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Office of the Royal Development
Projects Board (ORDPB)
2012 Arun Amarin 36,
Bang Yi Khan, Bang Phlat,
Bangkok 10700, Thailand
Tel.: (66-2) 447 8500
Fax: (66-2) 447 8543
E-mails: vetiver@rdpb.go.th;
Foreign_rdpb@yahoo.com
Homepage: http://prvn.rdpb.go.th
Editor's E-mail: narongchc@au.edu

Editorial

Unique Property of Vetiver: Salt Tolerance

This is the third part of a series of the Editorial on the unique property of vetiver. Vetiver has another unique property in that it can tolerate a high concentration of salt than most plants. Such a tolerance can be obtained from two sources (i) selection of naturally-occurring clones having some degree of salt tolerance, and (ii) in vitro induction using calli from young inflorescence.

Through the first approach, a clone of vetiver has been shown to exhibit higher degree of salt tolerance up to 17.5 $mS.cm^{-1}$. Similarly, four Thai ecotypes of vetiver were found to have more salt tolerance than the others and can grow in 20 dS/m solution.

Through the use of tissue culture technique by growing vetiver callus on salt-containing medium, salt-tolerant explants have been obtained; the gamma-radiated explants were found to contain higher K and Ca ions than the untreated ones, while the amount of N and Cl ions were similar. Callus exposed to 50 Gray could tolerate as high as 4.0% NaCl while the untreated callus could tolerate only 3.0% NaCl.

In the recent investigation, the researchers from Kastsart University, Thailand cultured calli from young inflorescence of Sri Lanka variety on MS medium supplemented with 5 µM 2.4-D and 0.5-3.0% NaCl, at 0.5% intervals for 45 days. At 0.5-1.5% NaCl, 100% of calli survived. At 2.0, 2.5, and 3.0% NaCl, their survival percentage dropped to 82.5, 25.0, and 0%, respectively. The surviving calli regenerated to plantlets when transferred to hormone and NaCl-free MS medium for 30 days. However, the regeneration percentage declined with an increased concentration of NaCl. The 1.0-2.0% NaCl treated calli regenerated only 10-20% while there was no regeneration in 2.5% NaCl. All obtained plantlets were tested for their salt tolerance by culturing on MS medium with NaCl at the same level as their calli were treated, in comparison with the untreated plantlets. The result showed that the survival percentage of treated plantlets at each concentration of NaCl was higher. They tolerate up to 15% NaCl while the normal plant can tolerate nothing higher than 1.0% NaCl.

Salt-tolerant clones of vetiver would facilitate the productive use of underutilized saline soils that are widespread in many parts of the world.

Vetiver Grass for Saline Land Rehabilitation under Tropical and Mediterranean Climate*

1. Introduction

Vetiver grass (*Chrysopogon zizanioides)* is the base of the Vetiver System (VS), which was first developed by the World Bank for soil and water conservation in India in the 1980s. In addition to this very important application in agricultural lands, scientific research conducted in the last 14 years has clearly demonstrated that VS has much wider applications. This is due to its unique morphological, physiological and ecological characteristics that permit it to adapt to a wide range of climatic and soil conditions (Truong, 2002), including salt affected land (Truong, 1994).

Current applications include steep slope stabilization, mine, contaminated and saline lands rehabilitation (Truong, 1999; Truong, 2000) and recently wastewater treatment (Truong and Hart, 2001). As a result VS is now increasingly being used in over 120 countries for these purposes.
Because of its remarkable characteristics that permit it to survive where others cannot, vetiver grass often acts as a pioneer plant establishing itself in hostile conditions and creating microclimatic circumstances that permit a variety of other indigenous plants to prosper.

2. Some Special Characteristics of Vetiver Grass

2.1 Morphological Characteristics

Vetiver grass does not produce above or underground runners. The plant is distinguished by its strong and massive root system, which is vertical in nature descending 2-3 meters in the first year, ultimately reaching some five meters under tropical conditions. This massive, thick and immensely strong root system, with a tensile strength of one sixth that of mild steel, is very difficult to dislodge but can nevertheless be removed easily by man if required. The depth of root structure provides the plant with great tolerance to drought, permits excellent infiltration of soil moisture and penetrates through compacted soil layers (hard pans). Under dry land salinity conditions, once established this deep root system can exploit the less saline subsoil moisture.

Above ground, the shoots can grow to two meters and when planted close together it forms a solid vegetative barrier that retards water flow and filters and traps sediment in runoff water. Growth occurs from the crown, which rises relative to soil build-up. It is also highly resistant to pests, diseases, fire and heavy grazing pressure (Truong, 2000).

2.2 Physiological Characteristics

- Tolerance to extreme climatic variations such as prolonged drought, flood, submergence and temperature levels ranging from -20ºC to 55ºC.
- Vetiver has been shown to thrive under levels of precipitation ranging from 300 mm to 6000 mm per annum.
- Ability to re-grow rapidly after being affected by drought, frost, fire, saline and other adverse conditions when the adverse effects are removed.
- Adaptability to a wide range of soil types (pH 3.0 to 10.5) (Truong and Baker, 1998).

** Paper presented at the Productive Use and Rehabilitation of Saline Lands National Conference, Fremantle, October 2002 by Paul Truong, Department of Natural Resources and Mines, Brisbane, Q.truong@uqconnect.net; Ian Gordon, Department of Natural Resources and Mines, Brisbane, Q. ian.gordon@nrm.qld.gov.au; Fred Armstrong, Conservation Officer, Katanning, WA.; and Jeremy Shepherdson, EcotecWA, Kalgoorlie, WA,ecotecwa@bigpond.com*

- ❖ Highly tolerant to growing media that are high in acidity, alkalinity, salinity, sodicity and magnesium (Truong, 1994) (Truong and Baker, 1996).
- ❖ Highly tolerant to Al, Mn, As, Cd, Cr, Ni, Pb, Hg, Se and Zn in the soil (Truong and Baker, 1998).

2.3 Ecological Characteristics

Although vetiver is tolerant to extreme soil and climatic conditions, it is intolerant to heavy shade. Shading will reduce growth and, in extreme cases, may result in plant failure. Vetiver thrives on warm temperatures and open sunlight and in colder climates commences growth when soil temperatures reach 12-14ºC.

The adaptability of vetiver to such a wide range of soil and climatic factors, and its tolerance to a hostile environment in soils and toxicity result in it being of great value as a pioneer plant. If the planted or invading indigenous species of trees and shrubs eventually form into a heavy canopy above the vetiver, it will reduce its growth and, if desired, it will die out under prolonged shading. Thus, vetiver is a valuable pioneer agent for land rehabilitation and the re-establishment of native plants or in the context of forestry establishment on steeply sloping lands.

Whilst vetiver originates as a tropical grass its adaptability permits it to thrive in climatic circumstances outside the tropical and sub-tropical zones. Vetiver has been shown to grow well at latitudes of 40ºN in China and Southern Europe where it thrives in the Mediterranean countries, particularly in the hot and dry climate of southern Spain and Sicily (Pease and Truong, 2000).

In Australia Monto vetiver has been successfully established in Victoria and south west of Western Australia

2.4 Potential for Invasiveness

Most of the cultivars of *Chrysopogon zizanioides* that are now distributed globally have closely similar DNA characteristics and only a few have been shown to produce viable seeds or to become invasive (Truong and Creighton, 1994; Adams and Dafforn 1997). • In Queensland a sterile cultivar was selected and rigorously monitored and tested over the eight-year period commencing in 1989, this cultivar produced no caryopses when grown under glasshouse and field conditions and in dryland, irrigated and wetland habitats. This cultivar is registered as Monto vetiver in Queensland.

There are a number of seeded cultivars in Australia including a number from the Kimberley and New South Wales.

3. Tolerance to High Soil Salinity

The saline threshold of Monto vetiver is EC_{se} = 8 dSm^{-1} (Fig.1) and soil EC_{se} values of 10 and 20 dSm^{-1} would reduce yield by 10% and 50% respectively (Fig. 2 and Photo 1). These results indicate vetiver grass compares favourably with some of the most salt tolerant crop and pasture species grown in Australia (Table 1).

In Warril View Queensland, in an attempt to revegetate a highly saline area (caused by shallow saline groundwater) a number of salt tolerant grasses: vetiver, Rhodes (*Chloris guyana)* and saltwater couch (*Paspalum vaginatum*) were planted. Negligible rain fell after planting so vetiver establishment and growth were extremely poor under the extremely saline conditions. Following heavy rain during summer (nine months later), vigorous growth of all species was observed in the less saline areas. Among the three species tested, vetiver was able to survive and resume growth under the higher saline conditions (Table 3 and Photo 2), reaching a height of 60cm in eight weeks (Truong, 1996).

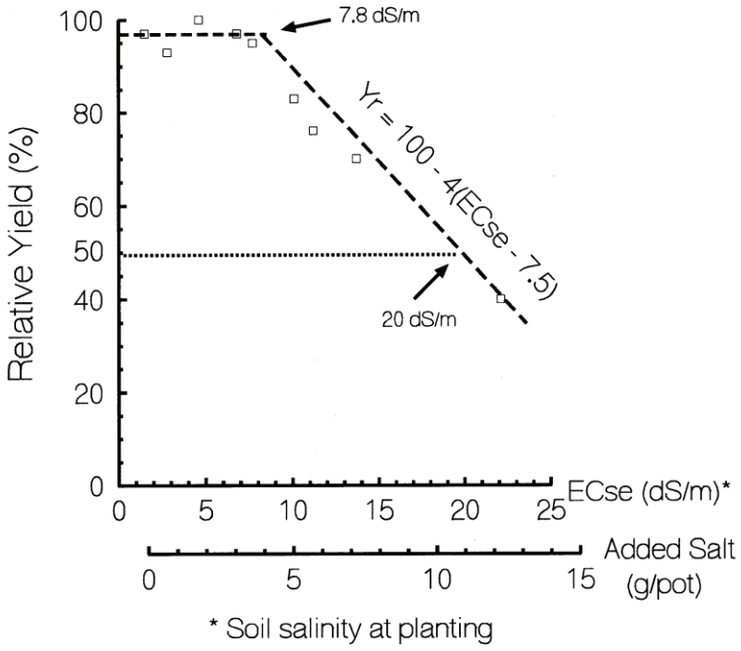

Figure 1. Saline threshold level of vetiver grass

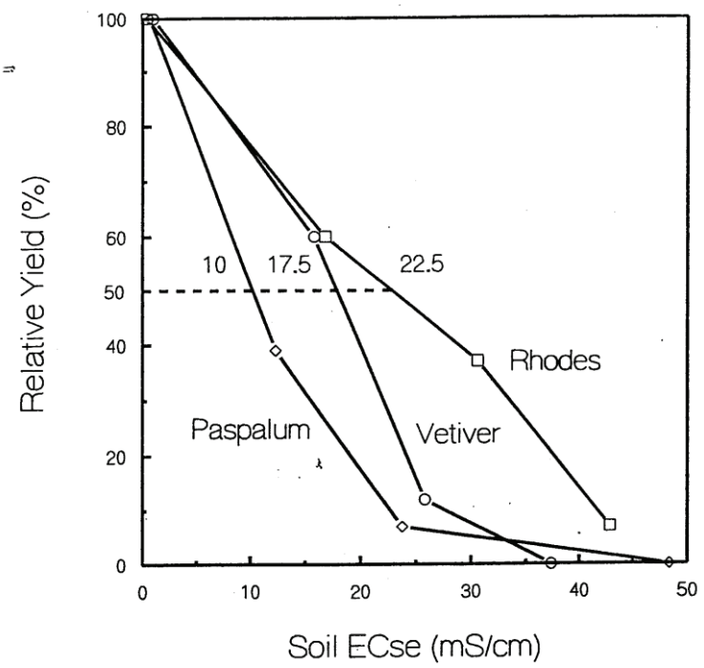

Figure 2. Saline threshold level of vetiver grass, Rhodes grass (*Chloris guyana)* and paspalum (*Paspalum dilatatum)*

These results are supported by observations in Fiji where vetiver has been grown in highly saline tidal flats next to mangrove.

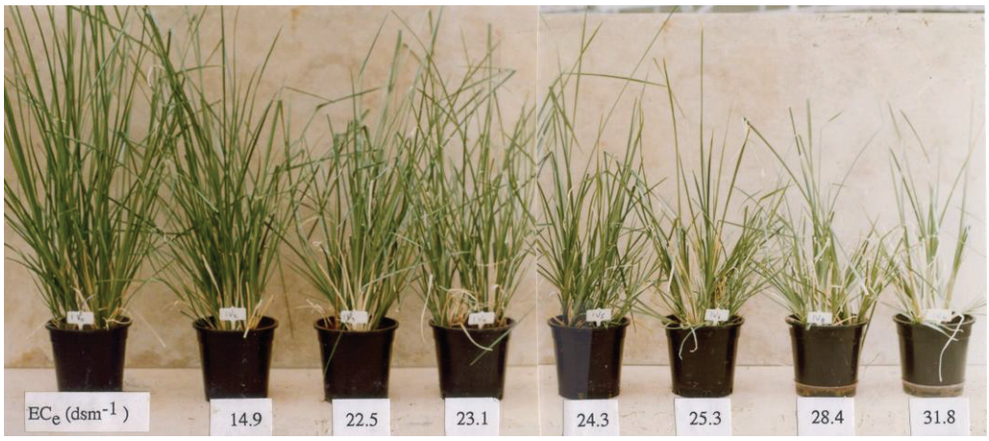

Photo 1. Response to varying levels of soil salinity.

Table 1. Salt tolerance level of vetiver grass as compared with some crop and pasture species grown in Australia (Shaw et al.,1987).

Species	Soil EC_{se} (dSm^{-1}) Saline Threshold	50% Yield Reduction
Bermuda Grass (*Cynodon dactylon)*	6.9	14.7
Rhodes Grass (C.V. Pioneer) (*Chloris guyana*)	7.0	22.5
Tall Wheat Grass (*Thynopyron elongatum*)	7.5	19.4
Cotton (*Gossypium hirsutum*)	7.7	17.3
Barley (*Hordeum vulgare*)	8.0	18.0
Vetiver (*Vetiveria zizanioides*)	8.0	20.0

Table 3. Soil salinity levels corresponding to different species establishment.

Species	Profile Soil EC_{se} (dSm^{-1}) 0-5cm	10-20cm
Chloris guyana	4.83	9.59
Paspalum vaginatum	9.73	11.51
Vetiveria zizanioides	18.27	18.06
Bare ground	49.98	23.94

Under saline conditions, while gypsum had no effect on the growth of vetiver, nitrogen and phosphorus fertilisers greatly increased its yield. DAP (Di-ammonium phosphate) application alone at 100 $kgha^{-1}$ increased vetiver dry matter yield nine times.

4. Tolerance to High Alkalinity and High Sodicity

In addition to its high salt tolerance, vetiver grass can flourish under high sodicity and alkalinity conditions. Soil with ESP (Exchangeable Sodium Percentage) higher than 15 is considered to be strongly sodic (Northcote and Skene, 1972). Vetiver established and grew vigorously on bentonite tailings with ESP of at least 48%. Similarly, Table 4 shows a typical highly alkaline (pH=9.6) and sodic (ESP=33%) composition of a coal mine overburden. Moreover, the sodicity of this overburden is further exacerbated by the very high level of magnesium (2400 $mgKg^{-1}$) compared to calcium (1200 $mgKg^{-1}$).

Photo 2. Among the three species tested, vetiver was able to survive and resume growth under the highest saline conditions at Warril View

Table 4. Chemical analyses of a coal mine overburden.

Soil pH (1:5)		9.6	Calcium	($mgKg^{-1}$)	1200
EC dSm^{-1}		0.36	Magnesium	($mgKg^{-1}$)	2400
Chloride	$mgkg^{-1}$	256	Sodium	($mgKg^{-1}$)	2760
Nitrate $mgkg^{-1}$		1.3	Potassium	($mgKg^{-1}$)	168
Phosphate	$mgkg^{-1}$	13	ESP*	(%)	33
Sulphate	$mgkg^{-1}$	6.1			

* ESP = Na % of total cations

5. Use of Vetiver Grass in Saline Land Rehabilitation

5.1 Soil and water conservation in agricultural lands in Queensland

Vetiver grass has been used for soil and water conservation in orchards, cropping and grazing lands instead of contour banks in Queensland. Due to its high level of salinity tolerance vetiver is particularly effective in gully erosion control in sodic and salt affected soils. When planted on contour lines vetiver hedge acts as a porous barrier, spreading and slowing down runoff water, trapping sediment and increasing water infiltration thus conserving soil moisture on sloping land (Fig.3).

5.2 Saline mine tailings in Queensland

A trial was set up to select the most suitable species for the rehabilitation of a 23ha coal tailings dam. The substrate was saline, highly sodic and extremely low in nitrogen and phosphorus. The substrate contained high levels of soluble sulfur, magnesium and calcium. Plant available copper, zinc, magnesium and iron were also high. Five salt tolerant species were used: vetiver, marine couch (*Sporobolus virginicus*), common reed grass (*Phragmites australis*), cumbungi (*Typha domingensis*) and *Sarcocornia spp.* Complete mortality was recorded after 210 days for all species except vetiver and marine couch. Mulching significantly increased vetiver survival but fertiliser application by itself had no effect. Mulching and fertilisers together increased growth of vetiver by 2 tha^{-1}, which was almost 10 times higher than that of marine couch (Radloff *et al, 1995*; Truong, 1999).

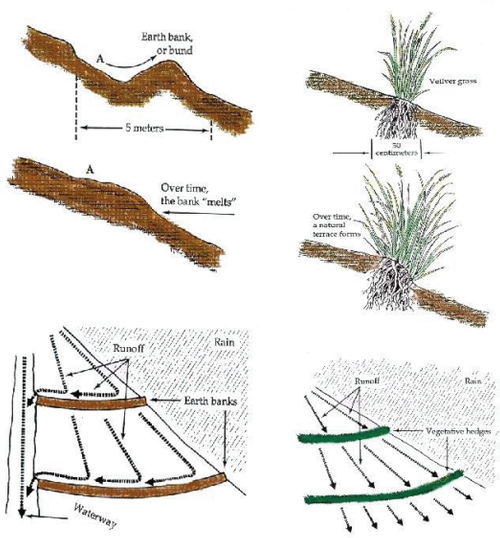

Fig.3. Contrast between conventional contour bank and vetiver hedge in soil and water conservation.

5.3 Sodic mine tailings in Queensland

Bentonite mine tailings (reject) is extremely erodible as they are highly sodic with Exchangeable Sodium Percentage (ESP) values ranging from 35% to 48%, high in sulphate and extremely low in plant nutrients. Revegetation on these tailings has been very difficult with other plant species but with adequate supply of N and P fertilisers vetiver established readily on these tailings (Bevan and Truong, 2000).

5.4 Tidal creek bank stabilization in Queensland

Vetiver has been used successfully for stream bank stabilisation of tidal creeks and canals in southern Queensland. At a site on the Gold Coast, two years after vetiver was planted to stabilise a tidal creek bank, mangrove seedlings were found growing among vetiver rows. Similar occurrences were also observed on the west coast of Fiji.

5.5 Essential oil production in the Kimberley, Western Australia

More than 16 vetiver cultivars were introduced to the Ord River scheme in the 1960s as a crop for essential oil production. Although some of these produce viable seeds (2-3%) they have not spread beyond the boundary of the experimental plot at the research station in Kununurra. However, because these cultivars are seeded, their use is not recommended outside the Kimberley region.

5.6 Monto vetiver as a grazing species in Katanning, Western Australia

Monto vetiver was first introduced to WA following the PUR$L conference in Albany in 1996 by Tess Casson who was then working with Brian Warren, WA Agriculture in Katanning. The team was looking for:

- A salt tolerant and summer growing fodder plant to provide supplementary feed to stock during summer and autumn.
- A salt tolerant, deep-rooted plant that can lower the water table, particularly soil moisture built up in the summer months.

When Tess Casson left Katanning, the trial site was temporarily 'lost' until it was 'rediscovered' by Fred Armstrong in 2001. According to the grazier, Russel Thomson, vetiver established and grew well in the last 6 years on its own, without fertilizer and other maintenance despite extremely heavy and continuous grazing by sheep during drought periods (Photo 3). Based on the size of the plant growing in Fred Armstrong's garden at Katanning and the size of the crowns of plants in the paddock, this planting would produce vetiver at least 1.2m tall every summer (Photo 4).

In 2000, Jeremy Shepherdson introduced Monto vetiver for mine and saline lands rehabilitation in Kalgoorlie. Initial results from the demonstration trial at Gribble Creek were very encouraging, Monto vetiver established well with initial irrigation under extremely saline conditions (Soil EC = 10.43 - 46.00 dSm^{-1} and pH: = 7.13 - 7.76). (Photo 5). However due to vandalism the trial was stopped after a few months, had it been continued until its root system reached the less saline subsoil moisture, vetiver would continue to grow. This is the outcome of plantings under similar conditions in Queensland and Victoria.

Currently Paul Truong is working with ATA Environmental South West using Monto vetiver for treatment of wastewater from wineries in the Margaret River region

Photo 3. Six year old vetiver planting at the Thomson's property, Katanning, it has survived under extremely heavy and continuous grazing by sheep during drought periods.

Photo 4. A Monto vetiver plant growing in Fred Armstrong's backyard in Katanning.

5.7 Monto vetiver in Victoria

The Victorian Department of Agriculture introduced vetiver to Swan Hill early in the 1990s to control saline seepage from sloping orchard land in the region. After initial irrigation in the first summer to encourage root growth, vetiver continued to thrive once its roots reached the less saline subsoil moisture. It was noted that under the wet Victorian winter, vetiver was not badly frosted and continued to grow slowly, reaching a height of 2m after 2 years. With this growth, when appropriately laid out vetiver planting would be very effective in reducing saline seepage on sloping land (Photo 6).

Recently Monto vetiver has also been used very effectively in providing a windbreak on an orchard in western Victoria.

Photo 5. Demonstration trial at Gribble Creek, Kalgoorlie.
Note the white salt on the surface near the vetiver plant.

Photo 6. A two-year-old vetiver row at Swan Hill
planted to control saline seepage from sloping orchard plot.

6. Overseas Applications

Vetiver has been widely used to stabilize dykes on prawn farms in Thailand, China, Vietnam and the Philippines. Salinity level of these ponds fluctuates but it is often the same as seawater. In Indonesia and the Philippines vetiver has also been used successfully for beach erosion control and estuary protection against tidal surge.

7. Nutritional Values and Palatability

Concurrent to the field planting at Katanning, Tess Casson also tested the digestibility of vetiver shoots under both *in vivo* and *in vitro* conditions. Results indicate that vetiver is highly digestible, and at least equal to or better than most tropical grasses.

Vetiver has been used for centuries as a fodder crop in India, the Philippines, China and Thailand, its nutritional values and palatability are listed in Table 5.

Table 5. Nutritional values and palatability of Monto vetiver grass

Nutrients	Concentrations (%)
Nitrogen	1.51
Phosphorus	0.29
Potassium	1.75
Calcium	0.52
Magnesium	0.33
Sodium	0.08
Sulphur	0.21
Crude fat	0.4
Crude fibre	7.1
Palatability	Horse, dairy cows, cattle, buffalo, rabbits, goat, sheep, wallaby and kangaroo

8. Planting Materials

Vetiver has to be established vegetatively by crown subdivision into slips of 3-4 tillers. Planting materials are available as:

- Bare root slips, fresh subdivision from clumps that can be planted direct. This method is inexpensive but plants take longer to establish and there is a greater likelihood of failures.
- Bare root plantlets, 2-3 weeks-old slips, which have been raised in sand bed and supplied fresh for planting within a week. This method reduces potential failures.
- Tube stock, slips raised in a nursery for 6-7 weeks in summer. This method is relatively expensive but produces good quality plants with minimal failures.

9. Conclusion

Monto Vetiver grass has demonstrated its ability to establish and thrive under highly saline conditions in general. But it has been shown to be particularly effective where saline high water table is the causal effect.

In the Woolbelt of WA, due to its fast growth in warmer months, vetiver can be used as a ‘green pick’ during the summer where it has been planted in hedgerows for soil and water conservation on high points in the landscape.

In the Wheatbelt of WA it can also be used for soil and water conservation, and sediment control particularly where gully and streambank erosion is a problem.

In orchards vetiver can be used to reduce saline seepage and windbreaks.

On sloping land it can be used as a pioneer species to stabilise erodible sites first and then rehabilitate with native or plantation species later.

Due to their seediness, albeit very low, the use of vetiver cultivars from Kununurra is not recommended outside the Kimberley region.

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Text/PowerPoint of Second Latin America International Conference on The Vetiver System

Held in Medellin, Colombia. The papers and PowerPoints presentations are now available at this

link:http://www.vetiver.org/LAICV2F/index.htm. There are some very interesting presentations including a new model for determining vetiver requirements for small scale wastewater and sewage treatment (http://www.vetiver.org/LAICV2F/2%20Environmental%20Protection/E1Truong_TE.pdf) and how to construct a vetiver latrine (http://www.vetiver.org/LAICV2F/2%20Environmental%20Protection/E5Lee_TE.pdf). There are other excellent papers relating to bio-engineering, environmental protection and socio-economic aspects of the Vetiver System. You can also find a useful paper and presentation on the history and achievements of the Vetiver Network International (http://www.vetiver.org/LAICV2F/0%20Plenary/P1Dick_TE.pdf). Papers and PowerPoints are presented in English, Spanish and Portuguese (not all). Please share this post with your friends and colleagues.

Richard Grimshaw
Chairman, TVNI

Second Latin America International Conference on The Vetiver System Conference Papers and PowerPoints

(Text and Power Points: ES=Spanish, P= Portuguse, E=English)

October 3-5, 2013, Medillin, Colombia

No.	Title	Author	Text	Power Point
P1	Past Achievements and Future Direction of The Vetiver Network International (TVNI)	Richard Grimshaw	E, ES, P	E 1.94MB
P2	Vetiver Grass in Engineering Works in Brazil	Aloisio Rodrigues Pereira, et al.	E, ES, P	P 7.13 MB
P3	Vetiver System for Prevention and Treatment of Polluted Water and Contaminated Land	Paul Truong	E, ES, P	E 9.43 MB
P4	Mine and Associated Rehabilitation Projects in Africa and Indian Ocean Islands	Roley Nöffke	E, ES	E 31.83MB
P5	Discurso Principal en Reciente Aplicaciones Emergentes: Aceite Esencial y Biocombustibles	Gueric Boucard Y Fernando Correa Ponce	ES	ES 3.63MB
P6	El Vetiver Despues de la Cuarta Conferencia de Vetiver. Desarrollos de Comunidades en Venezuela a Través de la Aplicación Integral del Sistema Vetiver	Oswaldo Luque M.	ES	ES 2.9MB
	Bioengineering			
B1	Brazzaville to Pointe-Noire Highway Congo Brazzaville	Alain Ndona		E 4.12MB
B2	Avances Tecnologicos con Vetiver en Ecuador	Luis Daniel Mascaró Benites		ES 2.74MB
B3	Combination of the Vetiver System and Geomats as a Bioengineering Technology	Leonel Castro	ES, E	ES 1.8MB
B4	Applicaiones del sistemas Vetiver en Peru (Lima)	Alois Kennerknecht		ES 88.9MB

B5	Meceta SAS, Colombia			ES 12.4MB
B6	Sistemas Vetiver "Conciencia Verde Para un Desarrollo Sostenible" Posibles Aplicaciones	Juan Daniel Londono		ES 3.62MB
B7	Muro Verde de Contenção com O Uso de Vetiver em Área de Preservação Ambiental	Andrade Engenharia	P	P 7.08MB
B8	Sistema Vetiver: Tecnologia Verde Para Estabilização E Reabilitação de Encostas	João Henrique Eboli e Carmem Lucas Vieira	P	P 10.8MB
B9	Vetiver Como Practica Conjunta de Protección en Talud de Alto Riesgo en el Tambor-Edo Miranda Venezuela	Oswaldo Luque M Lic Oscar Quintero W		ES 1.37MB
B10	Estabilização de Taludes Marginais com Uso de Vetiver: Experimento No Rio Cuiabá, Estado De Mato Grosso - Brasil	Elder de Lucena Madruga, et al.	P	P 1.49MB
B11	Current Infrastructure Protection Projects Using Vetiver System in Vietnam	Man Tran and Paul Truong		E 6.04MB
B12	Protección y Recuperación de Márgenes de Cursos de Agua Con Técnica de Bioingeniería	Paula Leão Rodrigues Pereira y Aloisio Rodrigues Pereira		P 7.46MB
B13	Control de Erosion y Sedimentos con Sistemas Vetiver en Margen de Rio, Taludes, Carcavas y Mineria en Venezuela.	R.Luque y J.Luque	ES	ES 16.2 MB
B14	The Vetiver System in Panama	Marietta Landis		E 8.11MB
B15	Vetiver System Applications in Madagascar for Sustainable Development	Yoann Coppin		E 13.6MB
B16	Abonos de Occidente RL. Gerente General, Costa Rica. Manejo y Rahabilitacion Ambiental de Reilenos Sanitarios	Yorleny Cruz		ES 20.4 MB
	Environmental Promotion			
E1	Computer Model for Treatment of Small Volume Wastewater	Paul Truong and Nicholas Truong	E, ES, P	E 2.23MB
E2	La Adaptación Autónoma al Cambio Climático Mediante el uso del Sistema Vetiver: una Herramienta para la Conservación del Suelo y el Desarrollo Comunitario	Oscar Rodríguez Parisca y James Smyle	ES	ES
E3	Vetiver Para Control de Lixiviados en un Filtro Biológico de Aireación Extendida.(Fbae)	Oswaldo Luque M	ES	
E4	Uso de Chrysopogon zizanioides para la fitore-mediación de suelos contaminados por As y Hg	Sandra Arce, et al.	ES	
E5	The Vetiver Latrine. Simple, Innovative & Sustainable	Owen Lee	E	withdrawn

E6	Efecto del vetiver *(Chrysopogon zizanioides* L.*)* en la reducción del flúor y otros compuestos contaminantes en aguas de consumo humano. Caso: Caserío Guarataro, Estado Yaracuy, Venezuela	Ruíz Carmen Yazmín		ES 7.6MB
E7	Remoción De Aluminio En Aguas Residuales Industriales Usando Especies Macrófitas:Una Aplicación Para El Pasto Vetiver	Irene Saffo, et al.		ES1.26MB
E8	Comportamiento del Pasto Vetiver *(Chryso-pogon zizanioides)* en Areas Degradadas en la Compañía Minera Simsa S.A.A. Junín, Perú.	Casas		ES 1MB
	Socio-economic			
S1	El Vetiver Despues de la Cuarta Conferencia de Vetiver. Desarrollos de Comunidades en Venezuela a Través de la Aplicación Integral del Sistema Vetiver.	Oswaldo Luque M		ES 2.93MB
S2	Projecto Vetiver. Uso principal para plata de vetiver: Destilacion	Fernando Correa Ponce/ Gueric Boucard		ES 3.63MB
S3	Experiencias en la Reproducción del Cultivo de Vetiver en Ingenio Magdalena, Guatemala	Luis Guevara, et al.		ES 7.3MB
S4	Vetiver Works in Thailand - Model of Success	Suwanna Pasiri		E 8.12MB
	Others			
O1	Pasto Vetiver en la Estabilizacion de Taluds	F.L.R. Pereira	P, E S	P 2.32MB
O2	Evaluación Preliminar de Once Ecotipos de Vetiver *(Chrysopogon zizanioides Y C. nemora-lis),* en Diferentes Condiciones Agroecológicas	E. Arcana, et al.	ES	ES 64K
O3	Evaluación de la Anatomía Foliar de Cuatro Ecotipos de Vetiver *(Chrysopogon zizanioides* Y *C. nemoralis*)	E. Arcana, et al.	ES, E	ES 735K

The First Philippine Conference on Vetiver

The international experts from The Vetiver Network International (TVNI) led by Dr. Paul Truong, together with local end-users will share their knowledge on the economic value and numerous applications of the Vetiver System that are responsive to environmental mitigation needs over a broad range of ecological conditions during the 1st Philippine Conference on Vetiver, March 5-7, 2014 at the Grand Ballroom of the Intercontinental Manila Hotel in Manila, the Philippines.

The theme of the Conference is "The Vetiver System and Its Many Environmental Applications". The three-day conference will feature plenary sessions, case study presentations and workshops, highlighted by a whole day technical tour on the third day. Keynoting the Opening Ceremonies is Senator Ferdinand Marcos, Jr., Chairman of the Senate Committees on Local Government and Public Works.

Plenary topics to be covered include:

- The State of the Philippine Environment
- The Vetiver System and its Global Applications
- The Application of Vetiver in Real Estate Development; and
- The Socio-Economic Impact of Vetiver.

Case study presentation and workshop topics include:

- Treating Industrial Wastewater through Vetiver
- Slope Stabilization
- Prevention and Treatment of Contaminated Wastewater
- Reclamation of Mine Tailings
- Propagation Methods of Vetiver
- Soil Improvement
- Wetland and Marginal Land Restoration
- Agricultural Use, Nitrogen Fixing and Integrated Pest Management Features of Vetiver
- Stabilizing Geo-Hazard Areas; and
- Implementation of Vetiver Use in Public Infrastructure.

The Conference also invites submission of papers for oral or poster presentation. Topics of interest should be based on the Case Study Tracks outlined in the Technical Program.

Environmental and other policy makers; local government units; watershed managers; public infrastructure planners and managers; private businesses involved in construction, property development, mining, among others; research institutions and academe; international development agencies and non-government organization; farming communities would greatly benefit in attending the conference.

Early bird rate of US$125.00 can be availed until January 31, 2014. For Conference and Exhibit details, please contact the Conference Secretariat at e-mail <meet_inc98@yahoo.com>.

Further details of the Conference will be given in thenext issue of Vetiverim

The 6th International Conference on Vetiver (ICV-6)

In May 2015, Vietnam will be the host for The 6th International Conference on Vetiver (ICV-6) with the theme, "Vetiver System: Empowering Sustainable Development". The tentative dates are set to be from 5 - 7 May 2015 at Furama resort in Da Nang, Vietnam.

ICV-6 aims at providing an opportunity for academicians and professionals from various disciplines around the globe to meet in Danang city of Vietnam to share, discuss, and learn about the latest Vetiver technologies and applications. Being the host of ICV for the first time, The Vietnam Vetiver Network has confirmed its the role as an enthusiastic member of The Vetiver Network International.

The International Conference on Vetiver (ICV) is a scientific event focusing on various applications of the Vetiver System. Such an event was first held in 1996 in Thailand and extended to other countries under the supervision of The Vetiver Network International (TVNI) and the Chaipattana Foundation.

The Fifth International Conference on Vetiver (ICV-5) in India in 2011 was a great success. It attracted nearly 250 registrants representing 20 countries from around the world, and provided significant opportunities for networking, professional growth and education, as well as business opportunities.

Following the success of ICV-5, ICV-6 is expected to have equal or even more participants, as "sustainable development" based on the Vetiver System is seriously considered than ever before in many countries. This conference will be attended by decision makers, researchers and specialists representing the government and private organizations undertaking the global task of "sustainable development".

The program of ICV-6 reflects those of the past ICVs, which consists of the Keynote Address, Presentations of Invited Speakers and Contributed Papers, Poster Papers, and Study Tours. Social activities such as Welcoming Toast, Reception Party and Farewell Dinner will be organized. In addition, it is hoped that the Organizer will organize an international training course on "Vetiver Handicraft Making" for those who want to have "hands-on" practicum on Vetiver handicraft making" from the most experienced guru from Thailand.

Supporting organizations include TVNI, the Chaipattana Foundation, Vietnam Vetiver Network, Da Nang People's Committee, Da Nang University and many others from the private sectors and Non-Government Organizations.

Further information about ICV-6 will be updated in the Second Announcement, to be published in October 2013.

About The International Conference on Vetiver

The International Conference on Vetiver is a prestigious scientific forum of worldwide experts in researches and applications of Vetiver System under the sponsors of The Vetiver Network International (TVNI) and Thai Royal. It is hoped that the Chaipattana Foundation, His Majesty the King of Thailand's personal agency, will, as in the past ICV's, contribute, in kind and in cash, in the organization of ICV-6. During the past 15 years, this Conference has been held for 5 times in various countries:

ICV-1: Vetiver Grass – A Miracle Grass (Chiang Rai, Thailand, 1996).
ICV-2: Vetiver Grass & Environment (Phetchaburi, Thailand, 2000).
ICV-3: Vetiver & Water (Guangzhou, China, 2004).
ICV-4: Vetiver & People (Cacaras, Venezuela, 2006).
ICV-5: Vetiver & Climate Change (Lucknow, India, 2011).

Office of the Royal Development Projects Board
2012 Arun Amarin 36, Bang Yi Khan, Bang Phlat
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