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Welcome to ICV-2

The Second International Conference on Vetiver (ICV-2), which is to be held in Cha-am, Phetchaburi, Thailand, 18-22 January 2000, is the second of its kind, and also the second to be held in Thailand. We have many good reasons to host this most important global meeting of the 'Vetiverians'. Having an experience in organizing the very successful International Conference on Vetiver (which was later renamed ICV-1) in Chiang Rai, northern Thailand in 1996, we consider it a privilege to have a chance once again to host ICV-2. This is our first reason why we believe that we can host ICV-2 on a rather short notice of less than a year. The second reason is the readiness and full back-up of all 40 or so agencies working hand-in-hand with the Office of the Royal Development Project Board in providing technical as well as administrative supports for ICV-2. But the most important reason behind our acceptance is to have a chance to commemorate the Sixth Cycle Birthday Anniversary (on 5th December 1999) of His Majesty the King, a person who is not only the "Father of all Thai people, but also the "Father" of the vetiver research and development in Thailand". It is fair to say that, from the very moment He delivered the first initiative about vetiver on 22 June 1991, Thailand has started to work on all aspects of vetiver R&D at a most accelerated pace, as was witnessed in ICV-1. His continued support and 21 additional initiatives made over the years have not only provided incentive for all of us to actively work on this amazing plant, but have also strengthened our belief that vetiver, a seemingly useless plant (as it bears the name of being a grass – considered by most Thais to be a worthless plant) has, in fact, versatile uses. The point His Majesty has tried to convince all of us, based on his own observation and experiments, is that the vetiver grass technology is a simple, low cost technology which can solve the world's complex problem of soil loss due to erosion.

For those who plan to attend ICV-2, we hope you enjoy your visit to Thailand and get as much useful information on vetiver as you would expect. For those who are unable to attend, hopefully you will keep up with the proceedings of the Conference which should be available within six months.

It is by coincidence that we organize ICV-2 at the time the world is cerebrating the Third Millennium. We hope that ICV-2 will be as successful as ICV-1, and that there will be all kinds of good work done throughout the year by each and every reader of VETIVERIM.

We wish you a Very Happy New Year, New Century, and New Millennium.

Messages from the Coordinators of the Vetiver Networks on the Occasion of ICV-2

The Vetiver Network (TVN)

On the occasion of the Second International Conference on Vetiver I would like to congratulate those involved in putting this important conference together. The conference gives an opportunity for people to come from all over the world to exchange new ideas and experiences relating to this unique grass. The vetiver grass technology (VGT) is becoming known throughout many parts of the world and its applications widen each year. Because of what we have done with VGT scientists working in colder areas of the world are looking at other grass species to see if similar results can be achieved. This we support. We can learn from these other initiatives and use the results to support VGT programs. As each year goes by I am astounded by the versatility of the technology, and I remain convinced that VGT will be a major bioengineering tool in this new Century for soil and water conservation and other natural resources related applications.

Dick Grimshaw, Coordinator, TVN

Leesburg, Virginia, USA

The Europe and Mediterranean Vetiver Network (EMVN)

The EMVN has certain features that are rather different to other regions. Firstly, all the countries in the region lie to the north of the tropics or sub-tropics. Secondly, vetiver activities within the region are still in their infancy; EMVN is one of the most recent to be formed and little is known about VGT within the region. Thirdly, in the European countries of the region in particular, there is relatively little small-scale subsistence farming; so the focus on vetiver usage is somewhat different in such countries having much high-density, small-scale agriculture. Finally, much still remains to be learnt regarding the climatic and, therefore, the geographic limits under European conditions that determine where vetiver can be grown effectively.

ICV-2 will provide an excellent opportunity for me, as the Coordinator of EMVN, to meet personally with the many contacts that I have been establishing through our networks over the past two years, and especially, to learn techniques that are being applied elsewhere and which have relevance to us in EMVN. The proposed panel discussions will be of particular value in this regard.

It is most likely that in EMVN a preponderance of future activities will occur in the field of bio-engineering, i.e. the use of VGT to stabilize engineered structures such as highway embankments and cuttings, dam walls and spillways, railroads, etc. Disaster prevention, particularly in such as land slides on volcanic pumice is an important issue that affects some EMVN countries. There will be extensive

coverage of these aspects during the Conference and it is hoped that much valuable material will be obtained on the current state of the art in developing these technologies.

Another filed in which vetiver may have an important role to play in EMVN conditions is in agro-forestry and pure forestry. Information will be sought on experiences obtained elsewhere that may have application to EMVN conditions, both in regard to soil and water conservation in pure forestry stands and the improvement of yield in small-scale orchards. What is proposed under the Technical Tours should yield much valuable experience that can be related to EMVN experiences.

Overall, at this stage of development, EMVN has little information or experience that it can offer others. However, there is much that we will wish to glean from the experiences of other Networks.

Michael Pease, Coordinator, EMVN

Lagos, Algarve, Portugal

The Southern Africa Vetiver Network (SAVN)

Congratulations to all involved in the organization of this prestigious conference. It is an honor to be able to participate and exchange ideas on a technology which contributes so much to the conservation and management of our fragile natural resource base. It is a particular pleasure to meet so many people who, up until now, have been silent and faceless friends on the distant end of an electronic network. Our common challenge is to ensure that vetiver takes its rightful place at center-stage in the field of environment and development during the new millennium. This challenge is not one of technical application but, rather, of communication – communicating effectively the technology to as broad an audience as possible. On behalf of all the participants in the Southern Africa Vetiver Network I wish the conference great success and hope that we can reciprocate as hosts in the not too distant future.

Duncan Hay, Coordinator, SAVN

Pietermaritzburg, South Africa

The Latin American Vetiver Network (LAVN)

It is my pleasure to send a greeting to the readers of the VETIVERIM from the home of the Latin American Vetiver Network (LAVN) in San Jose, Costa Rica. In October 1995, Dick Grimshaw asked if I would be interested in developing and coordinating a regional vetiver network to serve Latin America. There was a need for a network to serve the predominantly Spanish-speaking region to improve information dissemination and promotion, gather information and provide a network for contacts and information exchange.

In the 20 countries of the network which include Mexico, Central America, South America (including Portuguese-speaking Brazil) and the Caribbean (Puerto Rico, Dominican Republic, and Cuba) we have seen our membership almost double in the past four years to approximately 725 members. Our newsletter, *Boletn Vetiver*, is printed and distributed on average twice a year – *Boletn Vetiver No. 7* was sent out in September 1999. There is currently a list of 35 "advertised" vetiver plant material suppliers in the region that is steadily growing.

Day to day activities of the network include answering correspondence (this ranges from membership inquiries, specific information requests, updates of vetiver projects, requests for planting material, helping individuals make contacts with other members, etc.), sending out member information packages (this includes all newsletters and the little green book) or specific information requests (for example, photos pertaining to a specific use of vetiver such as in coffee), and continuing work on other projects.

Joan Miller, Coordinator, LAVN
San José, Costa Rica

The Pacific Rim Vetiver Network (PRVN)

Although PRVN, by itself, does not have any role to play in the organization of ICV-2, it is my pleasant duty, as the Acting Coordinator of PRVN, to welcome all participants to this gathering of the world's vetiver experts. As the Office of the Royal Development Projects Board (RDPB) servers as the Secretariat of PRVN and Thailand Vetiver Network as well as the Organizer of ICV-2, it is difficult to separate each of these bodies or activities. Thus, we are all potential host of ICV-2.

Initiated at the request of Dick Grimshaw, Coordinator of The Vetiver Network (TVN) and endorsed by His Majesty, PRVN started to operate soon after the closing of ICV-1. With limited budget and staff, our objective is rather humble, like that of the vetiver itself, i.e. simply disseminating VGT through the publication of a quarterly, English-language newsletter, the VETIVERIM, and occasional technical bulletins and a few other activities, like arranging study tours for scientists from neighboring countries, providing plant material and information, providing expert advice as requested, etc., have also been carried out by RDPB on behalf of PRVN.

We are overwhelmed with the responses received from intended participants. With our budget constraint, however, we cannot comply to the many requests for financial support from a number of scientists, especially from the very far places to join us. We have tried to make the program as informative and lively as possible. We hope that you will find the conference useful and the experience memorable.

Even though the "Amazing Thailand Year 1998-99" was over, there are still plenty of amazing things in Thailand for you to explore and enjoy, including the "Amazing Thai Vetiver".

Narong Chomchalow, Acting Coordinator, PRVN

Bangkok, Thailand

The Winners of the King of Thailand Vetiver Awards

His Majesty the King of Thailand has agreed to award two $5,000 from the Chaipattana Foundation Funds to the best vetiver research work and the best dissemination of vetiver technology work. All papers submitted for presentation at ICV-2 are eligible for the competition. There were over 50 papers for each category. At the end, the Selection Committee could only select the best three papers (instead of just one) in each category to receive the King's Awards. The following paragraphs provide the information on the title of the paper, name(s) and affiliation of the author(s), the abstract, and the statement of merit which has made each won this prestigious award.

The global impact of vetiver grass technology on the environment by Paul N.V. Truong, Resource Sciences Centre, Queensland Department of Natural Resources, Brisbane, Australia

The vetiver grass technology (VGT), which is based on the application of vetiver grass was first developed by the World Bank for soil and water conservation in India in the 1980s. While this application still has a vital role in agricultural lands, scientific research conducted in the last ten years has clearly demonstrated that VGT is also one of the most effective, low cost and natural methods of environmental protection. As a result VGT is now increasingly being used worldwide for this purpose.

Pollution of the environment due to soil erosion and agro-chemicals contamination from agricultural lands, urban wastes and by-products of industrial and mining operations is a major global problem, as most of the pollutants are often toxic to flora, fauna and human beings living in the vicinity or further downstream of the contaminated sites.

The main factors that contributed to the global application and acceptance of VGT are the availability of scientific data to back up anecdotal field observation and also to provide explanations to vetiver's phenomenal and unique characteristics. More specifically, the breakthrough was achieved following the establishment of high tolerance levels of vetiver grass to adverse soil conditions, heavy metal toxicities and agro-chemicals in the last six years.

This has subsequently led to: (i) the establishment of VGT as an effective, low tech and low cost method of mine rehabilitation, (ii) establish VGT as an effective off-site pollution control method by trapping pesticides, herbicides and nutrients in runoff water from agricultural lands, and (iii) demonstrate that vetiver is highly suitable as a wetland species. As it is extremely tolerant to high level of agro-chemicals under the wetland conditions. This paper presents the state of knowledge of the proven and potential applications of VGT in the above fields, and also other applications in protecting the terrestrial, aquatic, aerial and social environments.

Statement of Merit

Scientific research conducted in the last 10 years has clearly demonstrated that vetiver grass technology (VGT) can provide a natural, effective, low tech and low cost alternative means of solving the pollution problem and it is being increasingly used globally for the protection of the environment. The main factor that contributed to the global application and acceptance of VGT are results of scientific research conducted by this author in the last six years in establishing benchmark tolerance levels of vetiver grass to adverse soil conditions and particularly to heavy metal toxicities and agro-chemicals. This has led this author and his colleagues to subsequently demonstrate firstly that VGT is a natural, effective, low tech and low cost method of mine rehabilitation, secondly that VGT is an effective off-site pollution control method by trapping pollutants in runoff water, and thirdly that vetiver is highly suitable for wetlands due to its extreme tolerance to agro-chemicals under the wetland conditions.

VGT is therefore ideally suited not only for the developing countries but also globally for the protection of the environment in the above fields and also other applications in protecting the terrestrial, aquatic, aerial and social environments from both agricultural and industrial pollution.

The use of vetiver and three other grasses for re-vegetation of a Pb/Zn mine tailings at Lechang, Guangdong Province: A field experiment by W.S. Shu, H P Xia[1/], Z.Q. Zhang, C.Y. Lan and M.H. Wong[2/], School of Life Sciences, Zhongshan University, Guangzhou, China

The Lechang Pb/Zn mine is located at the north of Guangdong Province, South of China. The tailing pond had been abandoned over five years, and re-vegetation was necessary for stabilizing the bare surface of the pond to reduce its environmental impact. Chemical analysis indicated the tailings contained

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[1/] *South China Institute of Botany, The Chinese Academy of Sciences, Guangzhou, China*

[2/] *Institute for Natural Resources and Waste Management, and Department of Biology, Hong Kong Baptist University, Kowloon Tang, Hong Kong, China*

high content of heavy metals (Pb, Zn, Cu and Cd) and low level of major nutrient elements (N, P and K) and organic matter. Heavy metal toxicity and extreme infertility were the major constraints on re-vegetation. A field experiment was conducted to compare the growth of vetiver grass *(Vetiveria zizanioides)*, and three other grasses *(Paspalum notatum, Cynodon dactylon* and *Imperata cylindrica* var. *major)* on the tailings. The tailings were amended with four treatments, namely: (i) 10-cm domestic refuse + complex (NPK) fertilizer (Tr.A), (ii) 10-cm domestic refuse (Tr.B), (iii) complex (NPK) fertilizer (Tr.C), and (iv) tailings without any amendment used as control (Tr.D). The six-month field experiment showed that both the domestic refuse and the NPK fertilizer could improve the growth of plants on tailings, and the combination of domestic refuse and NPK fertilizer (Tr.A) had the greatest benefits. After six months of growth, vetiver grass growing on Tr.A had a height of 220 cm, cover of 100%, and a dry weight yield of 2,111 g/m^2. The height and biomass of vetiver grass were significantly greater than those of other three grasses growing on the same treatment. Judging from the above results, vetiver grass was the best species among the four species used for re-vegetation of Lechang Pb/Zn mine tailings, followed by *P. notatum, C. dactylon* and *I. cylindrica.*

Statement of Merit

Re-vegetation of metalliferous mine tailings is necessary for long-term stability of the land surface. The success of reclamation schemes is greatly dependent upon the choice of plant species and their methods of establishment. The present experiment aims at comparing the growth of vetiver and three other grasses on Lechang Pb/Zn mine tailings with different amendments in order to find the most useful grass for re-vegetation of Pb/Zn mine tailings and the most effective measure for its establishing on these tailings. The result indicated that vetiver grass was very useful in re-vegetation of Pb/Zn mine tailings and might have wide application in the restoration of mine wastes and heavy-metal-contaminated soils.

The senior author and his colleagues had made the right approach in selecting the site for their experiment, and had carefully selected the right species (i.e. vetiver and three other grasses) for re-vegetation. The proper combinations of the amendments, the appropriate method of sample collection and chemical and statistical analyses, have all contributed to the success of the experiment.

Research on Methodologies for Selection, Propagation and Cultivation Techniques of Vetiver Grass and Its Application in Thailand by the Department of Land Development*, Bangkok, Thailand

Soil erosion is a major cause of the land degradation that affects agricultural areas in Thailand. Resolving the soil erosion problem can be achieved only by appropriate technological solutions that are traditionally and economically accepted by the local land users, particularly the farmers. His Majesty's initiative on vetiver grass as an agronomic measure against soil erosion has increasingly been recognized. Being one of the implementing agencies, the Department of Land Development has been assigned to conduct research to identify appropriate methodologies for cultivation of vetiver grass in Thailand.

Research stretching over eight years concerned vetiver cultivation, large-scale field plantation, quantification of environmental impacts and non-agricultural uses of vetiver. Illustrations of the interesting research results by statistical means are highlighted. Clearly, vetiver provides simple, cheap and comprehensive means to control or minimize soil erosion. Hence, vetiver is increasing in popularity, is being widely adopted by Thai farmers and can be used for many other purposes.

Statement of Merit

This paper is a compilation of various research and development results conducted over the years by the Department of Land Development (DLD) in selecting the most suitable ecotypes of the vetiver grass, the effective techniques of their propagation and cultivation as well as the study on the utilization of the vetiver grass.

Vetiver researches in Thailand were started only a few years back with no prior knowledge and experience. Through this short period of eight years, DLD had conducted variety trials using 78 ecotypes which were collected from Thailand and abroad, then reduced to 28 and finally was able to select only 10 most appropriate ecotypes for promotion. Through various experiments conducted to arrive at the most effective techniques in propagation, Thailand has so far produced close to 100 million vetiver tillers which had been planted throughout the country; this is probably the world's largest in vetiver planting. Various techniques of cultivation were developed, including spacing trials with combination of ecotypes in different soil types. To make vetiver more attractive to the farmers, DLD had conducted trials on the utilization of vetiver grass in order for the farmers and their families to earn extra income from vetiver

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* *Conducted by S. Morakul, P. Vijarnsorn, C. Anecksamphant, S. Rajani, W. Chinapan, A. Sukhkasem, U. Taejajai, A. Pothinam and P. Tepnaraprapai*

handicraft products as well as industrial products, many of which have great potential for industrial development which can reduce the use of wood from the forest, another approach in the conservation of the environment.

Promoting Vetiver Grass Technology in Venezuela by Oscar S. Rodriguez P., Institute of Agronomy, University of Central Venezuela, Maracay, Estado Aragua, Venezuela

A two year project (1997-99) was conducted by the Sociedad Conservacionista Aragua (SCA) with financial and technical support of The Vetiver Network (TVN), and sponsored by other local institutions like the Aragua's State Secretary of the Environment and the Central University of Venezuela. Twelve workshops were organized and more than 300 participants received training on vetiver grass technology (VGT). The trainees were extension workers, technicians, university students, farmers and representatives of NGO's. A good geographical distribution of project activities was achieved as is shown in a map developed by the project. High priority was given to the production of written material, including a technical bulletin, newspaper and journal articles, and a series of brochures to support the project activities. Other priority was the participation in different meetings where specialized and general public become aware of vetiver applications for erosion control and environmental protection. Field demonstration plots were developed in three locations with different agro-ecological and farming conditions. VGT performance was proved to have a high potential for adoption among farmers for soil conservation, and for enhancing development of sustainable land use systems.

Statement of Merit

This paper describes how vetiver has been promoted in Venezuela through an NGO. The main achievements reached during the two-year project (1997-99) were the successful strategies used in promoting VGT, including the workshops which were needed to introduce the technology to many potential users for the first time, the three different demonstration sites in diverse agro-ecological conditions which were effective alternative for erosion control and environmental protection, the international cooperation through The Vetiver Network and the Latin American Vetiver Network in providing technology transfer and shared experiences, and the local institutions (governmental and non-governmental) which demonstrated the advantages of working together sharing resources and strengths. Volunteer students participation was also a key element to disseminate VGT. Students also benefited from the opportunity to get additional training. It was concluded that VGT has a high potential for adoption among farmers and at the same time, to help develop sustainable land use systems.

Vetiver Technology Development and Dissemination in China: From Agriculture to Engineering

by Liyu Xu, National Coordinator, China Vetiver Network, Nanjing, China

Soil erosion became critical issues facing our global society, while vetiver, a miracle grass, can play an important role in soil erosion control, land rehabilitation, earth work protections, etc. The China Vetiver Network (CVN) has promoted the dissemination and extension of vetiver grass technology (VGT) throughout the country, through national information service, technology distribution via public media, organizing multiple conferences, workshops, and training courses, operating joint field surveys and investigations, arranging demonstrations and bilateral visits, distributing planting materials and mini-grants, etc.

Recent investigation indicated that non-agricultural practices caused 72.0 and 89.4% of the total erosion area and soil loss, respectively, which aggravated flooding and other natural disasters, influenced farming production and threatened people's life. CVN puts emphasis on the application of VGT for infrastructure stabilization, and highway embankment fixing in the past two years.

Methodologically, the networking was to find factors which might impact VGT dissemination and solve problems through different methods from time to time so that the best approaches for dissemination of VGT are developed.

Statement of Merit

This paper describes the role of vetiver grass in soil erosion control, land rehabilitation, earth work protections in China, all of which have been quite successful through the active involvement of the China Vetiver Network (CVN) in disseminating VGT through national information service, technology distribution, field investigations, demonstrations, distribution of planting materials and mini-grants. The most significant contribution of CVN was its involvement in the application of VGT for infrastructure stabilization and highway embankment fixing in order to mitigate massive erosion and soil loss due to non-agricultural practices which aggravated flooding and other natural disasters and thereby influencing farming production and even posing a threat to people's life.

The use of vetiver grass system for erosion control and slope stabilization along the Yadana gas pipeline right of way by the Petroleum Authority of Thailand, Bangkok, Thailand

The 238.5-km Yadana gas pipeline of the Petroleum Authority of Thailand (PTT) passed a 50-km strip of forest in which 20-m width was allowed for use during construction, amounting to erosion. According to Environmental Impact Assessment (EIA) studies, without any preventive measure, especially for the Slope Complex Soil Series in the high mountain area, erosion rate may increase by 100 times. To minimize environmental impact during construction and to achieve maximum effectiveness in rehabilitation, construction strategy was formulated to create permanent soil erosion control structure with physical erosion design approach, i.e. soft plugs, diversion berms, and drainage System, combined with re-vegetation and agronomic erosion control methodology along the pipeline right of way. *Vetiver grass was specifically introduced in the high-risked erosion areas.*

Erosion rating was calculated and classified into low risk (E0), moderate risk (E1), high risk (E2), and very high risk (E3). In the E1 areas, the following measures have been provided: building permanent soil erosion control structure, re-vegetating with three kinds of leguminous covers, sowing of various grass species and immediate re-vegetation before the first rainy season; in the E2 and E3 areas: building permanent soil erosion control structure, including soft plugs and berms as well as vetiver grass planting, sowing of various grass and leguminous species before the first rainy season and re-vegetation before the second one.

Vetiver grass was planted in the E2 and E3 areas along the contour line, 10-15 cm apart, along the same contour furrow while hedgerows were spaced about 1.0-1.5 m, amounting to 1.5 million tillers being used in this Project. In the E3 area with over 35° slopes, berm construction may not prevent erosion during the first rainy season; therefore, jute sacks filled with a mixture of soil and grass seeds were arranged in ladder-pattern, pegged with live stakes. Grass and legume seeds were sown. Sacks were holed and planted with vetiver tillers so that their roots grew into the soil while sacks naturally decayed. Those laddered jute sacks naturally formed permanent soil ladders covered with vetiver and other grasses.

Vetiver grass indeed plays a very significant role in making physical erosion control structure a naturally permanent erosion control structure.

Statement of Merit

This paper describes environmental problems created as the result of constructing Yadana gas pipeline passing through the critical areas of 50 km-strip of forest with 20-m width, equivalent to 96 ha of the right-of-way area. Bare soil resulting from the construction was immediately exposed to erosion. Without any preventive measure, erosion rate may increase by 100 times. The Project has made effective use of vetiver grass system (VGS) in erosion control and slope stabilization along those critical areas. As soon as vetiver tillers were properly planted, the rows of vetiver grass immediately served to prevent erosion while other vegetations took some time to grow. The VGS enhanced and reinforced the *physical erosion control structure* constructed in areas with high risks of erosion to eventually become *natural permanent erosion control structure.* The VGS also conserved soil moisture and thereby helped perennial trees (which have been balled and re-planted) to grow back to their original state or better in a period of three years onwards.