 in 2012

3. Honorable Mention Award from "The Royal Project Extension Project Award 2012"

4. Network community as learning center for smog crisis solving by Community Capacity Building for Solving Smog Crisis Project from Faculty of Political Science and Public Administration, Chiang Mai University

5. Winner of "Clean Village and Strength Community Award" from the Royal Project Foundation

5. Local communities gather into natural resources and environmental conservation group operating conversation activities by using participatory approach in order to strengthen their own societies and communities and also realize the significance of natural resources and environmental conservation on their livelihood.

Example of Vetiver Grass Extension Areas

General agricultural areas in highland



Agricultural areas in the Royal Project Extension Pang Dang Nai

