

Vetiver Grass: A Key to Sustainable Development on Bali

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Abstract: Ekoturin Foundation's East Bali Poverty Project (EBPP) introduced Vetiver grass to Bali in March 2000 as part of a comprehensive programme to reduce poverty and promote culturally sensitive sustainable development in impoverished mountain communities, prioritizing children. Vetiver grass proved the most effective means of preventing erosion on steep and sandy mountain tracks and in establishing organic vegetable farms on steep and barren land that could previously only sustain cassava and corn. Vetiver also became a powerful awareness tool in children's integrated education programmes, both in developing their organic vegetable school gardens and creative handicraft lessons from the roots and dried grass.

The children soon understood the many functions of Vetiver grass for soil stabilization, erosion control and source of mulch in developing sustainable organic vegetable farms. They eventually became their parents' teachers when organic farming cooperatives were established in the same four hamlets in 2003 in large central gardens provided by the respective communities: illustrating how Vetiver could open up the potential of their huge tracts of land – now only producing cassava and corn.

Initial research in Desa Ban illustrating the different growth patterns of Vetiver in varying situations enabled EBPP to promote Vetiver to the general public and act as consultants, thus promoting Vetiver benefits to the end user. Nurseries in the mountain project and in Denpasar, as well as a basic information centre soon ensured many Vetiver clients throughout Bali.

Dissemination of Vetiver information from evidence of field trials, photographs, examples of children's handicrafts, newspaper articles, the internet and word of mouth from satisfied customers has seen the growing acceptance of Vetiver throughout Bali. Vetiver can succeed throughout Indonesia, once people can see examples, as the children in our projects have illustrated and through our research oriented developments and their motivation to mould a better future.

Key words: Vetiver; poverty; erosion; children; sustainable development; organic farming;

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1 INTRODUCTION

Bali, renowned as a tourist paradise with lush rice fields and golden sand beaches, has a very different side that few tourists ever see: abject poverty in the hot and dry mountainous north-east of the island, offering poor prospects to dozens of villages for improving the lot of future generations.

Thousands of families eke out a subsistence living on this arid land, farming cassava and corn, the only crops they know that can survive in such harsh land conditions of steep and barren mountain slopes covered in tens of metres of volcanic ash, with no rivers for irrigation.

Most live in abject poverty due to their inability to cultivate any profitable cash crops due to the severe land erosion from torrential rains and high winds, preventing essential top-soil and micro-organism development. Cassava and corn, the staple for nearly all these families, have little overall nutritional value

and fetch a very low price in an already saturated market. Another obstacle to development is the isolation of these villages; requiring 3-4 hours walk to the nearest market, water sources and health centres.

In 1998, East Bali Poverty Project (EBPP) founders identified Desa Ban (Ban village) on the north slopes of Mounts Agung and Abang in Karangasem Regency, East Bali, as the most impoverished of these villages, virtually cut off from the outside world. Participatory community surveys identified severe malnutrition and endemic iodine deficiency disorders (IDD), the highest in Indonesia (Udayana University, *et al*, 1997/98) and a direct result of a diet deficient in nutrients, exacerbated by a staple of cassava which, in fact, blocks iodine absorption to the body.

The major challenge was to find a long-term solution for sustainable development, prioritizing nutrition: how to grow vegetables in this hostile terrain that could provide the essential micro-nutrients required for good health, especially for pregnant mothers and young children. It was necessary to be able to establish pilot organic learning gardens that could flourish despite soil erosion. The ultimate goal was to convert 5,000 hectares of steep volcanic land on these arid mountain slopes into an eventual nutritious food forest, similar to what had possibly existed before the 1963 eruption of Mount Agung. However, some means of stabilizing these slopes was required before proceeding with a sustainable organic farming program.

Vetiver grass (*Vetiveria zizanioides*) was identified as the only ecologically and economically viable solution, research indicating that once established it could facilitate formation of terraces, thus forming a barrier to contain the up to 40cm soil erosion encountered each year. The first 83,000 Vetiver slips, bought in March 2000 to protect the verges of over 5km of dirt roads to facilitate year-round access to remote health centers for 240 isolated families, performed well, rapidly strengthening the 60 degree sandy verges to be found along much of the road alignments. Monthly measurements of Vetiver growth on three different mountain tracks provided such encouraging results that EBPP bought 200,000 more Vetiver slips in December 2000 to start nurseries in each hamlet and initiate terrace development for pilot organic school gardens. In February 2001 Vetiver education was incorporated into the school curriculum and at the same time introduced to the communities, whilst simultaneously promoting the benefits of Vetiver in the local media and charity bazaars throughout Bali. Apart from this essential benefit of stabilizing slopes, it was quickly found that Vetiver had several other uses of considerable value to the development of the community, and these are summarized in the paper.

2 THE EAST BALI POVERTY PROJECT: THE BACKGROUND

2.1 Key Barriers to Sustainable Development in Desa Ban

The East Bali Poverty Project (EBPP), a non-profit foundation, was established in 1998 at the peak of the Asian economic crisis, with a quest to find the poorest communities on the island and identify ways to initiate sustainable improvements to their lives, prioritizing children. The overall aim was to establish model projects whereby impoverished and isolated villages, the key stakeholders, could become self-sufficient through learning appropriate methods to maintain good health, provide their own nutritional needs and eventually how to take ownership and replicate these programmes to ensure sustainability for future generations. Desa Ban was identified as the most impoverished village in Bali (Fig. 1).

Participatory interviews conducted with 1,056 of the 2,100 families living in the 19 hamlets, revealed the following problems:

- Existing market and health centre 3-4 hours mountain walk;
- Water supply 1-6 hours mountain walk, depending on hamlet and which spring they used;

- Widespread acute iodine deficiency and malnourishment;
- Widespread illiteracy due to lack of active government schools within walking distance;
- Poor health due to remoteness of health centers and lack of knowledge of importance of nutrition and hygiene.

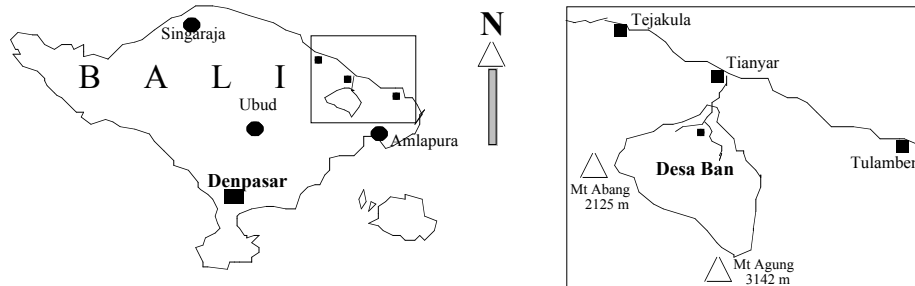


Fig. 1 Map of Bali showing Desa Ban (Ban Village)

The main obstacle to their development was lack of any road infrastructure or transport: 95% had never left their village. The 10,000 population of Desa Ban live in nineteen hamlets scattered over 50 sq. km. of Mounts Agung and Abang from approx. 250-1,500 meters altitude. Only the six hamlets nearest the bottom of the mountain can be reached by road; the other thirteen are remote from each other and can only be reached on foot or by strong motor cycle.

With such a long list of deprivations, it was clear that key problems such as roads, water supply and provision of health centers were not within the capabilities of a new foundation, yet that the common threads linking the community's problems were illiteracy, malnutrition and a complete lack of motivation, as they really had no choice or chance to change.

With a mandate to help, yet with promises of no handouts such as money or rice, EBPP team in November 1998 asked the communities in the eight most disadvantaged hamlets (identified from participatory interviews) to state their main desires for change. The unanimous response of seven hamlets was "children's education as a foundation for a better future". The eighth requested training in better farming techniques to enable them to grow crops other than cassava and corn on their steep and dry land. These aspirations provided the formula for initiating sustainable development programme design and an inspiring and productive collaboration began with the neediest hamlets.

Goals (Fig. 2) were agreed with the community, clearly showing the indispensable link between education and organic vegetable farming. It was essential that all programmes must become models that could be replicated, not only in Desa Ban, but also throughout Indonesia. In addition, they should not require any investment by the community, except their full participation and motivation.

2.2 Education for sustainability

Integrated education curricula were designed, including comprehensive programmes in nutrition, hygiene, sanitation, primary healthcare creative arts and self-sufficient organic farming, introduced for the first time in December 1999 in Bunga hamlet. Vetiver (*Vetiveria zizanioides*), which had been clearly identified as the most effective "hedge against erosion" was not to enter the project until almost a year later,

mainly due to budget constraints, but also because it was important for the children to understand soil improvement techniques first. Organic material had to be available, provided by children bringing cow manure from home. The community provided a level area of only 100 square meters adjacent the children’s school for trials to see just what would grow, with sufficient nutrients in the soil. Organic worm castings fertilizer was added at the time of planting seedlings, resulting in an impressive yield from the tomatoes, carrots, broccoli, cabbage and lettuce in the first trials. With such promising results, local donors were soon found to fund our first batch of Vetiver grass in March 2000.

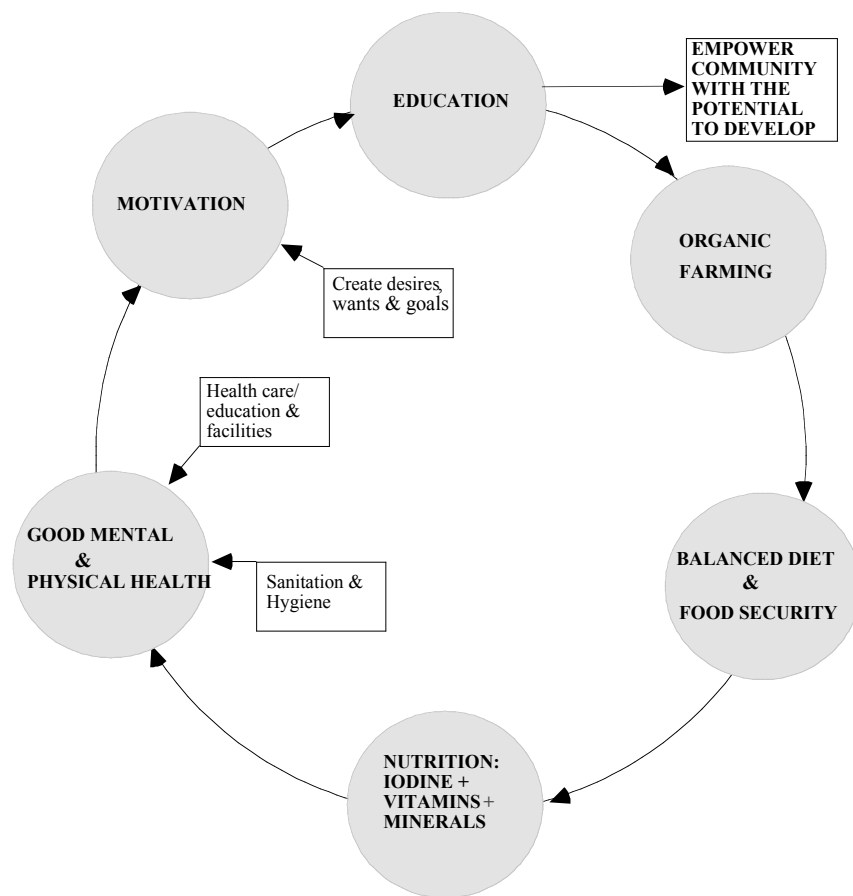


Fig. 2 Goals Diagram

Since launching the first integrated education programme in 1999, more than 250 children aged from 6 to 14, in the six most remote hamlets in Desa Ban are now literate. Each child gets a nutritious meal every day at school, including a glass of milk, a multivitamin tablet, fish, eggs, tofu, rice and vegetables – bought at the nearest market over 20km away. Since 2001, most of the children’s daily vegetables have been harvested from their organic vegetable school gardens, with many keen parents observing and enthusiastically helping.

3 INTRODUCING VETIVER TO COMBAT EROSION IN DESA BAN

3.1 Background

EBPP first identified Vetiver grass in 1998 as the best option to pilot land stabilization on the steep and sandy mountain slopes for trials of improved agriculture. Our only source of reference, Internet research, showed many successes round the world, yet no examples were available in Indonesia. On the contrary,

agricultural experts in Bali who only knew Vetiver by its roots, akar wangi, used to produce the aromatic Vetiver oil, expressed skepticism. Some suggested we should teach the communities to make better use of the cassava, as it was impossible to cultivate vegetable farms in such hostile terrain: no proper soil as such in the area, only a combination of volcanic sand and gravel, which is very porous, liable to erosion and poor in organic matter. Encouraging the communities to develop income from cassava was not a viable option due to the health problems created by a staple of cassava, a goitrogen, which blocks absorption of essential iodine to the body. The key to solving problems of nutritional deficiencies in the region was to ensure that alternative crops could be grown as a staple, potatoes being the community's choice.

3.2 The first Vetiver trials in March 2000

Vetiver was first purchased in March 2000 to stabilize steep soil verges and prevent erosion on three key access tracks, over five kilometers in length, in the south of Desa Ban on the arid northern slopes of Mounts Agung and Abang at altitudes from 900-1,300 meters. Recently strengthened by EBPP, using appropriate technology, these new roads provided the first ever vehicular access for hundreds of families to hospitals, markets and other essential facilities over 15 km. away – a trip that was previously done on foot. Without any erosion control on these verges, many on the edges of steep slopes, the road improvement would certainly not be sustainable. With a very limited budget - all EBPP programmes are totally funded by charitable donations - we took a calculated risk and bought 83,000 Vetiver slips from the only source we knew, Flores in East Indonesia. 80,000 were allocated for the road protection and 3,000 slips were retained for trials in the three hamlets

3.2.1 Stabilizing steep mountain roads

The 80,000 slips (ideally we needed over 240,000) were planted on verges of selected sections of the three different dirt roads that posed the greatest threats from erosion: the steepest sections with sheer drops of up to 60 degrees, where torrential rainwater runoff had caused land-slips in the past.

Time was the factor causing most concern, knowing that the Vetiver had been dispatched five days ago and we were only weeks away from the start of the dry season. Full participation to plant the grass was therefore requested from the 250 families who would benefit, providing an ideal opportunity for introducing Vetiver to them in preparation for eventual land improvement.

Planting, using sharpened bamboo sticks to force holes into the stiff volcanic gravel to insert the slips, was completed in three days. The rains stopped two weeks after planting and with no means of watering the grass or knowing what precautions to take for optimum growth, EBPP team just left it to grow.

Advice during a field visit by Mr. Ed Balbarino from the Philippine Vetiver Network in May 2000 guided EBPP team on research, monitoring, maintaining and transplanting Vetiver. He also honored the project by initiating and jointly hosting East Bali Poverty Project's first Vetiver Conference with David Booth on 31st May 2000. Research results are reported in Section 4 below.

3.2.2 Introducing Vetiver to isolated communities through children's education

The 3,000 Vetiver slips kept back from the road project were divided between three of the most isolated hamlets in the region, to initiate small case studies illustrating ways that Vetiver could effectively support model organic farming projects leading to eventual sustainable development. Knowing that the introduction of new concepts to a pre-literate population takes time and sensitivity, the trials were conducted through the children of newly inaugurated education programmes. Their Vetiver education had started a few days earlier with the task of daily maintenance and replanting of displaced slips on the road verges, disturbed either by rain or wind erosion.

In Cegi hamlet, EBPP local school was used for the most effective experiment to illustrate the root and slip development of Vetiver, by planting a single slip in a 120 centimeter high pot the children made from bamboo, with a plastic lining to be able to view root growth. In Pengalusan, the most isolated hamlet, Vetiver was planted on 70 degree sloping sand verges which previously eroded almost daily.

These trials were the basis of our research and development from 2000 to 2001.

4 RESEARCH AND DEVELOPMENT FROM VETIVER TRIALS 2000-2001

Results from initial research from the Vetiver bought in March 2000 verified that Vetiver would be an indispensable element in East Bali Poverty Project's sustainable development planning. It was clear that Vetiver could grow well in sandy volcanic soils at high altitudes and that neither extensive watering nor fertilizer were needed to stimulate growth in the absence of organic matter. The experiments conducted in different hamlets enabled the communities to participate in the learning process, setting the foundation for eventually establishing local nurseries to provide sufficient Vetiver to transform up to 5,000 hectares of almost barren land into productive local businesses over the next seven years.

4.1 Monitoring Vetiver growth on mountain roads

Expert advice from Mr. Ed Balbarino in May 2000 helped EBPP team to develop procedures to record monthly measurements of Vetiver height and slip propagation on the three different mountain tracks: Bubung (saddle of Mounts Agung and Abang) to Daya; Daya to Cegi; Daya to Bunga.

Each road section was divided to 100 meter lengths and mean measurements of number of tillers and Vetiver heights were recorded on the same day of each month. The amount of shade was also recorded in order to assist with future planning of nurseries. Soil samples were also taken in all three areas to verify soil properties, indicating all were similar with Ph values between 5.7 and 6.5. Table 1 shows monthly measurements from June 2000 to May 2001 on representative sections.

Table 1 Monthly records of tillers and Vetiver grass heights on three mountain tracks

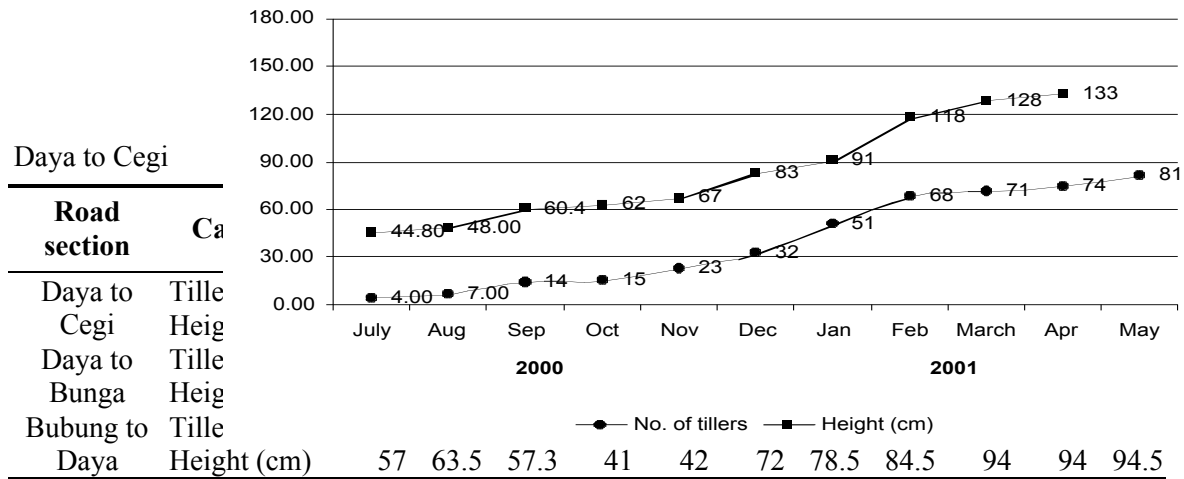


Fig. 3

Graph of Vetiver growth on Daya to Cegi track June 2000 – May 2001

The results showed that tiller growth in the three areas show surprising differences in rates: those on the steep track to Cegi hamlet far out-performed the other two areas even though they had the most shade. (Fig. 3). The conclusion we drew was that the tree shade in Cegi protected the Vetiver from the severe heat, thus slowing down soil-water evaporation.

4.2 Children’s research in Cegi hamlet: Vetiver enters educational curriculum



The Vetiver slip planted by the children of EBPP Cegi School provided a daily source of amazement, not only for the children, but also their parents. Watching a leaf of grass grow in sand, with new shoots coming up almost daily after the first month and regularly observing root growth through the plastic sheath, was a phenomenon that changed the perceptions of a whole community: Vetiver was accepted.

In May 2001, when that single Vetiver slip, planted in late March 2000, was taken out of its bamboo pot, root and slip development were beyond all expectations:

- Roots extended 2.2 meters, burrowing over one meter into the compacted volcanic gravel below the pot;
- The slips numbered at least 145.

The whole plant was initially kept for display and illustration to the general public in Bali, but unfortunately both the roots and the leaves had to be used in June 2001 for the children's creative handicraft classes, part of their school curriculum. (See photo 1)

This great success illustrated to the community and EBPP team that cultivation of Vetiver for erosion control in the sandy mountain environment to initiate land improvement for organic farming was now firmly established as a key element of EBPP's sustainable development programmes.

4.3 Stabilizing steep soil verges in Pengalusan hamlet

By March 2001, dense green Vetiver had reinforced the slipping sand on the 60 degree slope rising up

Photo 2 Vetiver stabilizes sandy slope



from the main access track within Pengalusan hamlet, with community housing perched precariously at the top of the slope. (See photo 2) By June 2001, many families had already started splitting Vetiver culms to stabilize land around their own homes. It was clear here again, as in Cegi, that once Vetiver stock was available to start with land rehabilitation for developing pilot organic gardens, the community would not need much more familiarization of Vetiver.

5 ORGANIC GARDEN DEVELOPMENT ON BARREN LAND

5.1 Establishing nurseries on barren slopes

Success with the initial Vetiver trials encouraged us to buy 200,000 more Vetiver slips in December 2000 to establish nurseries, initially for establishing organic school gardens in the four hamlets benefiting from EBPP education programmes. The communities in the hamlets of Bunga, Cegi, Pengalusan and Manikaji provided steep and unproductive plots of land near to the children's schools for nurseries and school gardens. The aim was to illustrate how steeply sloping barren land could be transformed to fertile terraces, once Vetiver was established. By late March 2001, Cegi nursery was ready to be harvested and the children were the first to establish their 400 square meter school garden, carefully cutting one-and-a-half meter wide terraces on the barren 20 degree slopes. Double rows of Vetiver in zig-zag pattern were carefully planted 15-30 cm. back from the terrace face, putting aside the cut roots and grass in preparation for their handicraft classes. The Cegi nursery has continued to flourish, recently providing stock for the terraces of the 700 square meter community garden established in February 2003.

5.2 Children's new school garden in Cegi becomes example for sustainability

The success of the Cegi school garden in 2001, growing fifteen vegetables, sowed seeds of enthusiasm in the community to such an extent that they requested the garden be handed back and provided another

Photo 3 Cegi children's school garden



location, this time with more than 30 degree slope. The experienced children rapidly prepared their new garden, this time using simple bamboo borders as initial borders to contain the soil, planting Vetiver around the perimeter. When the bamboo rotted, Vetiver was firmly established to contain the soil and provide a ready source of mulch once seedlings had been planted. Now firmly established as the model organic garden in the village, complete with worm farms, nursery and rainwater collection reservoirs it is the first vegetable garden in the region with a year-round supply of nutritious vegetable. (See photo 3) The garden is also the training centre for other programmes and the newly trained farmers, paving the way to future self-reliance and food security.

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5.3 Community learning gardens (See Photo 4)

Lessons from their children had motivated farmers in all four communities to ask for training so that they could eventually start their own kitchen gardens, with aspirations to eventually convert much of their

Photo 4 Vetiver terraces in Manikaji garden



cassava and corn fields to organic vegetable gardens: each family has an average of two hectares of land. Farmer's cooperatives were established in early 2003 and training of almost 100 cassava framers started, initially in the children's gardens. The children were the teachers, guiding their parents through all the steps of organic farm development: land improvement; planting Vetiver; establishing terraces; building the infrastructure of worm farms, nurseries and water reservoirs. EBPP program provides for minimum two years training, or until such time as all are proficient in the preparation, soil improvement, planting, harvesting and seed saving. Successful harvests of potatoes, carrots, tomatoes and many green vegetable in mid-2003 have prepared the farmers for one more years training, to understand principles of crop rotation, meaning that in 2004 each should be ready to start their own kitchen garden. EBPP will provide each farmer with a "starter pack" of Vetiver, organic worms and seeds on the condition they return the same quantity plus 15% within a year, for passing on to another group of farmers.

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6 OTHER SUSTAINABLE USES OF VETIVER IN DESA BAN

6.1 Handicrafts from roots and grass provide education and recreation

The first harvest of Vetiver grass in 2001 enabled EBPP team to integrate creative handicrafts into the children's school arts curriculum. Learning about the aromatic roots, many chose to produce simple fans, whilst others experimented with making drinks coasters, dolls, animals and simple balls. Dried grass was used to make simple dolls and hand-brooms. Bearing in mind that prior to joining EBPP's education programmes, recreation for children in these remote hamlets was almost non-existent, not even engaging in typical children's sports. Within weeks of the children starting, parents were joining the handicraft classes, many seeing the potential in the future for developing cooperatives to sell their handicrafts.

Knowing that there is a very active industry in Indonesia for many kinds of handicrafts using *akar wangi* (Vetiver roots), especially place mats, coasters and lamp shades, many of EBPP's foreign donors who have seen the children's work are already seeking overseas outlets for when sufficient stocks are available. Training will certainly be required to ensure they produce top quality products relevant to trends in the market.

6.2 Protecting mountain springs from erosion in Water Resources project

Vetiver is now being used as a bio-engineering solution to protect remote mountain springs which provide the only source of water for over 1,500 families. They are now being developed as part of the water resources project which started in August 2002. Most of the spring eyes emanate from the faces of hillsides, and once developed with concrete spring boxes, need extensive protection to stabilize the surrounding sandy slopes from erosion by torrential rains. In many cases we must divert potential water courses, deciding in these cases to use Vetiver slips which have been reared in 10 cm. polybags, to ensure sufficiently rapid growth before the onset of the rains. Organic worm fertilizer, provided below the roots at the time of planting, helped accelerate the growth so that within two weeks of planting new tillers were already growing.

6.3 Effective source of mulch for organic gardens

During the first organic garden trials in 2001, one of the biggest problems was the rapid drying out of the soil due to the intense sun and strong winds. The sparse ground cover in surrounding areas meant it was almost impossible to cover the soil with anything except complex bamboo shade structures. However, once the Vetiver had grown sufficiently it then became second nature to the children to trim the Vetiver borders around their individual gardens to provide a sufficient source of mulch, resulting in much more prolific harvests.

7 DISSEMINATING INFORMATION ON VETIVER BENEFITS

7.1 Vetiver Conference in May 2000

This conference was initiated by East Bali Poverty Project team to coincide with the visit to Indonesia of Dr Edwin Balbarino, the Founder of the Philippines Vetiver Network. The purpose of the conference was threefold: (a) to advise and assist EBPP team and the local community in getting optimum benefit from Vetiver Grass shoots planted on steep mountain slopes in East Bali through the extensive knowledge and experience of Ed Balbarino; (b) to bring together interested parties in Bali from Government, NGO's and private sector with a vested interest in the long term benefits of using Vetiver grass for both agricultural and non-agricultural purposes; and (c) to initiate the East Indonesia branch of the Indonesian Vetiver Network as a forum for sharing knowledge for the greater benefit of Indonesian farmers primarily by improved soil and

water conservation. All who attended were learning for the first time that Vetiver had other uses apart from producing aromatic oil. Most were keen to keep in touch with EBPP to learn more once we had examples to show and stock to sell.

7.2 Promotion through bazaars, media and internet

Indonesia is one of the only developing countries in the Asia Pacific region that does not actively promote Vetiver for agricultural purposes. Since 2001 however, when EBPP started publicizing Vetiver through local bazaars, articles in the local and national media and the internet, great interest has been generated. Nurseries we developed both in Desa Ban and the Denpasar area have been the first point of interest for many potential Vetiver clients, resulting in regular sales and consulting projects to help with a wide range of erosion problems. One of the reasons for our success has been the examples we could show, some in photographs, others directly on the project: tangible proof of how Vetiver can improve agriculture and stabilize land in a wide variety of situations. Many satisfied clients, in both Bali and Lombok in East Indonesia, regularly come back for more Vetiver and recommend the Vetiver solution to friends and colleagues.

7.3 Vetiver Information Center

EBPP presently provides initial information and advice from our Denpasar office, where potential clients and donors can see many photos as well as a wide selection of handicrafts produced by the children in the education programs. Samples of mature Vetiver in pots line the entrance to our office, but we are not yet able to provide the level of information and service we would like due to limited space and resources.

8 CONCLUSIONS

Vetiver has played a key role in helping East Bali Poverty Project achieve the first stages of the food security and sustainable organic farming goals, bringing the four beneficiary hamlets much nearer to self-sufficiency and sustainable social and economic development, the greatest benefits being to the children. Key developments since EBPP introduced Vetiver to Bali in 2000, with tangible examples for children, farmers, Government departments and the general public, can be summarized as follows:

- Erosion control, bio-engineering and handicraft development are all now being seen by the community as an integral part of their aspirations for the future;
- Model projects that are now taking shape in all aspects of the communities' lives are forming a solid foundation for many further program planned incorporating a wide range of other sustainable improvements, including trees, herbs, spices, beekeeping, Vetiver home industries and educational courses for schools and farmers groups;
- The Desa Ban farmers who are now learning sustainable organic farming techniques will eventually be the trainers for others farmers groups, school children and government departments in agricultural improvement in barren land, with Vetiver as the first step;
- The dissemination of information on the potential benefits and promotional tools used by East Bali Poverty Project have created a new awareness to the Indonesian public on the potential of Vetiver as an inexpensive and sustainable solution for many aspects of daily life, verified by the many Vetiver clients throughout Bali and Lombok.

- The Vetiver information center in EBPP's Denpasar office has been an inspiring source of Vetiver information for the general public and generated many Vetiver clients, yet needs more resources and funding to be sufficiently effective for more complete promotion and dissemination of Vetiver information throughout Indonesia.

Acknowledgments

This paper was made possible primarily due to the hard work, dedication and initiative of all the members of East Bali Poverty Project team, with special thanks to the children who have shown remarkable motivation and patience in tending the Vetiver grass and giving their energy into creation of Vetiver handicrafts. The authors express thanks to Richard Wendt, our key organic farming advisor, who explained planting procedures for our first Vetiver grass in March 2000 and also to Mr. Edwin Balbarino of the Philippine Vetiver Network for his valuable advice and assistance in our Vetiver research and Conference. Thanks also go to all the members of the International Vetiver community who have been regular advisors by email to our many queries in response to our enquiries from potential Vetiver clients. Finally, thanks are due to Dr J Scott Younger for his constructive advice and comments during the preparation of this paper.

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A brief introduction to the first author

David Booth, a civil engineer with over 20 years experience on a wide range of construction projects in many developing countries including Indonesia, moved to Bali in 1993 where he decided to use his international experience to give something back to the people of Indonesia. With some concerned Indonesian friends, he established the Ekoturin Foundation in 1998 after identifying the impoverished communities in mountainous East Bali as a region he felt his extensive experience could be put to good use. As Founder and Chairman of Ekoturin Foundation he coordinates all project planning and design.