REPORT ON THE TRIP TO INDIAN IN APRIL 2016

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Trip Schedule

- Hatsun Agro Product LTD: 3 - 8 April
  - Consultancy on Application of Vetiver Phytoremediation Technology
- Coimbatore: 10 - 12 April
  - Seminar at Tamil Nadu Agriculture University (TNAU)
  - Indian Vetiver Network
- West Bengal: 13-18 April
  - MGNREGA
  - GRAM

Hatsun Agro Product LTD

This trip was realised following the invitation of Hatsun Agro Product LTD, Chennai, to investigate the introduction of Vetiver Phytoremediation Technology (VPT) to treat effluent discharged from its factories.

Hatsun Agro Product LTD in Chennai is one of the biggest and most progressive dairy processing companies in India, with nine factories spreading over the length of the State of Tamil Nadu. The factories process milk from small dairy farmers producing various dairy products for the Indian market.

Effluent from these factories is first treated to comply with Indian Environmental Protection standard then released to constructed wetlands planted with various native and introduced species.

To increase the efficiency of the existing wetland, the Company is interested in introducing VPT into its Environmental Protection Management plan, which will affect the livelihood of 400 000 Indian farmers in Tamil Nadu.

A report has been submitted to Hatsun for consideration. Simulation by a computer model indicated that VPT is more effective than the existing setup, requiring smaller land area, hence potential for future expansion. In addition, in combination with other Vetiver System applications, VPT can provide a solution to deal with some problem soils.

I would like to thank Hatsun for the opportunity to introduce VPT to India and particularly to enhance the application of this Indian native plant to all India particularly to Tamil Nadu and West Bengal, as indicated in the schedule above.

Workshop at Tamil Nadu Agriculture University (TNAU), Coimbatore

The India Vetiver Network (INVN) and TNAU jointly organized the one day Workshop on 11th April16. INVN received full support from TNAU starting with Vice Chancellor Dr. K. Ramasamy, Prof. Rajamani and his team. Though we expected around 100 people, more than 250 delegates participated in the event. There were some interesting papers on waste water treatment, carbon sequestration etc. in addition to my overview of the subject.

The proceedings is being prepared.

Indian Vetiver Network

The Vice Chancellor informed that TNAU will be happy to associate with INVN for betterment of crops and farmers. On seeing the enthusiasm in Tamil Nadu in general and TNAU in particular, Dr Haridas offered to transfer INVN Centre from Trichur, Kerala to TNAU, Coimbatore. A Core Committee of 8 people was formed and headed by Prof. Rajamani, Head, Medicinal & Aromatic Plants Division, TNAU, to review the progress every month till about August16. More activities and enrolment of new members are expected later.

If everything goes well INVN may organize Second National Workshop in 2017 in Coimbatore.

The success of this workshop and future operation were actively supported by Mr Ashok Kumar, a Core Committee member of the new INVN.

Observation

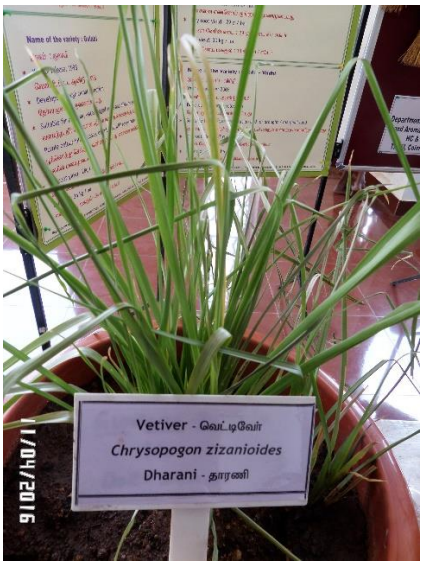
This workshop has undoubtedly seen the resurgence and growing interest in vetiver application in India, which will widen its applications.

Among the papers presented, the most interesting are:

- ***Development of new varieties of Vetiver for oil production*** by Dr. V. Sundaresan, Scientist In-Charge, Central Institute of Medicinal and Aromatic Plants, Research Centre, Bangalore. The most promising three genotypes:

1. ***Dharani***, Dual purpose genotype, useful for protecting soil erosion, tallest, very broad dark green leaves. Longest and thickest root network, suitable soil binder–cum high oil yielder, 38kg/ha oil yield

Dharani: Dual purpose genotype



2. ***Gulabi,*** Medium tall, long root, late flowering. Suitable for drought, marginal, water logging areas, high pH, alkaline soils. Special perfumery value. 34kg/ha oil yield

Gulabi: Suitable for drought, marginal and water logging areas.


3. ***Kesari,*** Tall with thin narrow leaf. Thin fibrous and medium long roots. Suitable for drought/marginal land, late flowering. Special perfumery value. 30kg/ha oil yield.

Kesari: Thin and medium long roots. Suitable for drought/marginal land.


- ***Vetiver Systems for Carbon Sequestration and Economic Returns,*** by E.V.S.Prakasa Rao Formerly Head, Central Institute of Medicinal and Aromatic Plants, Research Centre, Bengaluru, India and Chief Scientist and Advisor, CSIR-Centre for Mathematical Modelling and Computer Simulation. Dr Rao showed that:

1. Vetiver produced the highest biomass (>1800g/plant/year) as compared with Lemon grass(<600g/plant/year) and Palmarosa (<400g/plant/year)
2. Vetiver sequestered 58% Organic C in shoot and 54% in root as compared with 55% Organic C in shoot and 48% in root for lemon grass and 55% Organic C in shoot and 52% in root for Palmarosa
3. Dolomite application improved tillers per plant (14.3 vs 34.3), biomass per plant (169. 7g vs 588.7g), root weight per plant (32g vs 48g) and oil yield (0.32gvs 0.48g)

My presentation covered the following topics:

- Introduction to TVNI and Current Global Applications of Vetiver System Technology, with emphasis on Environmental Protection
- Introduction to Vetiver Phytoremediation Technology, with emphasis on wastewater treatment and pollution control
- Bioengineering Applications of Vetiver System Technology in riverbank stabilisation in West Bengal
- Future R&D Direction**.** The following topics should have high priority in future research

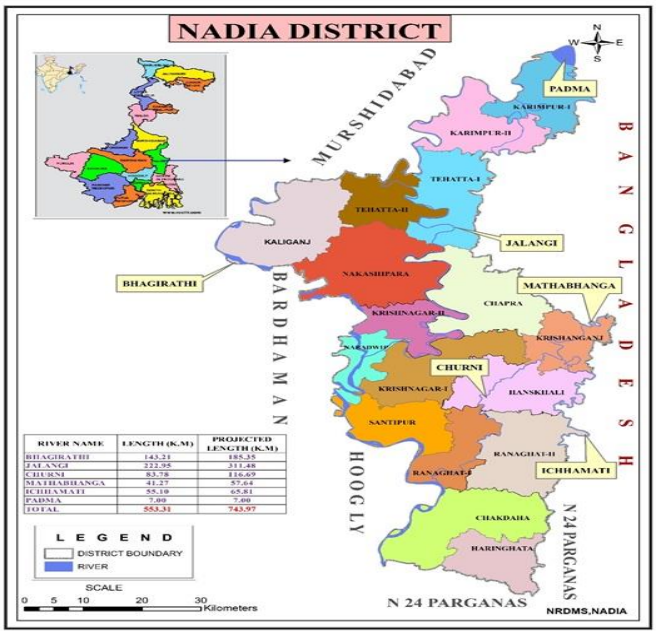
  Applications of the Vetiver Phytoremediation Technology to purify polluted water from hazardous chemicals, particularly organic compounds such as human hormones, antibiotics, drugs and food additives.

However the topics that drew most attention and interest is Vetiver Toilet, based on Vetiver Latrine concept developed by Owen Lee for Haiti. As a result, I prepared a short presentation on Vetiver Toilet (attached) for all workshops in West Bengal, where it received similar attention and interest as in Tamil Nadu.

Workshops in Nadia West Bengal

Under the Mahatma Gandhi NREGA (MGNREGA) Scheme, Nadia District of West Bengal has taken the initiative to protect riverside soil erosion by planting vetiver only and or in combination with stone boulders/sand bags. The objectives are to protect its people from riverside landslides and flood, which is very often occurs as happened in 2015 and devastating flood in 2000 where maximum parts of the district were submerged and the loss many lives and property. This project named by the Hon'ble Chief Minister of West Bengal, Mamata Banerjee as "SABUJAYAN" and launched on 23-11-2015. Now, 50 nurseries have been established and planting has started on some areas along the riverbanks.

The main sites are on several tributaries, Bhagirathi, Churni, Mathabhanga, Jalanji, Padma and Ichhamati of the Ganges with one originates in Bangladesh. The total length of the main sites on the river in the district is 743.97 km, ie approximately 1 488km bank on both sides. The project total cost of Rs. 31 crore (#USD500M) is shared by the Indian and West Bengal State governments. Currently 22 million vetiver slips are being raised in 55 nurseries along the rivers, making it the world biggest Vetiver project. The project comprises of three parts: 1. Nursery raising, 2. Plantation in riversides, 3. Handicrafts preparation from vetiver plant parts.



With the invitation of Mr Vijay Bharti, IAS, Chief Magistrate of Nadia and Dr. Babulal Mahato, Nadia District Nodal Officer, a Seminar was hosted by Prof. A. Chagraborty, Vice Chancellor of Bidhan Chandra Krishi Viswavidyalaya University and Prof. K. Brahmachari as Organising Secretary.


There were six presentations altogether, following an excellent introduction by the Vice Chancellor, Prof. A. Chagraborty who fully supported the project and believed that Vetiver System Technology will provide an effective and successful remediation for the erosion of the Ganges tributaries in Nadia. Other presentations were from Dr K Rudra, a renowned Riverbank expert, Dr Mahato, Mr Vincent and Mr Pradeep Kumar.

My presentations covered the following topics:

- Principle of Riverbank Stabilisation
- Mekong Riverbank Stabilisation in Cambodia
- Riverbank Stabilisation in Mekong Delta, Vietnam

In addition, the following presentations were shown to the University staff and government officials:

- Introduction to TVNI and Current Global Applications of Vetiver System Technology, with emphasis on Riverbank Stabilisation
- Riverbank Stabilisation in Assam, India
- Riverbank Stabilisation in Bangladesh
- Beach and Riverbank Stabilisation in Australia and Brazil

CONCLUSION AND RECOMMENDATIONS

- **Nursery raising:** This program is highly commended as it provides jobs for village women, who are actively involved and take over the "ownership".
- **Planting on riversides**: The planting should be implemented slowly and carefully as Vetiver is very effective in protecting the banks against wave action and flood erosion where the slopes are stable. It is not effective if the toe slope is undermined or actively eroded.
- **Handicrafts preparation from vetiver plant parts:** Visit the Thai Royal Project Board in Bangkok and requesting a Handicraft Training Program for village women.

Field trip photos in Attachment 1

GROUP FOR RURAL ALTERNATIVE MOVEMENT (GRAM)

Group For Rural Alternative Movement is a Wet Bengal based NGO, with focus on the improvement of livelihood of isolated rural community. GRAM works closely with MGNREGA Scheme and coordinate and supervise the community nursery program for MGNREGA.

The visit to GRAM was organised by Samsun Nabi, Gram Chief Coordinator following the invitation by and Mr Manik Mondal, secretary Mr P. Vincent, vice President of GRAM. The program included:

- Visit to 'Manik Fakirer Bari' an ashram at Begunkola Island by crossing River Ajoy, visit nursery, embankment work observation and onsite comments and advices to delegates.
- Seminar and Presentation at local community Hall to community leaders and local government officials

The highlights of the visit were:

- Establishment of Paul Truong Vetiver Propagation and Innovation centre at KATWA
- Visit to Ghoramara Island - the sinking Island in the gulf of Bengal

Foundation Stone of Propagation and Innovation Centre at Nabagram Katwa

The centre will be part of a Community Hall built from local and state funds.

GHORAMARA ISLAND - THE SINKING ISLAND IN THE GULF OF BENGAL

Ghoramara is one of the 10 sea-facing Islands in the Southern Sundarbans, others are Sagar, Jambudwip, Namkhana, Mousuni, Dakshin Surendranagar, Dhanchi Dalhousie, Bulchury and Bhangaduari, which are on a vast mangrove delta shared by India and Bangladesh. Climate change and the associated sea level rise is seen to be a major threat to low-lying areas like these islands. Together, they amount to 69% of the land lost to the sea. Ghoramara in particular has lost 75% of the landmass just over 31 years (1968-1999). Currently Ghoramara, part of the Hooghly river estuary which was 8.51 sq. km, now reduced to 4.45 sq. km, caused by continual climate change in just over 31 years

Continual rise in sea level due to climate change, will continue to create havoc in the estuary causing the islands to erode away and it continues to recede, forcing villagers to rebuild homes further inland. Villagers lose their ancestral land, houses, cattle and even their loved ones to the waters that lash the island. One farmer who owned 30 acres of ancestral land and now barely has one left. A few kilometres away another farmer, whose ancestral house that weathered the elements for over a hundred years has succumbed to the waters. “We have seen our neighbours drowning in the water when their house and livestock was washed away,” recollects an old mother. The water creeps up stealthily on them leaving them hapless. So what do they do when drowning is inevitable? “We make a grab for the food items and run towards higher grounds,” she says.

Points of disadvantage for the Ghoramara:

1. Sea level rise
2. Salinity
3. Erosion
4. Land loss

The Western parts of the Sundarban is populated and supposedly more vulnerable as compared to the eastern part. Ghoramara comes under this region is a result of the building the Farakka Barrage on the river Ganges that has led to the increase in the velocity of water flow in the Hooghly channel, making it a powerful agent of erosion.

In January 2014, the World Bank released a strategy report 'Building Resilience for Sustainable Development of the Sundarbans'. In its report, the organization has pegged losses to India due to climate change occurring in Sundarbans at Rs 1290 crore (#USD20B) annually. It is evident that in overlooking the damages, India is harming none but itself. And many on the eroding island second that.

A panel discussion lead by Dr. Paul Truong, Mr P. Vincent, Mr Samsun Babi and community leaders was held at the community hall on Ghoramara Island, the panel recommend the following steps should be taken:

- Since there is a certain ecological coercion in this region and people living in fear have to be addressed first to reinstate hope to struggle to survive using the elements of nature and adaptability of ecological importance. Keeping in mind all the adverse situations, Paul Truong said there is still hope to protect the existence and to improve the sanitary level of

local people on this Island with application of the Vetiver System, by making arrangement with the authorities to protect the Island and create sustainable damage control measures.

- To bring back the confidence of the local people an awareness and large scale dissemination about the Vetiver System should be organized. Participation of the local folks is compulsory in this programme especially including the panchayat and its members.
- Where the previously constructed guard walls are badly damaged due to erosion and those are yet to be constructed have to be protected with vetiver planting. Poor construction practices and improper design of roads and embankments without compaction make embankments easily erodible to rain and wave action.
- Inland infrastructure particularly the mud roads and dikes and ponds, vetiver planting should be used to stabilize them.
- Public and communal toilets should built where the poor have not been able to avail. The health and hygiene will be definitely taken care of as well in the plantation process which includes eco-toilets built with help of vetiver.
- A focus on the banks of the guard walls built around the Island should be made. Presently there are no vegetation on these flood or coastal embankments built along the periphery of the Island. An immediate action of vetiver plantation on these guard walls in the form of rows is necessary.
- The embankment of the river which has merged with the guard walls has to be given special attention while planting vetiver along with indigenous weeds along the water baseline. The plantation should be done during the monsoon as rain water will decrease the salinity level, which will help the plants to establish in low areas.
- Determination of slope stability of vetiver grass protected slope. Field trials for determining the efficacy under different soils (saline, non-saline, contaminated soil) and geographic condition (floodplain and coastal zone in Ghoramara).
- Similarly using the vetiver plantation around the inland water bodies like ponds and tanks can reduce sedimentation and purify water quality. This will certainly give an advantage in fish farming.
- Introducing and encouraging the uses of vetiver biomass for biofuel and handicraft production
- Experience from Mekong Delta, Vietnam can be implemented at Ghoramara, where farmers benefit greatly from Vetiver planting. It provided an economic incentive to farmers living along the dike. By law, farmers are not allowed to dig up or destroy vetiver plants but they are free to harvest it for their own uses such as fodder, mulch, thatch or string making and burning to control weeds, as well as grazing their stock on the batters

Field trip photos in Attachment 1

Conclusion and Recommendations

- Vetiver planting on new and existing dikes which are badly damaged due to erosion to be carried out ASAP
- Planting Vetiver on inland infrastructure particularly the mud roads and dikes and ponds.
- Public and communal toilets should be built for village people
- Planting Vetiver around the inland water bodies like ponds and tanks can reduce sedimentation and purify water quality
- Building and testing vetiver toilet on private houses

OVERALL CONCLUSION AND RECOMMENDATIONS

Although the effort in stabilising the banks of the Ganges and its tributaries is highly commended. I think the most significant contribution the Vetiver System Technology can make to India in general, is pollution control, particularly sewage effluent treatment,

As conventional sewage effluent treatment plants used in the developed countries cannot be implemented in India for obvious reason. Onsite and smaller units can be established at source such as Vetiver Toilets as shown in Attachment 2. This will certainly have a direct impact on the hygiene standard and health at the grassroots level.

ATTACHMENT 1

FIELD TRIPS IN NADIA WEST BENGAL

- ***Erosion on Ganges River***



FAILED CONVENTIONAL MEASURES

Sand bags

Gabion

Wooden structures

Rock Riprap

- ***Community Vetiver nursery***

- ***Vetiver Planting on riverbank by local community***

Planting and maintenance by women in the local community, who are very proud of their achievement

Planting on terraces to protect road and rock riprap to retain rocks

Welcome to NABAGRAM KATWA

Foundation Stone of Propagation and Innovation Centre at Nabagram Katwa

FIELD TRIP TO GHORAMARA ISLAND, WEST BENGAL

Boat to GHORAMARA Island

Beach Erosion on GHORAMARA Island


Protection dike on GHORAMARA Island


Eroded Protection dike on GHORAMARA Island

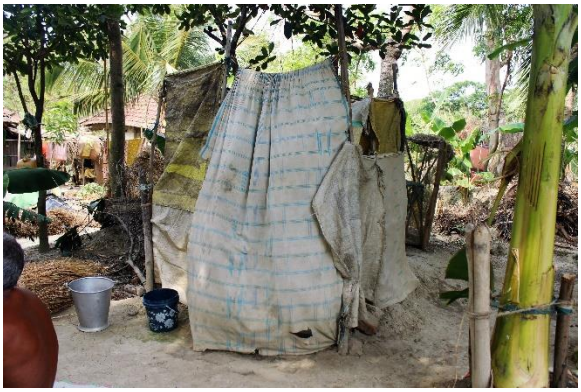

Meeting with Community leaders

Village water supply pond and polluted corner

Village Community toilet front and back, discharge effluent to village pond

Children swimming in polluted village pond and women use pond water for washing and cooking

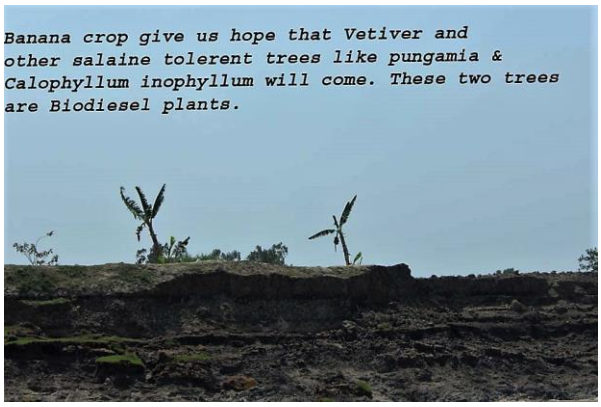
Home toilet on the edge of pond



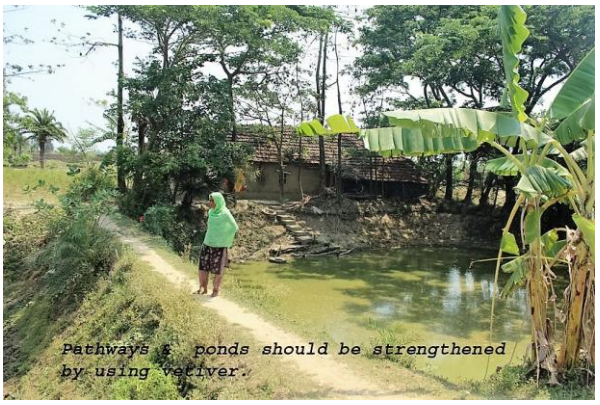
VINCENT PAULRAJ INPUT

Southern side:
Sea side so the tides are very strong. Salinity level may be high, should be analized. The gentle slope is an advantage factor,so trial Vetiver planting during moonsoon will give us hope.

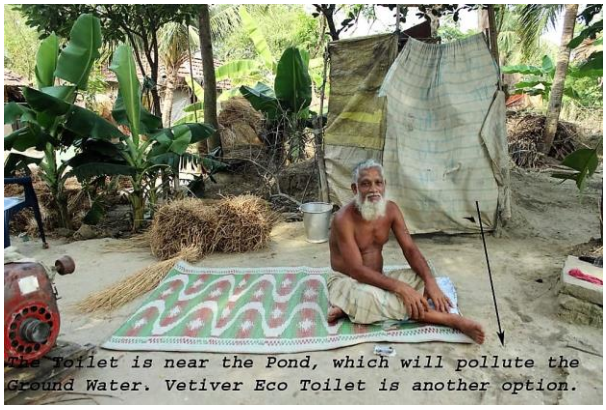
Tides are very powerful.



Banana crop give us hope that Vetiver and other salaine tolerent trees like pungamia & Calophyllum inophyllum will come. These two trees are Biodiesel plants.



Pathways & ponds should be strengthened by using vetiver.



The Toilet is near the Pond, which will pollute the Ground Water. Vetiver Eco Toilet is another option.

Banana,Palmyra & other Trees give us hope that Vetiver will come nicely

This structure can be replaced with Vetiver

Good to see kitchen Garden. More such gardens should be developed for sustainable living.

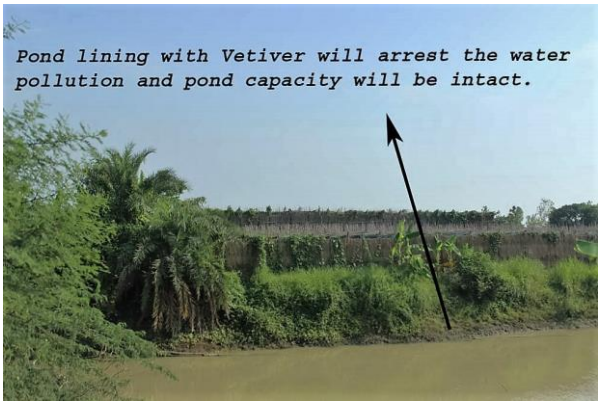

Behind the Government Office, this place
is good for Nursery. The area & water is Good.


Grass patches gives us hope for Vetiver plantation


Sea water is very close to the Bund, should act
fast to save the bund, Grass patches are visible.


Road sides - Biodiesel trees are ideal.
On the Slopes Vetiver is goodoption.


Village roads should have Pungamia or
calophyllum inophyllum


Pond lining with Vetiver will arrest the water
pollution and pond capacity will be intact.