

# People Participation on Using of Vetiver Grass for Soil and Water Conservation

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## Abstract

Khaohinsorn Royal Development Study Center has continuously served HM the King's initiative to use vetiver grass for soil and water conservation since 1992. Further activities which based on His Majesty's concept are researching, seedling propagation and extension for the purpose of one stop service center.

The research aspect has searched for vetiver grass varieties suitable for various ecotypes, its advantage to control erosion, retain soil moisture, and improve soil productivity. The proven results have been demonstrating in the study center and disseminating to farmers and interested people to practice in their farms. More than 4 millions vetiver seedling, named Suratthani, have been distributing annually. Vetiver grass planting campaign for soil and water conservation were illustrated to the farmers, community, and municipality combine with technology transfer have been proceeding all year round as an extension activity.

The campaign of vetiver planting for soil stability and land husbandry based on the principal of people participatory approach, the process needs to enhance the adoption, perception, and cooperation. The study center not only works closely with people but also supports them vetiver seedlings with technical knowledge while monitoring and evaluating process has been conducting annually.

The evaluation of farmers' utilization of vetiver grass for soil and water conservation practices resulted pretty well but outcomes are not satisfied. The appearance of land degradation still easily seen in this surrounding area because the farmers pay less attention to not persistent maintenance due to insufficient time and labor work. "As far as human long to utilize natural resources, reclamation of ecosystem is still a heavy task.

**Keywords :** Khaohinsorn, Suratthani, people participation, conservation, land husbandry

## 1 Introduction

Last 40 years, the surrounding villages of Khaohinsorn Royal Development Study Center at Phanomsarakam district, Chachoengsao province used to be a fertile forest. Due to deforestation on the undulating landscape with sandy-textured soil, and cassava (monocropped) plantation without land husbandry. Then the land became infertile and high erosion-prone area. The deterioration of soil resources around the area is mainly caused by impact of rain washing away top soil and excessive surface runoff, results in massive loss of the soil. Soil erosion occurs which heavily damage agricultural land and affects water storage capacity by becoming shallow due to siltation (Land Development Department, 1988).

This rainfed agricultural area is considered to be one of the most degraded ecosystem in the region where land, water and vegetation resources have been locked in an intricate cycle of degradation. Hence the environment protection is one of the most urgent mission for the people surrounded the study center (Khaohinsorn RDSC, 2003).

The Khaohinsorn Royal Development Study Center realizes an important role of soil and water conservation as a basic policy to be performed. The strategy of conservation is defined as a practical, easily manageable and low cost. Vetiver-vegetative method will be used for this policy and also need people cooperation. An attempt to bring about soil and water conservation to the area without people participation may not succeed. It is expected that people participatory approach can encourage people especially farmers become more and more involved in the process.

Vetiver grass (*Vetiveria zizanioides* Nash) is not sensitive to sunlight and can separate into new culms and produce inflorescences all year round. The clumps develop an extensive, tightly knitted, strong erecting wall, which clumps above soil possess close nodes developed as an elongation. Vetiver has strong fibrous root system which rapidly penetrates deep into soil more vertically than horizontally, and develops into a tightly knitted net. It holds the soil together and serves as an underground wall which not only retards waterflow but also allows it to seep into the soil. In addition, the root system helps to prevent gully erosion. The hedgerows will stop erosion caused by lower level contour while a contour bund is not capable. The root system is also capable to absorb plant nutrients and chemical substances. This method can be used to stop chemical fertilizer and pesticide from the farms before they flow into the water resources to protect water from pollutants and maintaining good water quality. It is rare or almost nonexistent that the pre-selected vetiver ecotypes are propagated by seeds and it will not become a harmful weed. It is safe to grow vetiver grass in orchards and other agricultural land. The vetiver clumps grow approximately 1 to 1.5 m. horizontally and not taking large space. It is possible to grow cash crops close to the vetiver hedgerows without reducing yield. When vetiver hedgerows are formed, they will enhance soil fertility by developing the surface soil and increase moisture content because vetiver hedgerows can preserve water between 25-70 percent. As the soil becomes more fertile, varieties of crops and ground cover crops will grow abundantly. Moreover, the cutting leaves to maintain the hedgerows and use as mulch will increase organic matter contents, plant nutrients, and soil microorganisms which even more increasing soil fertility. The utilization of vetiver grass for soil and water conservation is not difficult for farmers to apply on their land. When the farmer can develop the clear understanding of how vetiver grass can improve their land and the importance of soil and water conservation they will benefit. The fact that vetiver helps erosion and siltation decrease, thus this can contribute to creating benefits for the entire society (Chaipatana Foundation, 1996).

## **2 Materials and Methods**

### **2.1 Materials Used**

The Materials used are as follows :

1. Topographic map of the surrounding villages of the Khaohinsorn Royal Development Study Center, scale 1:50,000 as a base map.  
Map sheets number 5236 I, 5236 II, 5336 III, 5336 IV; Date : December 1989.
2. Digital maps of the study area, scale 1:100,000. Date : 2003

- (Boundary, Soil, Contour and Water resources maps).
3. MS Excel and SPSS for statistical analysis.
  4. GPS and field equipment for soil characterization.

## **2.2 Method Applied**

The study were carried out in 4 stages :

Stage 1 : Research activities.

Stage 2 : Propagation of vetiver seedling.

Stage 3 : Extension work.

Stage 4 : Monitoring and Evaluating.

### **Stage 1 : Research activities**

Researches and development on vetiver grass varieties which suitable for various ecotypes, and its advantage for soil and water conservation have been conducting before implementing for public perform.

### **Stage 2 : Propagation of vetiver seedling**

More than 4 millions of vetiver seedlings have been propagated distributed to farmers and interested people for soil and water conservation purpose annually.

### **Stage 3 : Extension work**

The extension of vetiver planting for soil stability and land husbandry, in combination with technical knowledge based on the principal of people participation enhances the adoption, perception, and cooperation.

### **Stage 4 : Monitoring and evaluating**

Monitoring and evaluating process has been conducting annually to assess farmers' attitudes on environment preservation towards the vetiver-vegetative measurement, as well as an observation of erosion hazard.

## **3 Results and Discussion**

HM the King realized the problem of soil erosion and its causes, and simultaneously recognized the potential of vetiver grass for preventing soil erosion and conserving soil moisture. The cultivation of vetiver is simplicity technology, easy maintenance, and inexpensive, that farmers can handle themselves. His Majesty has continuously expressed ideas of using vetiver grass for soil and water conservation measurement. The first Royal Initiative given on 22 June 1991, a part of which is "... study and trial on vetiver planting to prevent soil erosion at the specific sites of various Royal Development Study Centers, particularly at Huai Sai and Khaohinsorn, as well as other appropriate locations should be conducted to a wide extent ..."

### **3.1 Research activities**

Khaohinsorn Royal Development Study Center has served HM the King's initiative on researching of utilization of vetiver grass for soil and water conservation since 1992. The research conducted at the study center started with searching for vetiver varieties suitable for various ecotypes. The study resulted that vetiver can be classified into two categories. There are *Vetiveria zizanioides* and *Vetiveria nemoralis*. A large number of 28 varieties of vetiver were planted. Finally 4 varieties suitable under this ecotypes were selected, they are Kamkhaeng Phet 1, Kamkhaeng Phet 2, Suratthani, Songkhla 3.

Preecha and Sumet (1995) found that Suratthani variety can resist tree shading and endure 3-month in flooding. They also reported that the study on efficiency of vetiver bund compared to contour bund for erosion control in sloping sandy soil proved that plowing across slope with 2 rows of vetiver bund with distance of 24-meter between row and 3 rows of vetiver bund with distance of 12-meter between row gave more efficiency in reducing soil loss and surface runoff about 6–17 percent compared to plowing across slope without vetiver bund. Other trials were searching for the extension of tillers, together with the use of leave or fibrous root for improving soil fertility and preserving soil moisture.

The proven results have been demonstrating in the study center and disseminating to farmers and the public under the purpose of environment protection. The collection of 10 vetiver varieties are exhibited in the study center (Table 1). The procedure of using vetiver-vegetative method for soil and water conservation measures are demonstrated in the study center as well, such as vetiver bunds across slope, waterways, road sides, around farm ponds, in orchards or cassava guard rows etc. In addition, the proven result are applied to farm cultivation for sustainable agriculture.

**Table 1 Vetiver varieties, ecotypes and soil conditions**

<b>Ecotypes</b>	<b>Varieties</b>	<b>Soil Conditions</b>
<i>Vetiveria zizanioides</i>	Sri lanka	lateritic soil
(normally grow in wetland)	Kamkhaeng Phet 2	sandy soil to lateritic soil
	Suratthani	clay loam soil to lateritic soil
	Songkhla 3	clay loam soil to lateritic soil
<i>Vetiveria nemoralis</i>	Loei	clay loam soil
(normally grow in upland)	Nakhon Sawan	sandy soil to clay loam soil
	Kamkhaeng Phet 1	sandy soil to clay loam soil
	Roi Et	sandy soil
	Ratchaburi	sandy soil to clay loam soil
	Prachaub Khirikhan	clay loam soil

### **3.2 Propagation of vetiver seedling**

To serve His Majesty's suggestion of wide extent using vetiver grass for soil and water conservation, the study center has been setting up this activity as a principal action plan. The strategy is defined to implement vetiver-vegetative method due to simple practice, easy management, inexpensive, and applicable process. More than 4 millions vetiver seedlings, namely Suratthani, are annually propagated and distributed to farmers and the public (Table 2 and 3).

The seedlings propagated are provided into 2 portions. Two millions are implemented to farmers in the surrounding village via extension activities. Two millions seedlings are distributed to the public as requested. More than half of seedlings distributed is provided to the government sectors, especially military. Farmers know well how much vetiver grass provides its advantage to protect natural resources. But why farmers are ignorant? The most factor affecting the growth of vetiver is the lack of water for plant growth. Most farmlands are under rainfed conditions. Farmers shall grow vetiver, if their lands moisten enough.

There are two techniques of seedling propagation proceeded at the study center. The first method is propagated a tiller in a plastic bag : this is suitable for direct transplanting of young shoot in a specific area, particularly in poor or loose soil or vast area, such as planting along contour cultivation, around farm pond, or along road side. The second is propagated tiller in row by row : this is suitable for planting in a large-scale area, moist soil, loamy or clayey soil. The benefit is that it is easier to convey a huge pile of seedling, and reduce cost of transportation. Therefore, these kinds of seedlings are young bare-root shoots, proper time of planting is necessary.

**Table 2 Seedling Propagation (during 1996-2005)**

<b>Year</b>	<b>No. of seedling propagation</b>
1996	2,000,000
1997	4,500,000
1998	10,000,000
1999	6,500,000
2000	10,000,000
2001	9,000,000
2002	4,600,000
2003	9,500,000
2004	4,500,000
2005	4,000,000
<b>Total</b>	<b>64,600,000</b>

**Table 3 Distribution of Seedling (during 1996-2005)**

<b>Client</b>	<b>No. of seedling distributed</b>	<b>% distributed</b>
Individual	6,725,000	29.03
Farmer	4,130,250	17.83
Police	370,000	1.60
Military	5,779,500	24.95
Official organization	4,900,500	21.16
Land Development Station	1,085,000	4.68
University / School	160,175	0.69
Monastery	12,500	0.05
<b>Total</b>	<b>23,162,925</b>	<b>100</b>

### 3.3 Extension work

Campaigns of planting vetiver for soil stability and land husbandry emphasized on farmers' fields, community's lands and municipality have been proceeding all year round. The extension works consist of farmers meeting, training courses and field practices. The technology transferred is based on His Majesty's concept of simplicity, inexpensive, acceptable and applicable methodology.

It is important that people should participate in extension works which help to encourage people to work with the study center on planting and maintaining vetiver grass for soil and water conservation. A previous attempt of performing erosion control to the area without

people participation was not success. The people participatory approach enhance their adoption, perception, and cooperation of soil and water conservation practices, in which they conduct soil erosion control measure in their lands. By the way, it can encourage people become more and more involved in the process. Their problems and limitations feed back to the study center, thus improving the relevance of works.

Moreover, the study center continually encourage farmers, students, local administrators and the public to grow vetiver grass for erosion control in specific area and public spaces, viz. around reservoir's edges, along road sides.

The campaign of vetiver-vegetative for soil and water conservation introduced to farmers and community are as follows:

**1. Survey and primary data collected :** The target area cover 29 villages surround the study center, so-called the surrounding villages. Data for topographic and land quality are collected, including soil samples to analyze soil properties. Socio-economic and basic need of farmers combine with SWOT and problem analysis for each village are collected as primary data. The study center set up mobile man as a network in every village. The mobile team communicate farmers in the villages by working, helping and advising them agricultural matters.

**2. Set up the action plan :** The data collected are used as a guideline for policy planning. The bottom-up policy implementation approach should be agreed, verified and updated by stakeholders not only the farmers but also local administration before proclaiming as an action plan.

**3. Meet the community :** Meeting farmers in the target areas are arranged to create their understanding the natural resources base and participation the government. Ones who accept the regulations of the action plan are selected.

**4. Training programme :** The selected farmers are needed to attend trainings on soil and water conservation organized by the study center to get knowledge of practicing on natural preservation. They can contact the study center whenever they need.

**5. On-farm operation :** The infrastructures are constructed in farmers' fields as planned. The infrastructure were provided upon their requested. Most farmers need water sources for their consumption and irrigation, farm ponds and shallow wells are designed in their farms in proper locations. One of the regulations is indicated that farmers need to grow 3-row vetiver grass around pond's edge to control soil erosion. Contour cultivation, vetiver bund across slope, and vetiver guard row must be planted in sloping land, especially in cassava fields. Vetiver grass is highly recommended to plant for improving soil properties in land reshaped and poor quality soil. The conservation of infrastructures are constructed by the government. The vetiver grass should be planted as indicated for specific types of infrastructures by farmers themselves.

**5. Field day visit and maintenance of infrastructures :** Field day visit to farmers' fields and between farmers are highly needed to share, advise and exchange experiences of practicing. The farmers must prolonged use and maintain the infrastructures. They should always restore damaged-part to be in a good condition.

An on-farm extension on utilization of vetiver for soil and water conservation with participation of the farmers in the surrounding villages during 1996-2001 showed that 11 millions seedling were planted which it can compare to the distance of 550 kilometers. At

present, people pay more attention on the realization of environment protection. This is shown that during 2002-2005, more than 12.6 millions vetiver seedlings were planted for erosion control by individual sectors (Table 4).

**Table 4 Extension work on utilization of vetiver for soil and water conservation**

<b>1) On-farm works with farmers' participation in the surrounding villages (during 1996-2001)</b>			
<b>Activities</b>	<b>Amount of work</b>	<b>No. of seedling planted</b>	<b>Distance of planting (km)</b>
1. Around farm pond	1144 ponds	7,138,560	356.93
2. Vetiver bund across slope	112.70 kilometers	2,254,000	112.70
3. Along farm track	65.80 kilometers	1,316,000	65.80
4. Land reshaping	323.36 hectares	143,857	7.19
5. Reclamation of bad land	342.40 hectares	148,032	7.42
Total (1)		(11,000,449)	(550.04)
<b>2) On-farm works by various sectors in their lands (during 2002-2005)</b>			
<b>Activities</b>	<b>Amount of work</b>	<b>No. of seedling planted</b>	<b>Distance of planting (km)</b>
1. Around farm pond	547 ponds	547,000	273.50
2. Along road side	432 kilometers	8,640,000	432
3. Around bole of a tree	36 kilometers	720,000	36
4. Cassava guard row	55 kilometers	1,100,000	55
5. Seedling propagation	8.80 hectares	1,408,000	352
6. Contour cultivation	13.66 kilometers	273,200	13.66
Total (2)		(12,688,200)	(1,162.16)
<b>Total (1+2)</b>		<b>23,688,649</b>	<b>1,712.20</b>

**Source :** Action plan and report for implementation work in the surrounding villages : 1987-2006. The Khaohinsorn Royal Development Study Center, 2003.

### **3.4 Monitoring and Evaluating**

Monitoring and evaluating process has been conducting annually not only to assess attitudes of the farmers on environment preservation towards the vetiver-vegetative measurement, but also to observe an erosion hazard. The evaluation of 140 farmers of about 10 percent of farmers who have participated in using of vetiver grass for soil and water conservation in the surrounding villages, were chosen at random. The study found that most farmers knew well on the benefit of vetiver for soil and water conservation. However, the appearance of land degradation still occurred widely in the surrounding area. Onethirds of them paid less attention to not persistent maintenance due to insufficient time and labor work. Half of the them had other problems that affected the vetiver's growth were the use of herbicide in cassava's fields, carelessness of plowing, the extent of roads, the change of land owners, and no exact people take care of public areas (Table 5).

**Table 5 Factors affecting the growth of vetiver in farmers' fields**

<b>The problems</b>	<b>No. of farmer</b>	<b>Percentage</b>
Insufficient time	15	14
Lack of labor work	20	19
The use of herbicide in cassava 's fields	15	14
Carelessness of plowing	28	27
The extent of roads	15	14
The change of land owners	8	8
No exact people take care of public areas	4	4
<b>Total</b>	<b>105</b>	<b>100</b>

**Source :** Evaluation on farmers participation of using vetiver grass for soil and water conservation in the surrounding villages of Khaohinsorn RDSC, 2005.

Oranard (2004) had studied on the farmers' participation on the application of vetiver grass for soil and water conservation in the surrounding villages of the study center. The study reported that almost 127 farmers knew well on the benefit of vetiver for soil and water conservation. One-fifth of them had never participated all activities organized by the center. One-fourth suggested that the study center should give more knowledge through local communication. She also suggested that the concerned organizations on the use of vetiver for erosion control should activate more farmers to know the usefulness of vetiver for environment protection. The extension by training and practicing should be group participation in stead of individual.

#### **4. Conclusions**

“Working with farmers, not working for them”, this is a crucial expression for on-farm practicing. The success of implementation needs to ensure technology transfer to local people through hand-on training and practical application. Therefore, the agriculture sustainability can be achieved.

As far as human long to utilize natural resources, reclamation of ecosystem is still difficulty. Soil and water conservation measures seem to be a promising practices to most farmers. They know the advantage of vetiver-vegetative infrastructures that can control erosion, hence increase soil fertility and crop yields. Nevertheless, most of them still want the study center to help them repair the broken objects.

An integrated approach of land husbandry is highly recommend through sustainable management of natural resources as follows :

1. Reclamation of gullies by constructing of drop structure, check dams, vetiver bunds, and/or grass strips to retain eroded material in field, which will gradually level the gullies.
2. Maintenance of vetiver bunds regularly at places where their overflow, building up the bunds and/or stabilizing it with grass where necessary.
3. Planting vetivever grass on waterways/drains to retard run on/runoff.
4. Planting of fruit trees, pararubber trees and/or fast growing trees on the bunds and the drains to make maximum use of the land.
5. Mulch between the rows of crops to retard surface overflow.
6. Application of organic fertilizing materials, such as manure, leaf litter and other organic material to the fields.

7. Application of deep tillage once over two or three years, in rotation with minimum tillage to break existing plough pans and incorporate organic fertilizing materials to conserve the applied nutrients.
8. Crop rotation should be practiced as far as possible, green manure, incorporating with legumes and other agronomic measures beneficial to an optimal crop management should be practiced.

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