VETIVER NEWSLETTER

NEWSLETTER OF THE VETIVER INFORMATION NETWORK, NUMBER 11, JUNE 1994

THE NEWSLETTER

This newsletter has been entirely prepared by the vetiver users of Thailand and we give special thanks to **Dr. Sumet Tantivejkul**, Secretary-General, The Office of the Royal Development Projects Board . The newsletter provides an interesting account of the remarkable progress that has been made in the introduction of vetiver in a relatively short time. It is particularly important in that it describes how a major-country wide initiative has been undertaken involving policy makers, agencies, officials and the general public. I believe that we can all learn a lot from this initiative in Thailand, and I hope that it inspires some readers to mount similar efforts to reduce soil losses and improve water conservation. The Thai initiative also reflects on the professionalism and leadership of Thailand's King, **His Majesty, King Bhumibhol Adulyadej**. His Majesty has provided the leadership, and has demonstrated his keen interest through His personal participation and that of His Family. He has clearly inspired his people to act. He has also inspired a lot of people outside of Thailand, and in recognition of this, the Vetiver Information Network, at a private ceremony at the Royal Chitralada Palace, awarded His Majesty a specially commissioned bronze vetiver sculpture.

I would also like to take the opportunity of the occasion of this Newsletter to notify you that **Jim Smyle** will, from the beginning of June, be full time in Central America working out of San Jose, Costa Rica. I would like to take the opportunity of this newsletter to thank Jim for all the hard work that he has put into the Network both in the field and for the Newsletter. Without him we would not be where we are today. Fortunately we have not lost him. He will be establishing a vetiver network for Central and South America, and I hope, over time, those of you from that part of the World will direct your queries to Jim. He will respond to you in Spanish!! His address in Costa Rica will be: James Smyle, RUTA, Barrio Escalante, Del Parque Francia, 25 Metros Sur, Casa #342, San Jose, Costa Rica. Tel (506) 255 4011; fax (506) 222 6556.

Photo # 1. *Bronze sculpture, by Reginald Pollack, of Vetiveria zizanioides presented to His Majesty The King of Thailand, by The Vetiver Information Network.*

Photo Credit: R.G.Grimshaw

The next Newsletter, #12, will be published very shortly and will contain feedback from many of you who have kindly supplied information to the network, as well as some notes on my recent visit to India where there are some interesting activities occurring in the use of vetiver.

Dick Grimshaw

Development and Promotion of the Utilization of Vetiver Grass in Thailand

Photo # 2. *His Majesty The King of Thailand and Her Royal Highness the Princess Mother discussing the merits of some good quality vetiver planting material at Doi Tung Development Project.*

Photo Credit: Dr. Sumet Tantivejkul

Asia Technical Department
The World Bank

BACKGROUND

Thailand's soils are currently deteriorating at an unacceptable level that have reached a critical stage. Statistically, one third of the country, equivalent to 107 million rai (17 million ha —1 ha = 6.25 rai) has been seriously affected by soil erosion, particularly in the northern, north-eastern, central and southern parts of the country.

The problem arises from continuous misuse and non-protection of arable lands, deforestation, expansion of the business and industrial sectors into agricultural areas and increase in population, all of which combine to force farmers to exploit and devastate forest lands in the high plains or mountainous areas including the cultivation of short term crops without appropriate preventive measures against soil erosion. Recognizing the importance and necessity of solving the problem, His Majesty the King initiated the use of vetiver grass for conserving soil and water and improving the environment in cultivated and forested areas. His Majesty's initiative concerning vetiver grass was first received by Dr. Sumet Tantivejkul, Secretary-General of the Office of the Royal Development Projects Board, and other concerned people on June 22, 1991 at the Royal Chitralada Palace as quoted below:

"Vetiver Grass is a plant which has a deep root system penetrating straight into the soil and spreading like an underground fence capable of filtering sediments and protecting soil surface runoff. Given these favourable characteristics, studies and experimentation on the cultivation and use of vetiver grass should be conducted at the Royal Development Study Centres and other appropriate locations on a wide scale, and consistent with topographical conditions of the areas. On mountainous locations, vetiver grass should be planted as horizontal contour hedges across the slopes and gullies for protection against soil erosion and slippage and the maintenance of moisture in the soil. On the plains, vetiver grass should be cultivated around or on cultivation plots, in one or two contour lines. When inter cropped with field crops it should preserve moisture in the soil, absorb nitrogen, and prevent toxic, and other chemicals from flowing into rivers and canals. Moreover, vetiver grass should be planted around reservoirs to prevent the soil from collapsing into and filling up the reservoirs, as well as preserving the soil surface at the upper part of the reservoirs and accelerating tree growth in forest areas which receive adequate water. In addition, there should be a study on efficiency of vetiver grass in controlling the spread of the lalang grass (Imperate cylindrica) in the areas where the lalang is wide spread. At the upper partof the reservoirs, vetiver grass should be cultivated to trap sediments and absorb chemicals and toxins before flowing into waterways. These substances are then stored in the root and stem until they transform into fertilizer useful for plants. It is important to photograph the vetiver before and after the experimentation. Additionally the results should be recorded with respect to vetiver's growth, i.e. stem and root; capability of vetiver grass in conserving soil, increasing soil fertility and preserving soil moisture as well as studies on different species and ecotypes of vetiver".

His Majesty the King has paid regular visits to various areas where vetiver grass is grown in order to observe the results of the experimentation and give advice. Furthermore, His Majesty donated US$10,000 from His private fund to the Vetiver Information Network to support research on vetiver grass and its uses. His Majesty made the following observations to Dr. Sumet Tantivejkul on August 28, 1993 at the Royal Chitralada Palace.

"Vetiver grass must be planted 15 cm. apart for large clumps and 2-3 cm. apart for small clumps. However, the latter approach using small clumps at 2-3 cm. interval is believed to be more effective as it will economize the planting slips and form a dense hedge within a few months. By using large clumps with wider intervals, it may take about 2 years for the hedge to become effective. This time frame is too long. The plantings at the Doi Tung Project are rather expensive because vetiver grass is planted in a very dense hedge. However, the project is intended to be an experiment with rapid results. In conclusion, planting smaller clumps at closer distance is appropriate. The vertical interval between rows should be two meters according to the technical paper; the interval being measured vertically along the slope of two meters descending from top to bottom. The interval might not always be 2 m. distane, but can be 1.50 m. as practical. At 1.50 m. apart, it might be more "comfortable" since it is approximately the height of a person. If it is 2 m., a person would have to stretch, but this is also practical , since it would enable the person to view the second row more easily."

Following His Majesty's initiatives to use vetiver grass for soil and water conservation, government and non-government agencies gave greater attention to the importance of soil and water conservation. The Office of the Royal Development Projects Board provided a central coordinating role for 16 agencies: Department of Land Development, the Royal Forestry Department, Department of Agriculture, the Royal Irrigation Department, Department of Agricultural Extension, Office of Agricultural Land Reform, Department of Livestock Development, Department of Border Patrol Police, Department of Public Welfare, Office of the Accelerated Rural Development, Department of the Royal Highways, Kasetsart University, Chiang Mai University, Khon Kaen University, Prince of Songkla University and Scientific and Technological Research Institute of Thailand.

These agencies were assigned the role to conduct studies and experiments on cultivating and using vetiver grass at different locations and under different uses. In order to allow the activities of these agencies to operate in a cooperative and consistent manner, former Prime Minister Anand Panyarachun, in his capacity as the Chairman of the Royal Development Projects Board, mandated the establishment of the Committee on Development and Promotion of the Utilization of Vetiver Grass under His Majesty's Initiatives on June 24, 1992. The late, His Majesty's Privy Councilor, His Royal Highness Prince

Chakraphandphensiri Chakraphand, was the President of the Committee, with the Permanent Secretaries of the participating Ministries and Director Generals of different agencies acting as the executive members of the Committee. The Secretary-General of the Royal Development Projects Board was appointed as the member and secretary. This Committee is responsible for formulating policies and guidelines in the development and promotion of the use of vetiver grass according to His Majesty's initiatives, as well as monitoring and providing suggestion oncerning the operation of the projects.

On August 13, 1992, the Chairman of the Committee on Development and Promotion of the Utilization of Vetiver Grass officially set up the Master Plan Team on Development and Promotion of the Utilization of Vetiver Grass, and the Monitoring and Evaluation Team, both involving representatives from the agencies. The Master Plan Team drafted a master plan for the development of the vetiver grass program, the features of which reflected the consistent and supportive framework of an operation due for completion within 2 years (1993-1994).

The Master Plan contains five plans for the overall operation of the project as follows:

Research, investigation and experimentation plan is subdivided into three groups comprising: the botanical and genetic research group; appropriateness of the utilization of vetiver group; and propagation of vetiver grass using tissue culture techniques group.

Public relations plan involves making of posters, publications, leaflets and brochures; promotion through various sources of mass media; making of video and slides; organizing of seminars targeting 200 concerned officials per year throughout the country as well as preparation of occasional exhibitions.

Dissemination of knowledge plan embraces organization of training for the trainers from concerned agencies, practical seminars for research officials and field practitioners, as well as overseas training in specific fields on technology for the utilization of vetiver grass.

Demonstration and promotion of cultivation in targeted areas plan focuses on campaign promotion on the use of appropriate vetiver species (Vetiveria zizanioides), appointment of the Office of the Royal Development Projects Board and the Department of Land Development to be the central agencies to distribute the correct species/ecotypes of vetiver grass; and to prevent the uses of wrong species which may become noxious weeds and damage the country. At present, the agencies have produced and propagated more than 3 million tillers for distribution to other agencies for further propagation purposes.

Monitoring and evaluating plan: The Committee on Development and Promotion of the Utilization of Vetiver Grass is responsible for studying documents, collecting field data, interviewing the field implementing officials for field data and taking photographs. Moreover, the responsible agencies in the areas where vetiver grass is grown are required to report the results of the operation to the Committee every four months, in the form of a published report, including detailed data analysis. The reports would be further disseminated.

The results thus far of the monitoring and evaluation of the vetiver plantings in the targeted areas from October 1992 to September 1993 are summarized below:

STUDY AND RESEARCH

Collection of Species of Vetiver Grass: The Department of Land Development has collected all the species of vetiver grass, both locally and abroad, to grow in different habitats of the country so as to conduct a comparative study on their growth in different conditions of habitats. Currently, the vetiver grass can be classified into two species as follows:

Vetiveria zizanioides (Nash).This species is able to adapt very well and grow fast in various environmental conditions. Most of the exotic types which were introduced from India, Sri Lanka and Indonesia are especially selected plants and are treated under the factors different from the natural conditions, such as regular cutting, in order to accelerate stem propagation, limit the emergence of inflorescence and prevent cross breeding and mutation. The vetiver grass which is commonly found in natural habitats in Thailand adapts itself to suit the different conditions of the ecosystem, exhibiting many inflorescences and cross-pollination every year.

Although the cross-pollination makes the vetiver grass tolerant to diseases and climatic crisis, mutation may cause the unsteadiness and reduction of the volatile oils. The blade of the grass is 45-90 cm. long and 0.6-0.9 cm. wide, curved on upper surface and flat near the apex, with a smooth and waxy texture, and dark green in color. The color of the lower surface is paler than that of the upper surface. The septum can be seen clearly especially at the basal and middle part of the blade; whereas, the midrib is obscured and buried in the blade.

The one year vetiver has long roots that enable it to penetrate more than one meter below the soil surface. This depends on soil conditions and on the strength of the plant. In alluvial sandy soil, the grass will produce the longest root possible. On December 19, 1991 at the Doi Tung Development Project, Chiang Rai Province, observations showed (by digging around the grass and washing off the soil with water) the deep and expansive pattern of the root of the Surat-Thani ecotype grown on laterite soil, the upper part being alluvial and the lower part being clay. The vetiver grass which was 7 months old had leaves 1.50 m. high and roots penetrating vertically 3.10 m.

Vetiveria nemoralis (Camus).This

species is known as the local vetiver, and appears limited to the Southeast Asian region which embraces Thailand, Laos, Cambodia, Vietnam and Malaysia. Nevertheless, there is no evidence of its uses. This type of vetiver grass is normally found in dry areas or in the type of soil which allows good water drainage in every region of Thailand, especially in dipterocarp forests. However, the species is rare on the peninsular. The grass grows well in areas exposed to both strong and moderate sunlight. The uppermost part of the "bush" bends down in the same manner as in Cymbopogon sp. The stem does not stand upright as in Vetiveria zizanioides. In some areas, the grass forms a dense bush serving as ground cover over a large area, for example, in the area of Wong Tee Kai at Huai Kha Khaeng Wildlife Sanctuary, Uthai Thani Province. Those grown in dipterocarp forests are often threatened by forest fires because their dry leaves can easily catch fire. However, since the basal part of the bush is very dense, it is not easily destroyed by forest fire, and new leaves emerge shortly afterwards. The Vetiveria nemoralis leaf is 35-6 cm long, 0.4-0.6 cm. wide, and pale green. The transverse section of leaf shows triangulate shape in outline.

The leaf texture is coarsely rough and slightly waxy making it fade in appearance. The color of the lower surface of the leaf is the same as that of the upper surface except it is paler. The septum can not be seen; whereas, the midrib is hard and forms the prominent ridge.

The root of this type is shorter than that of Vetiveria zizanioides. The grass of about one year produces a root which is 80 - 100 cm. long. The inflorescence can appear in many different colors, particularly that of the Uthai Thani and Nakhon Pranom ecotypes. Commonly found are those ranging from creamy white to purplish red.

Production and Propagation of Tillers:
The Department of Land Development is the principal government agency responsible for producing and propagating vetiver grass. The Department has been propagating 10 ecotypes of vetiver which are primarily selected according to their individual locality. These ecotypes are Loei, Nakhon Sawan, Kamphaeng Phet 1, Kamphaeng Phet 2, Roi Et, Ratchaburi, Prachuap Khiri Khan, Surat Thani, Songkla 3 and Sri Lanka. The Deparment intends to propagate a total of four million tillers in the fiscal year 1993. The purpose is for distribution to other agencies for further multiplication.

Photo # 3 *Different ecotypes of vetiver grass after one growing season at the comparative experimentation plot at the Pikun Thong Royal Development Study Centre.*
Photo credit: ***Dr. Sumet Tantivejkul***

Photo # 4 Propagation of vetiver grass in plastic bags conducted in Department of Land Development's various stations in the country.
Photo credit: ***Dr. Sumet Tantivejkul***

The rest will be distributed to interested farmers and used in demonstration activities in other locations under the Department of Land Development.

The production and propagation of vetiver tillers is also undertaken at the Royal Development Study Centers, where it is mostly used. The Doi Tung Development Project, the largest producer in the country, has also been producing a large number of tillers for uses in the project. At present, it has reached a total of eight million tillers, most of which are the Surat Thani ecotype of Vetiveria zizanioides. The most popular method of propagation of vetiver is by shoot separation, since the grass can produce many shoots at a fast rate. The propagation of vetiver using this technique is performed in three ways: in plastic bags; in raised fields; and in large cultivated plots.

Study of Propagation of Vetiver Grass Using Tissue Culture Techniques:
Since propagation of vetiver grass in plastic bags impose problems on transportation, Dr. Uthai Jaranasri, of the Doi Tung Development Project, has succeeded in propagating vetiver grass us-

Photo # 5. *Propagation of vetiver grass in large cultivation plots at the Doi Tung Development Project.* ***Photo credit: Dr. Sumet Tantivejkul***

ing a tissue culture technique using maristematic tissue of the inflorescence. This method is appropriate because it does not promote mutation; besides, tiny vetiver tillers make it easy for transporting large quantities to other areas. Moreover, the Department of Botany, Kasetsart University (Deputy Professor Kamolpan Namwongseprom and Assistant Professor Malee Nanakorn, 1992) has experimented with this technique using lateral or terminal buds of vetiver in order to promote rapid multiplication. The experimentation indicates that 70% of plantlets survive which renders the method effective. The vetiver grass tillers produced by this technique are then planted on sites of the Kasetsart University and Kamphaengsaen Campus and show healthy growth.

Study of Germination of Vetiver Grass Seeds: The Huai Hong Khrai Royal Development Study Centre (by Chiang Mai University) and the Kung Krabaen Bay Royal Development Study Centre (by the Department of Land Development) have studied germination of vetiver seed and reported that the seed does not germinate. The reason is believed to be because of defective seed collected from the immature inflorescence. After studying the development stages of the vetiver's inflorescence from flower to seed, Dr. Weerachai Nanakorn (Botanical Garden Organization) found that under optimum conditions, seed can germinate.

Photo # 6. *Between the fingers is the maristematic tissue which will develop into an inflorescence, and in the bottle is the seedling (plantlet) of vetiver produced from the tissue culture of the buds.*
Photo credit: *Dr. Sumet Tantivejkul*

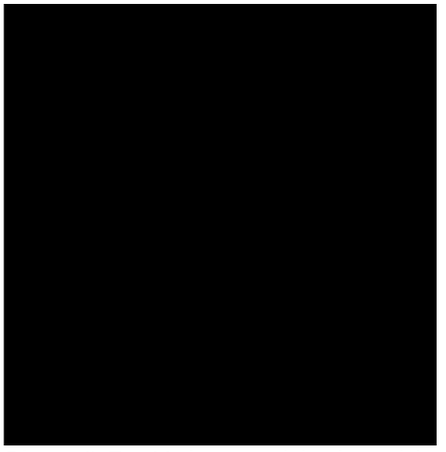

Photo # 7. *Vetiver seed having sticky, tapioca like, brown color texture.*
Photo credit: Dr. Sumet Tantivejkul

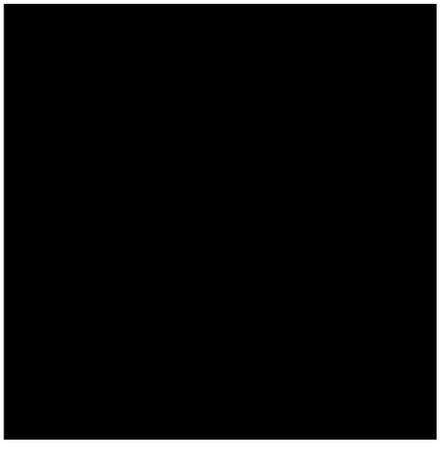

Photo # 8. *Different stages of germination.*
Photo credit: Dr. Sumet Tantivejkul

Study of Efficiency of Vetiver Grass in Soil and Water Conservation in Agricultural Areas: Presently, experiments relating to the efficiency of vetiver in soil and water conservation have been conducted in many agricultural areas throughout the country. The agencies responsible for the projects are the Department of Land Development, the

Royal Irrigation Department, Kasetsart University, Chiang Mai University, Khon Kaen University, Scientific and Technological Research Institute of Thailand and Department of Agricultural Extension. Most of the experiments have only just started and the monitoring work in the field has not yet been conducted.

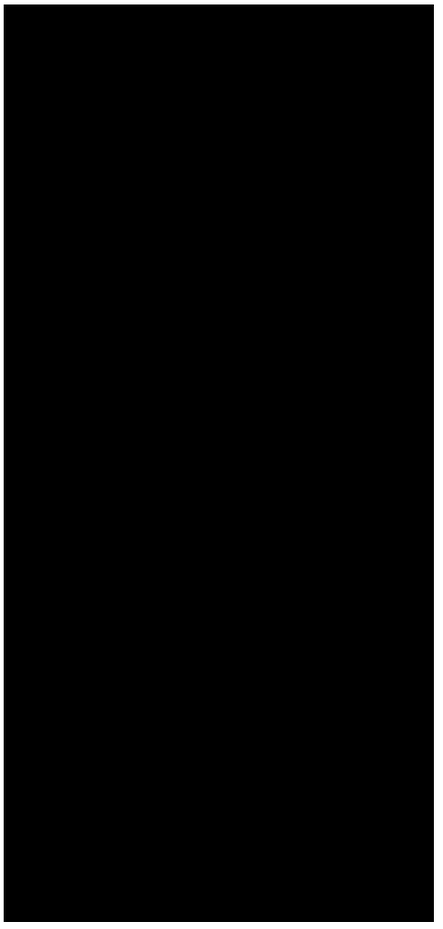

Photo # 9. *Seedling at four days develops clear spines on the edge.*
Photo credit: ***Dr. Sumet Tantivejkul***

Study on Root System of Vetiver Grass: The Khao Hin Sorn Royal Development Study Centre has conducted the study on root system of the six ecotypes of vetiver by planting the material in individual rows measuring one meter with vertical interval of 50 cm. and digging the soil to observe the root depth. The Doi Tung Development Project has also studied the growth of the root of the Surat Thani ecotype and indicated that vetiver grass at seven months of agehad a height of150 cm. and a root 3.10 meters long.

Study on Growth of Vetiver Grass under Critical Conditions: Vetiver grass was planted under **shade** in the conserved forest at the Khao Cha-ngoom Deteriorated Soil Rehabilitation Project in Ratchburi Province and in Suan Phai Ruak at the Sirikit Conserved Forest Project, most of the plantings died. From this experimentation, it can be concluded that the vetiver grass hardly grows under shade. At the Khao Hin Sorn Royal Development Study Centre, Chachoengsao Province, experiments on the cultivation of vetiver grass, both of Vetiveria zizanioides and Vetiveria nemoralis, under an eight year para-rubber plantation revealed that these two species responded to shade to a different degree. Only 50% of the Khao Hin Sorn ecotype of Vetiveria nemoralis survives, whereas, the Surat Thani ecotype of Vetiveria zizanioides showed increase in height despite little branching. The Khao Hin Sorn Project finds that **in flooded areas** the Surat Thani ecotype of Vetiveria zizanioides had good growth.

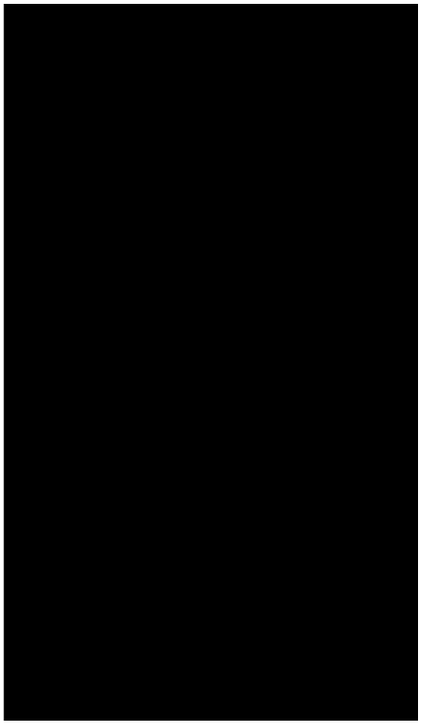

Photo #10. *Vetiver at seven months grown on natural loose and solid laterite developed a 3.10 meters long root .*
Photo credit: *The Doi Tung Development Project, Chiang Rai Province*

At the Kung Krabaen Bay Project, vetiver grass survives on laterite sois and in spaces between rocks on roadside slopes (where it is a good soil binder). The Puparn Royal Development Study Centre, Sakon Nakhon. The Regional Forestry Office, Petchburi Province, has grown vetiver (with supplementary and occasional watering) on **hard pan soils**, and found that vetiver shows moderate growth. The result showed that vetiver grass roots can successfully penetrate hard soil.

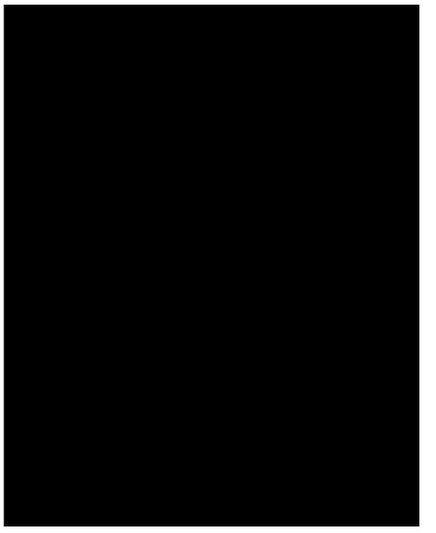

Photo # 11. *Vetiver grass of one year and six months old can grow well in laterite soil.*
Photo credit: ***Dr. Sumet Tantivejkul***

Study on Cultivation of Vetiver Grass to Maintain Moisture for Fruit Crops: The Khao Hin Sorn Royal Development Study Centre conducted an experiment on the cultivation of vetiver grass in a circle around fruit trees and obtained unfavorable results, for the likely reason that the vetiver grass blocks the flow of soil moisture to the fruit trees and/or effect of competition between the vetiver grass and the fruit trees. Additional studies on cultivating vetiver grass in semicircles around the fruit trees are being undertaken, but have yet to be analyzed.

DEMONSTRATION AND IMPLEMENTATION WORK

Cultivation of Vetiver Grass on the Banks of the Pond: Cultivation of vetiver grass on the banks of ponds to collect sediments and prevent collapse of newly constructed banks was successful and

Photo # 12. *Vetiver planted to bind earth banks which were constructed to prevent the brackish water from flowing into the fields at the Pikun Thong Royal Development Study Centre.* ***Photo credit: Dr. Sumet Tantivejkul***

efficient.

Cultivation of Vetiver Grass on Earth Banks: At the Pikun Thong Royal Development Study Centre, Narathiwat Province, vetiver grass has been planted on earth banks built to obstruct the flow of brackish water into farmers' land. The results indicate that the grass maintains the shape of the banks and reduces the degree of damage from the brackish water.

Cultivation of Vetiver Grass in Water Gullies: Demonstration of using vetiver grass hedges in the inverted "V" shape, and other configurations, have been carried out at the Huai Hong Khrai Royal Development Study Centre, Chiang Mai Province; the Kung Krabaen Bay Royal Development Study Centre, Chantaburi Province; and the Khao Chagoom Deteriorated Soil Rehabilitation Project, Ratchaburi Province.

Cultivation of Vetiver Grass to Rehabilitate and Improve Deep Gullies: At the Kung Krabaen Bay Royal Development Study Centre, vetiver grass has been cultivated in association with sand bags to arrest sediments in deep gullies. At the Doi Tung Development Project, the vetiver grass has been cultivated in small gullies by the road sides to collect sediments and reduce the velocity of water flows.

Cultivation of Vetiver Grass to Rehabilitate Deteriorated Soil: The Khao Changoom Deteriorated Soil Rehabilitation Project, Ratchburi Province, demonstrated the cultivation of vetiver grass as horizontal contour hedges on slopes of hard, dry and barren laterite soil that are affected by surface run-off. Cultivation of vetiver grass in this manner reduces erosion, allowing water to penetrate the soil and increase soil moisture. The result is that the yellow barren soil became covered with fresh green plants; a condition that indicates an improvement of soil quality to the extent that it could eventually come back into gricultural use.

Prevention of the Collapse of High Road Cuts and Road Shoulders: Vetiver has been cultivated on steep road shoulders in the Doi Tung Development Project. The results are under study.

Cultivation of Vetiver Grass to Trap Toxic Substances: The demonstration is conducted along the edges of the reservoirs at the Huai Sai Royal Development Study Centre with the objective of preventing toxic substances from the nearby golf course flowing into reservoirs.

Other agencies which have carried out experimentation on vetiver grass are as follows:

The Department of Agricultural Extension has cultivated vetiver grass for demonstration and propagation purposes in area covering 5,870 sub-districts in 73 provinces, each with one kilometer of vetiver.

The Royal Forestry Department has cultivated altogether 1,408,500 vetiver tillers within 60 watershed management units in Chiang Mai, Chiang Rai, Phayao, Phrae, Nan and Lampang provinces.

The Royal Irrigation Department has propagated and conducted studies and research on general aspects of vetiver grass as well as the use of vetiver grass to conserve large water resources.

The Office of Accelerated Rural Development has cultivated 803,673 vetiver tillers in the area of reservoirs and check weirs in Lampang, Lamphun, Chiang Mai, Chiang Rai, Phayao and Phrae provinces.

Border Patrol Police Headquarters has cultivated 626,175 vetiver tillers within schools and villages under their responsibility, covering an area of 124 rai.

The Department of Public Welfare has cultivated vetiver grass within the area of the Hill tribe Development and Welfare Centres in the northern part of Thailand covering 13 provinces.

The Department of Livestock has conducted studies on efficiency of vetiver grass for feeding animals in terms of nutritious value.

The Department of Agriculture has conducted studies on the efficiency of vetiver grass as part of integrated farming systems.

The Royal Highway Department has cultivated vetiver grass along road embankments.

The Office of Agricultural Land Reform has cultivated vetiver grass along the banks reservoirs and dikes within Udon Thani, Nakhon Ratchasima, Nong Khai and Lop Buri provinces.

Photo # 13 *Vetiver planted on cut and fill slopes of newly constructed roads to prevent erosion and collapse of cut and to stabilze fill embankment at Doi Tung Development Project, Chieng Rai Province.* ***Photo Credit : Dr. Sumet Tantivejkul***

The Department of Cooperatives Promotion has prepared propagation plots and encouraged the members of the cooperatives to participate in the activities of the Community Cooperative Units, Cooperatives Demonstration Centres, Cooperatives Demonstration Units and Agricultural Cooperatives. The total area of the plots is 10 rai with 32,800 vetiver tillers.

The Department of Land Development has cultivated 5,367,224 vetiver tillers within the areas of land development stations throughout the country.

The Scientific and Technological Research Institute of Thailand has conducted study on the use of vetiver grass' root and volatile oil extraction from its root.

The Universities of Kasetsart, Ch iang Mai, Khon Kaen and Prince of Songkla have conducted studies and research on efficiency of vetiver grass in various aspects.

Vetiver GrassVetiver grass can be used in many ways, using its different components, i.e. leaves or root. Vetiver grass can also be cultivated for soil and water management to protect against soil deterioration and to maximize land use. Its use can be summarized as follows:

In terms of environmental and biolgical conservation Vetiver grass can be used for soil and water conservation in many ways:

Cultivation of vetiver grass as horizontal contour hedges on slopes to reduce the rate of water flow and to increase the trapping of soil sediments (the latter naturally become earth banks).

Cultivation of vetiver grass to protect against gully erosion.

Cultivation of vetiver grass to maintain underground moisture.

Cultivation of vetiver grass to protect against damage to bench terraces or hillside ditches.

Cultivation of vetiver grass to prevent soil sediments from flowing into canals, waterways, and farm reservoirs.

Roofing and household uses e.g. using its fragrant roots to freshen the air and repel insects in the closets.

Feeding animals such as cattle and goats with part of the tillers and young leaves. Research shows that vetiver grass can bet used as animal fodder.

Making herbal medicine and fragrance. It is reported that vetiver grass has traditionally been used as ingredients in ancient herbal medications which are capable of eliminating stomach gas, and treating stomach problems. The root can be extracted for volatile oil which is made into fragrance and thus, becomes commercially beneficial and valuable.

INTERIM REVIEW

After a period of implementation of the Project on Development and Promotion of the Utilization of Vetiver Grass Under His Majesty's Initiatives, the Office of the Royal Development Projects Board, as the coordinating agency organized a practical seminar in Chiang Rai Province on September 1- 4, 1993. The purpose was to offer the opportunity for representatives from participating agencies, both at the policy making and implementing levels, to exchange experiences, academic viewpoints, and opinions; as well as problems and obstacles in the administration and their solutions, so as to fulfill the objectives and produce the greatest benefits according to His Majesty's initiatives.

Furthermore, the Department of Land Deveopment has been assigned the leading role in collecting and propagating species and ecotypes of vetiver grass as well as disseminating knowledge and technology with respect to vetiver to other government agencies. The Department organized a practical seminar for scientists, technicians and field practitioners working within the Project on Development and Promotion of the Utilization of Vetiver Grass Under His Majesty's Initiatives on September 21-22, 1993 in Chon Buri Province.

Overall, the aforementioned seminars contributed to the understanding of the principles of project implementation arising from participant exchange of viewpoints and experiences. The seminars also laid the foundation and prepared-

ness on the part of the project officials to be able to accommodate the organization of the 1995 international seminar on vetiver grass in Thailand in partnership with the World Bank. The two seminars have further led to constructive understanding of the following viewpoints:

Project operations in general, results and activities, should be reported and presented to the concerned parties every year. Moreover, a yearly conference to discuss progress and encourage exchange of viewpoints should be organized.

With regard to the collection and evaluation of species and ecotypes of vetiver grass, there should be a discussion on the methods, use and standardized classification.

Study and research work should be broadened in order to cover a variety of fields. Characteristics of vetiver grass should be considered in full details so as to promote various and appropriate uses by taking account of the direct use in soil and water conservation, along with indirect and economic uses in which vetiver grass can beneficially coexist with other plants.

In the future, there should be greater emphasis placed on extending the advantages of vetiver grass for on-farm soil and water conservation. There is a need to furthe evaluate whether the technology is accepted by farmers. The promotion of the use of vetiver grass at present is limited by seedling propagation and transportation from nurseries to the planting areas, especially on slopes which rely solely in rainwater.

CONTACT PERSONS

Interested people can access additional information regarding Thailand's vetiver program by contacting the following persons:

Dr. Sumet Tantivejkul, SecretaryGeneral, The Office of the Royal Development Projects Board. Research and utilization of vetiver grass in the Royal Development Study Centres.

Mr. Sitthilarp Wasuwat, Director General of the Department of Land Development Research and demonstration on the use of vetiver grass for soil and water conservation.

M. R. Disnada Diskul, Director of the Doi Tung Development Project. Propoagation and the use of vetiver grass for embankment stabilization and protection against soil collapse along the slope of highway embankment and cut.

Mr. Taweep Taweepanich, Director General of the Department of Public Welfare. Demonstration and promotion on the use of vetiver grass on high plains.

Mr. Taweesak Sesavej, Director-General of the Department of Livestock. Research on evaluation of the nutritious value ofVetiver grass for animal fodder.

Dr. Weerachai Nanakorn, Director of the Botanical Garden Organization. Study and classification of species and ecotypes of vetiver grass.

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