

BEST PRACTICES ESTABLISHING A NATIONAL VETIVER DIFFUSION PROGRAM: EXAMPLE OF MADAGASCAR, A COUNTRY ERODING INTO THE SEA

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Abstract

If vetiver grass technology is so simple, inexpensive and good for the health of the soil, why isn't it promoted more broadly on a national scale in the same way vaccinations are promoted to preserve an individual's health? The answer is not related to the attractiveness of the technology, but to the challenge of dissemination. Madagascar is a best-case experience where a need to protect roads, safeguard hillsides and improve poor agricultural soils in a particular area helped catalyse and shape a broad-based, national vetiver dissemination program. This program appears to have led to the sustainability of the technology.

The Madagascar approach evolved over a three-year period and consisted of actions which (a) brought together interested people and organizations committed to vetiver, (b) ensured reliable and timely supply of vetiver plants to end-users, and (c) applied vetiver technology according to site-specific needs. The approach was low cost, involved information campaigns, used demonstration sites for practical applications, and benefited from research and applications developed in other countries. Success can be attributed in part to close relationships with the four target groups in the vetiver communications and implementation plan: (a) village associations, (b) private producers, (c) local elected officials, and (d) professional organizations, ministries and donors. Lessons learned from the Madagascar program could prove useful to practitioners hoping to establish a broad-based and sustainable vetiver program elsewhere.

Overview of the Madagascar program

The author headed a USAID-funded technical assistance project to stimulate the agribusiness sector and to rehabilitate rural infrastructure in two of Madagascar's six regions. The infrastructure component improved farm-to-market transport. It spent US\$13 million over five years to rehabilitate rural roads and partially rehabilitate a railroad. Rehabilitating the roads proved to be an easier task than assuring their maintenance at reasonable cost. The hypothesis was that maintenance could best succeed by using a participative approach with the local population, who had a vested interest in protecting the investment. Management of the roads was formally turned over to road user associations comprised of villages living alongside the roads and agricultural enterprises with an interest in the area. The associations and project staff witnessed serious problems when some of the new and costly engineered works washed out during a cyclone, and erosion and massive landslides threatened other areas under rehabilitation. We searched for solutions together, which led us to vetiver. We initially contacted The Vetiver Network through the Internet. They subsequently provided the project with information, guidance, experience and visual aids to tackle the problems that had already occurred and develop a capacity to avoid new ones. This led to a sensitivity and awareness campaign in the two regions where roadwork and agricultural intensification were being implemented. Subsequently, we expanded the initiative to the national level. This was done both in response to requests for assistance in setting up vetiver in other regions of the country and as a way to ensure long-term support from businesses, donors, professional associations, and government at the national level.

The overall cost for diffusing vetiver, first in the project area and later on a national scale, was roughly US\$750 000 over three years. This amount included about US\$464 000 for the purchase, transportation, and planting of the plants, US\$40 000 for the communications campaign and US\$ 196 000 for project-based technical assistance. We also benefited from about US\$50 000 of in-kind contributions from other organizations. The result was the planting and caring of approximately 160 linear kilometers of vetiver hedges (1.6 million plants), which protected over 400 km of roads and associated masonry works and 20 km of vetiver hedges along a railroad line, watershed basins and agricultural lands. Approximately 200

000 of the 1.6 million plants were used in agricultural plots to improve soil quality. Cost per planted meter averaged about US\$2.90. The cost of protecting rural roads and masonry works with vetiver varied from 1.2 to 4.6% of the rehabilitation investment. On average vetiver cost was 3.1% of rural road cost. We estimate that vetiver will extend the life of the road by 30 to 100%, thus greatly increasing the rate of return on the rehabilitation investment.

Over the course of the project, the vetiver activity assumed greater importance than what was anticipated at the outset. Through our participation with new partners who operated on a national scale (the National Environment Office, Ministry of Public Works, World Bank, UNDP, Peace Corps, Worldwide Fund for Nature and CARE), the technology became better known, and demand for assistance outpaced our ability to respond. After three years of intensive vetiver outreach activity, vetiver dissemination in Madagascar reached a significant scale. We had established a core of people skilled in the technology and a critical mass committed to its use. The adoption rate is high and the demand remains strong.

How did the country get to this point? What specific actions led to achieving this critical mass state? Looking back we concluded that the dissemination strategy developed as much by chance as by design. However, we believe that a good part of our success can be traced to the manner in which three questions were addressed: who will do the dissemination, with what material and by what means?

Two or three previous attempts at vetiver dissemination in Madagascar did not succeed. We believe our efforts have been rewarded because they:

- got the right people involved and committed,
- assured a reliable and timely supply of the plant material and
- provided technical support to assure the technology was applied correctly.

This paper discusses the manner by which these three concepts were addressed and given priority.

Get the Right People Involved

At the heart of a vetiver dissemination program is getting the right people and organizations involved and committed to promoting the technology. A program needs a locomotive, and it is preferable that this engine be an independent body that has

- a mandate to achieve results in a field such as agriculture, environment or infrastructure,
- recognized leadership skills,
- access to financial resources and
- the drive to establish partnership relations with other organizations.

Create a Catalyzing Event

To get people and organizations to address a common problem, organize an event such as a disaster preparedness seminar, a soil conservation workshop or engineers' conference on road maintenance. In Madagascar, an early catalyst to get people thinking about solutions to the massive erosion problem was the organization of a conference called "Effective technologies used to preserve agricultural soil and to reduce erosion". Vetiver was one of the field-tested technologies presented by practitioners to a diverse audience of agronomists, engineers, NGOs, researchers, ministries and donors.

Such an event becomes the catalyst to help conceptualize the scope and breadth of a vetiver program. It allows individuals and implementing bodies with the drive, ideas and nurturing skills to emerge as actors who will take the idea from conception to reality. It is useful to have an eye-catching presentation by a vetiver practitioner who has slides, reports, and scientific evidence and background information on vetiver in other regions or countries. Richard Grimshaw was the main advocate of vetiver technology at the conference, and he helped to establish the credibility of vetiver. The conference also discovered that other organizations which had used vetiver in the past had applied inappropriate technology. The Vetiver Network and its website (www.vetiver.org) provide excellent material and contacts to ensure good application of the technology.

The event can also serve as a preliminary planning platform to discuss target beneficiaries, resource requirements, sources of planting material, participating organizations, short- and medium-term goals, and a schedule of follow-on planning exercises.

Involve Both Big-picture People and the Detail Folks

In the early stages of program development, involve professionals representing the engineering, agricultural, environmental, financial, forestry, business and NGO sectors. Look for those who have a sense of the big picture and policy issues. People who are busy, who already carry many responsibilities, who have a wide network of contacts, and who work under a private umbrella are the most likely to help the initiative succeed. These people will know how to access key documents, pictures, reports, slides and videos on vetiver usage.

When considering partnership organizations, look for those that have the best records working closely with village associations, farmer cooperatives and producer groups. These are the resources that deal best with the smaller details such as how best to get the message to targeted beneficiaries, problems of local logistics and ground-truthing proposed practices. They are critical to a national campaign as they complement the vision, big-picture folks and help resolve practical problems at the village and local level. Remember that it is often the details that ruin a well-planned national vetiver program.

Create an Information Network among Key People and Leading Organizations

Critical to a national vetiver program is networking information about the plant, its uses and virtues to the beneficiaries, including those who plant, finance, become stakeholders, researchers, businesses and those who hold local and national offices. These groups must understand the plant, the technology and what vetiver has done elsewhere under similar conditions.

Basic information about vetiver exists in abundant supply. In addition to the vetiver website, important documents that help get started are the World Bank Technical Paper #273, the National Research Council's 1993 *Vetiver grass, a thin green line against erosion*, P.K. Yoon's 1991 *A look-see at vetiver grass in Malaysia*, and VGT newsletters. In addition, see the reference section of Richard Grimshaw's *Vetiver grass technology network and its impact on the environment*, presented at this conference.

To create the information network, the lead organization must establish a communications plan and a strategy to transmit information about the plant and the technology to target groups. Regardless of the target group, the program requires large quantities of visual aids and written documents, organizing workshops, participating in seminars, involving schools in "vetiver planting days", assuring press reporting and using resourceful and experienced personnel, even if at the outset they must be brought in from the outside. Estimate an active communications budget to be about US\$6 000 to US\$12 000 per year. Elicit help from journalists and the media only after there are success stories to report, have them visit demonstration sites and put them on a mailing list to receive all the documents you generate on vetiver and its use in the country. The communications plan or awareness campaign should be adapted to each type of beneficiary group. The challenge is to conduct your communications plan simultaneously with each. Aim at four segments of the active population discussed below:

- Vetiver users and direct beneficiaries;
- Private businesses;
- Local officials; and
- Ministries, donors and professional associations.

Vetiver Users and Direct Beneficiaries

The first group, by far the largest and the most important, is the rural farmer and village associations. These are the most strategic groups to reach along with adjacent schools, extension agents and model farmers. To reach them, use a community-based, participatory approach. Hold meetings. Find out their main environmental, agricultural and disaster-mitigation issues, and how they seek to resolve them. Be

prepared to introduce several techniques, including vetiver. Use individuals who are good at village-level mobilization to conduct these early meetings.

It is best to have a catalyst to introduce vetiver at this level such as a village-level project, a main event such as an “earth day”, or a road rehabilitation activity. The village has to feel the need for a vetiver project. Be prepared to show pictures, give a slide or portable-computer presentation of how vetiver is used, and provide simple handouts in the local language on how vetiver has benefited others in the same situation.

Private Businesses

The awareness campaign for the second group centres on private businesses, nurseries, seed producers, essential oil processors, transporters, people with land looking for an investment idea, and business associations. It focuses on ways to develop and help create the market for vetiver. Use illustrative cost estimates and reports on testing experiences. Provide onsite training visits, conferences and technical presentations.

Local Officials

The third group includes local officials in the regions where vetiver has the best chances of assisting soil erosion campaigns or addressing other particular problems. Visits, discussions, slide shows, demonstration sites, and presentations on how vetiver can give their locality a competitive edge are very useful. Local officials have to see the political advantage to their region before they commit to supporting a vetiver program. This legitimate concern is to be addressed in the communications strategy.

Ministries, Donors, Professional Associations

Technicians and decision makers at the level of ministries (agriculture, forestry, environment, land planning, public works, transport), professional associations (order of engineers, agronomist associations), and donors are the fourth target audience of a communications strategy. This is the hardest group to reach; many have set ideas, are not risk takers, and are comfortable with what their group has done before. One way to reach this group is by participation in technology seminars, conferences and workshops. You can issue press releases, set up demonstration booths and distribute books and brochures. Repeated visits to ministries and donor offices are a must.

Partnerships

Get partnerships established with NGOs (i.e. Peace Corps, UN Volunteers), extension services, environment projects, students and teachers at local schools, professional associations of engineers, agronomists and rural development specialists. Most important is the support and understanding of people in the private sector. It has been the experience in several countries that giving the lead to government ministries or research institutions have not produced the best results.

Newsletters/Mailing Lists

Establish a network among all partner organizations, individuals and ministries. Use electronic newsletters as a way to maintain communications among all these interested parties. Appoint one person to gather copy and to edit a newsletter that is Internet-based. Keep the text short and crisp, and send it regularly. For those who cannot be reached by email, fax the newsletters and as a last resort, mail them through the post. The newsletter mailing list should be expanded continuously.

Reporting

Finally, to expand the information network, it is good practice to prepare a report of the year’s activity, lessons learned, and above all to record the program with cameras for the first couple of years. The vetiver network would like to receive reports and pictures. The reports can be used for further extension

and sensitizing groups in other areas. Using a digital camera facilitates transmitting progress and success pictures to people in the network. Put a digital camera into your planning budget.

Assure a Readily Available Supply of Plant Material

A sound vetiver strategy requires planning for a surplus of plant material. The need for plants during every planting cycle almost always exceeds supply. We recommend promoting at least three types of plant material sources:

- Private nursery and growing fields of vetiver to supply the plant in clumps or plastic bags;
- Roving nurseries to supply on-the-spot replanting material;
- Small plots in the gardens of people committed to the technology – for multiplication, gifts, starters, experimenting, practice and testing.

Nurseries

Nurseries are established in well-watered, sandy soils and run by professionals. Where the cultivation of vetiver for essential oil exists, the producers can be enticed to provide cut clumps as starting material. Nurseries are encouraged to prepare plants in three forms: clumps, bags or individual tillers. As a basic multiplication technique, the nursery multiplies from its primary source by in-ground planting, not potted planting. Original tillers are to be planted 30 cm on a square in rich, loose soil. A warm, wet climate generally allows a multiplication rate of about 30-60 tillers per clump over a six-month period. The nursery will use part of the multiplication stock to put plants in polythene bags and part to be sold as tillers (2-3 shoots per tiller) for direct planting. Generally, the aim is to have several hectares in continual production so that every month as plants are taken from the nurseries, five to six times the amount can be replanted for multiplication and expansion.

“Roving” Nurseries

“Roving” nurseries or temporary multiplication centres are recommended for rural roads, hard-to-reach watersheds and other isolated spots, where established nurseries are far away and the cost of transport is high. Transporting plant material is one of the costliest links in the vetiver technology chain, which is why the onsite nursery is so important. The roving nursery was an extremely useful implementation tool in Madagascar. It allowed for rapid deployment of resources to isolated areas for short periods of time, and reduced overall cost of material by about 20%. A “roving” nursery is one that is established close to the planting area by a professional nursery person for a particular planting season. It is a temporary multiplication centre that has easy access to soil, water, labour and land. The plants multiplied in this nursery will equal the approximate number of plants needed for the site. Tillers or clumps are brought to the sites, and then a speedy production cycle is used. We recommend that all soil erosion applications of vetiver be planted from polythene-bagged plants rather than newly separated tillers. While this may increase overall costs, it ensures immediate protection of hillsides and roads for each forthcoming rainy season since the plant no longer goes through its dormancy phase.

The following steps are recommended for the roving nurseries:

- **Soaking:** To accelerate rooting, place tillers which have just been separated from clumps into a cow-tea bath for a period of 7-10 days (*pralinage* in French). The cow manure juice should cover the root and crown section of the plant. New white roots will emerge. Transplant these directly into polythene bags, or plant directly in hedgerow. Cow-manure bathing eliminates the browning phase that vetiver goes through when multiplied.

- **Use cow rather than bull manure:** Female manure has a greater concentrate of the hormone needed to stimulate new root growth. Do not let plants soak more than 10 days unless you add soil or dirt to the bath.

- **Quick rooting:** Dig a trench approximately 40 cm wide and 30 cm deep; insert a plastic sheet along the length and up the sides to form a watertight reservoir. Fill the trench with 10 cm of the cow tea

and soak the tillers upright. Make several of these so there is a continuous amount of available tillers for transplanting.

- **Transport:** For access to hard-to-reach mountainous planting areas, transport the tillers (which have already rooted from the soaking cycle) in baskets lined with plastic, allowing the roots to remain soaking in small amounts of cow tea. The baskets are head carried to sites, and can remain unplanted for up to two weeks while in the basket.

Garden Plots

People responsible and involved in the vetiver diffusion program need to be users, practitioners and experimenters. The best way to do this is to have small production plots right at home that can become the source of gifts of vetiver to anyone who comes by for information or suggestions. Prepare vetiver plants in nice pots to give away at every occasion, dinner parties, Christmas, birthdays. With every give-away, encourage the recipient to multiply the plant and the technology. Provide them with little written documents explaining its uses and benefits.

- **Transporting and unloading vetiver:** Plants are transported either as clumps, tillers or in bags. Easiest to transport are clumps.

- **Clumps and polythene-bagged plants:** They last the longest in transport. Clumps should be uprooted and transported so they can be watered daily. In a loaded truck, the transporter must agree to water clumps so the bottom plants get soaked during transport. We suggest clumps be packed in jute bags. Leaves and roots should be trimmed (leaves 25 cm; roots 5 cm).

- **Polythene-bagged plants:** They should be packed in crates if possible or laid horizontally. This method is all right if the packing and transport time does not exceed two days.

- **Tillers:** They should be bunched together in clumps of 10 or 12, and should be trimmed the same as clumps. They can be transported bare (which makes them easier to water) and stacked neatly. Cover with wet burlap to protect from sun and evaporation.

- **Timing:** Minimize the time between transport and replanting. Clumps can last up to two weeks, but every day left unplanted decreases the survival rate. Do not store the bagged plants in a shaded area. They need sun and water.

- **Moisture:** Do not transport bagged plants when the soil in the bag is wet. Bagged plants transport best when dry for three days. If possible do not water the nursery for three days before loading and transporting.

- **Unloading:** Unload plants in clumps or bunches as near to the planting site as possible. Handle plants as little as possible. Arrange for watering plants if they sit more than one day.

Apply the Technology Correctly

For a vetiver diffusion program to succeed, the technology has to be applied correctly, and for this to happen, the program needs a core of five or six well-trained professionals (engineers, agronomists, foresters, nurserymen) and a larger group of on-the-ground extension agents. The first group provides training, field support and networking at the implementing organization level, the second works directly with groups who grow, plant and care for vetiver at the base. The second group is best recruited from a pool of recent graduates of agronomy, engineering or forestry schools, NGOs and rural development projects. The younger, more dynamic and eager-to-learn individuals tend to be the best kinds. As individuals or members of an organization, they must be ready to live onsite, particularly during planting season and immediately after it. In Madagascar we used an apprentice (*expert junior*) program that placed recent graduates in villages to work on agribusiness efforts. Some were assigned to work promoting vetiver full time, others filled in when needed.

The majority of implementing organizations should be companies that do road construction, associated agroforestry contracting services or NGOs. The most effective way to assure that these organizations will implement the technology correctly is by providing them with detailed instructions of what is expected at every step of growing, planting and caring for vetiver. This is done through detailed and carefully written contracts. Regular supervision is important to be sure planters understand and apply the technology correctly.

Selecting Plant Sites

Experience in Madagascar proved that furrows or trenches should be dug 25 cm deep and about 20 cm wide in all areas where the vetiver is to be planted in hedgerows. Add approximately 1 kg of animal fertilizer or compost per linear meter. Mix the soil well. Have watering cans handy. The best time to plant is during the wet season. Prepare the soil and trenches for each day of planting.

- When planting along masonry works (along culvert exits, bridges, causeways, gabions), cut the furrows 4-5 cm from the masonry and along where the fill dirt meets the concrete. In this way, the vetiver can bond the two mediums as it grows.

- Where an embankment, hillside or cut is very steep, dig individual holes rather than furrows for each plant 10 cm apart, horizontally at about a 45° angle. This way the vetiver (preferably from a potted source) can fit in as a plug. The roots growing downward will protect the cut from erosion. On river embankments where flood water moves at high speed and there is a curve, dig cross furrows in a quadrant pattern, so that the vertical hedge can slow the flow and reduce the currents. Vetiver can survive for several months underwater as long as leaves protrude.

- Plant vetiver perpendicular to the flow of water. Hedges should be planted on the upstream and downstream sides of a cement crossing or bridge pillars to stabilize the footings and gabions. This prevents water swirls that loosen the soil under the cement structures. Space the lines one to two meters apart, depending on the slope.

- Always start from the low end of a hillside, and move upward as plant material and time permit. Avoid putting plants under bridges or shady areas since vetiver likes sun.

- Along masonry drains, plant a row of vetiver just uphill from the lip of the drain to prevent silting.

- Where large erosion gullies have been formed, dig the furrow at the base of the gully, and work your way up with successive rows several meters apart. To stabilize the plant during the rainy season, drive a wooden stake through the “crown” of the plant.

- On downhill curves, dig short furrows to plant vetiver in a herringbone pattern so that the water is directed from the road surface to the inside drain ditch, in order to reduce the speed of rushing water. The hedge can grow slightly into the road surface in order to increase the catchments of the herringbone pattern.

- On sites where fill dirt has been excavated, begin long rows of vetiver hedges from the base of the excavation site, upward to prevent further erosion. Ensure that the contour is respected. Place double or triple rows of vetiver along the lowest drainage points of the zone. Constantly check the selection and digging of the furrows as they are being dug. Have a supervisor outline the exact path the planting furrows are to follow along the slope’s contour to facilitate the work of those who dig the furrows.

It is important to remember that vetiver technology allows one to experiment. You might not get it right the first time, but at least you can modify and change the application points as the water runoff changes course.

Estimating the Number of Plants Required

For the first season, make broad estimates of plant needs. Use the rough number of 10 to 12 plants per linear meter (plants can be either as tillers or in polythene bags) or approximately 11 000 plants for every kilometer of hedgerow planted.

After the first year, estimates have to be more precise. For each site where vetiver contour hedging is proposed, establish an onsite planting matrix or *schéma d’itinéraire*. For a road site, the planning/planting matrix table will include for each kilometer (on the column side of the matrix) a

breakdown of the road by 50-meter lots, and (down the row side of the matrix) a list of all roadside items (e.g.: road bed left and right, bridge, access ramp to bridge, culvert, embankment left and right, ridge, gully, drain ditch, retaining wall, gabion, masonry ditch, cement crossing, downward curve, raised road-bed, etc). For each section of the road that needs to be protected, the engineer, vetiver specialist or program manager estimates the number of linear meters of vetiver hedge needed to protect the engineered work, embankment or fill site. Once recorded and reviewed by the potential planting entity, the planting matrix is finalized and inserted as part of a planting agreement or contract. The matrix is used to plan the budget, estimate the number of plants, people and time required to complete the planting cycle. But most important, it helps people review the work to be completed and establishes the base for agreement on the priority zones and areas where efforts will be concentrated. When working on the planting matrix, don't forget to look far uphill beyond the road site to check if runoff from heavy rains might not eventually come from areas far from the road, and which may need to be deflected using vetiver hedges. Count on planting time, transporting plants and watering to be greater in these areas than those adjacent to the road.

Replacement requirements over the course of a year vary from 10 to 30% due to the loss of plants that dry out, are eaten or washed away. Calculate this requirement in the plant estimates.

An adapted matrix is used to plan a watershed protection activity, an agricultural terracing project or reforestation. The estimated number of vetiver plants needed is derived from the number of walked-through linear meters identified for each project.

Planting and Supervising Planting

After losing a high percentage of plants due to drying conditions, we recommend planting vetiver from rootstock in polythene bags over planting directly from tillers. There are exceptions, but generally the survival rate of rooted plants is higher (98% versus 75% for tillers). They add good soil to the planting area, require less water and are more easily fixed (by putting a stake through the root system), thus reducing the chances of washouts during periods of heavy rain. Based on recent experiences in Madagascar, we recommend:

- Spacing between plants should not exceed 10 cm (the space of a closed fist).
- Animal or organic compost should be mixed at the bottom of the planting trench.
- The crown of plant should be covered with soil, but not planted too deeply.
- The earth around each plant must be compacted ("heeled") and slightly lower than ground level so as to create a small depression or gully that will retain water. It is compacted hard to reduce erosion caused when heavy rains fall before the vetiver hedge has had time to develop. Avoid mounting of earth around plant leaves.
- Plants should be watered daily for three to four weeks if there is no rain.
- Mulch, cut vetiver leaves or cut grass should be put along planted trenches to reduce evaporation, maintain moisture and begin trapping eroding soils.
- On very steep embankments, putting a stake through the root system will stabilize plants. If the area is riddled with runoff, plant vetiver with the polythene bag, but cut out the bottom to allow roots to spread. Push a wooden pole or bamboo stake through the bag after it has been planted in the trenches.
- Contractors must have large bags on hand at the construction site. The controlling engineer could count used nursery polythene bags as a way to control the number of plants planted, and ensure no used polythene bags are left to the wind.
- The site or supervisory engineer must establish the planting schedule with the contractor. Planting vetiver should not begin until road construction and engineered works are completed.
- Five days after the award of the contract, the planting contractor needs to submit to the supervisory engineer the plan of where, how, with whom, equipment and tools are to be used for the work.
- Once the schedule and plan are set and work begins, the controlling engineer keeps a daily log of all activities of the day (the number of plants planted, number of meters dug, number of meters

planted, number of people on site, and observations). The contractor and controller must agree on plant and meter counts to ensure proper payment papers are processed.

- The controller assures that all of the planted material is alive, free of disease, watered and in good vigorous shape.
- The controller assures respect of the detailed operational plan indicating the number of locations of plants to be planted. Jointly with the contractor, he determines deletions or additions to the original planning.

Motivating Workers

We recommend talking to workers about vetiver and giving each worker a handout to keep on the virtues of the plant and how to plant it correctly. This effort increases their interest, quality of work and commitment to the program.

Follow-up Work: Watering, Replacing Plants, Weeding and Trimming

While this important phase is straightforward, it must be included in the contract of the implementing entity. Payments under the contract for planting vetiver should be spaced out over several phases (i.e. first payment when establishing the work site, second payment upon completion of 40% of the work, then 80% of the work, then 90%). Do not make the final payment (10% of the total contract) until three weeks after all planting is completed and the engineer or controlling entity has conducted a follow-up visit. The contractor must replace all plants that have not re-sprouted and those that washed away. Replacing dead or damaged plants is a must in order for the vetiver hedge to be effective and for the technology to have credibility. Implementing groups must aim and insist on a 100-% success rate as well. The contractor or village groups or another entity must be contacted to ensure that watering is provided to the vetiver hedge for three weeks after planting if there has been no rain.

Avoid making the mistake of not planning or providing for weeding, trimming and watering after the planting cycle. Weeding should be planned for about one or two months after planting, and preferably six months thereafter. When weeds grow near or along the crown of the plant, vetiver growth is seriously delayed. Shade prevents vetiver from growing. Weeds (if the furrows have been well fertilized) will grow more quickly than the vetiver.

Vetiver hedges should be trimmed to about 50 cm (knee-high) within eight to ten months of planting if the plant has reached more than a meter in height. After that, hedges should be trimmed once or twice a year. The leaves can be used as mulch, thatch and handicraft.

Conclusion

While Madagascar's vetiver program began as a small project which addressed a specific problem in two regions of the country, it expanded nationally because demand for its services came from other parts of the country and a network was established to meet that demand. The dynamics that ensued, in which demand for the plant and accompanying support services challenged the suppliers of plant material, technical support and researchers, have led to an expansion of the use of vetiver throughout the country. Experience shows that we cannot go into an area or a country and initiate a vetiver program because it is good and works elsewhere. The starting point is the demand rather than the supply. In Madagascar, we believe the critical mass point has been attained because demand and supply are now both growing and reinforcing each other.

On the Demand Side

The Ministry of Public Works has indicated that all road contracts will require a vetiver clause and that the plant is to be used to protect engineered works and roadbeds throughout the country. The Order of Engineers has included vetiver in its norms to protect roads, dikes and watercourses. According to the Order of Engineers, use of vetiver will be required in all terms of references where soil erosion is an issue. The European Union and the Japanese Development Agency require that road and irrigation

projects funded by them use vetiver where soil is threatened. Two World Bank projects (the livestock project and a rural infrastructure project) are using vetiver. CARE, Catholic Relief Services and the Worldwide Fund for Nature are using vetiver in the infrastructure projects they finance.

On the Supply Side

Seven private nurseries are now producing vetiver, some in large quantities (capacity up to a million plants a month). Eleven construction companies have experience in planting vetiver and using the technology successfully. Approximately a dozen NGOs produce vetiver for their members and for sale in the agricultural sector, and approximately 30 village-level associations have small nurseries to produce plant material for road maintenance and agricultural intensification. Training in vetiver technology has been provided to engineer associations, officials from the forestry ministry and staff of the extension service at the Ministry of Agriculture. Development organizations such as the Peace Corps have been provided with vetiver training and they now incorporate vetiver in the training of all volunteers.

The keys to reaching the point of critical mass are getting the right people involved, assuring a reliable source of supply and applying the technology correctly.