The Green Reserve:

Experience with Vertiver in Madagascar Railroad

Vertiver Network

1. Vetiver System: a new concept for roads

- **more 'in-situ' water infiltration**, without compromising slope stability, infiltration is to be homogenous
- **more effective where conventional engineering is challenged,** e.g. on black-cotton soil, highly erodible soils, earthquake risk areas
- **environmentally more friendly (green) inputs**, reducing or eliminating need for external input (rock, cement, iron)
- **providing road-farm solutions: more local employment** and engagement of farmers along the road to use it on-farm and/or make farming on the roadside a possible compromise
- **cost-effective.**

Planting quality principles

Aim for 100% survival rate on hostile road embankments (cut- and fill batter), avoiding gaps: requires **expertise on managing the plant (quality) and site**

Watering: time of planting, watering method, moisture conservation

Speedy establishment required → pots, plugs, or pre-rooting slips, manuring

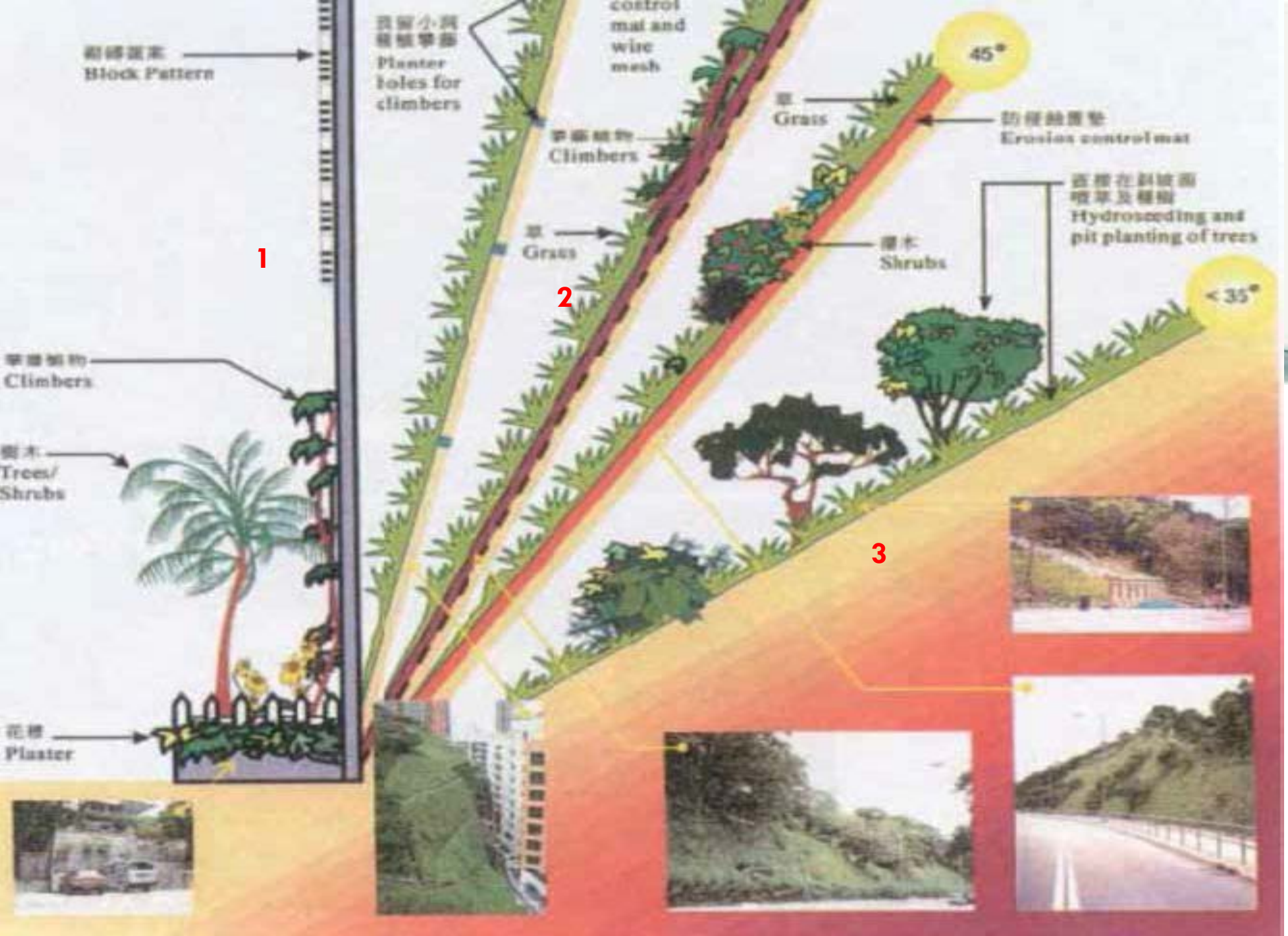
Slope engineering principles

Waterload: more equally distributed, and more evapotranspiration (ppre pressure quickly dissipates, and no local build-up)

Perennial roots pin down through hard pan, anchor for fill and topsoil; can reach 2-3m depth in year 1

Roots stronger than tree roots (75 Mpa is 1/6 of mild steel reinforcement)

Soil binding: very difficult for soil to be dislodged



1. Hard structures only
2. Combination of hard and soft bioengineering including geofabrics
3. Bioengineering alone including geofabrics on erodible soil

3. Madagascar railway: taking farmers along

Third steepest railway in the world, 200 km

Disaster strikes early 2000: 2 cyclones hit Fianarantsoa in 2 weeks

280 landslides (150,000 m^3 earth) cover the tracks

Eight washouts attack railway bed

1. How to stabilize the many still unprotected slopes?
2. How to reduce FCE vulnerability to future cyclone damage?

This has impacts on the livelihoods of 200,000 people

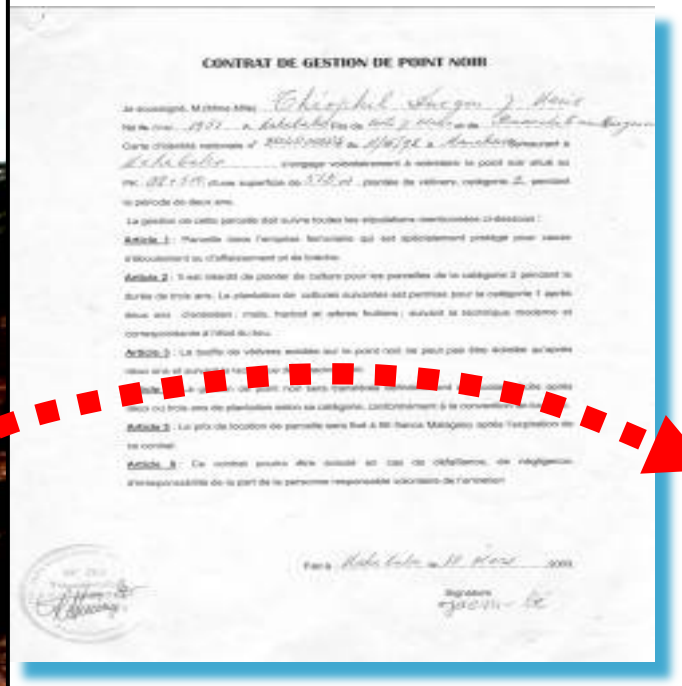
Thai specialists and Madagascar partners devise 2-pronged strategy

1. Systematically use Vetiver to stabilize all highly unstable points and drainage systems

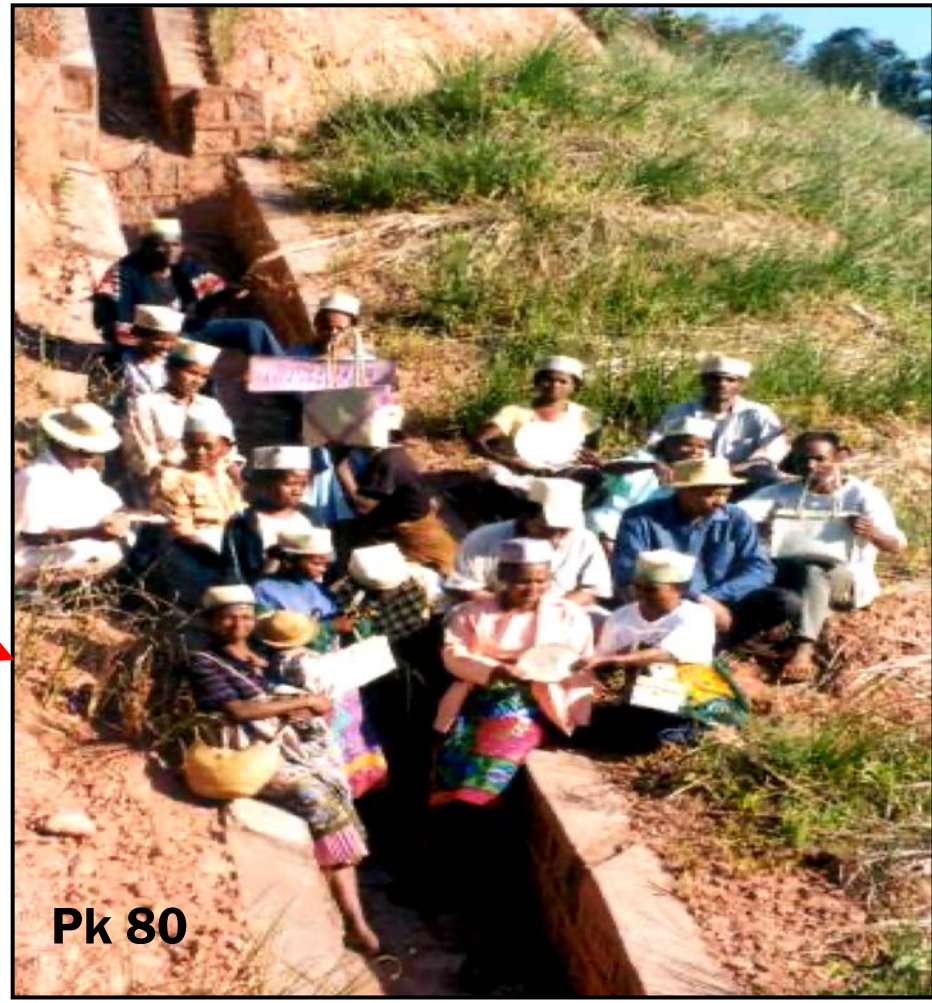
2. Institute a Vetiver-based system to reduce erosion and landslides along steep farmed slopes

Rail slopes: protecting gabions needed at the slope base, with Vetiver rows contours at 1 meter VI

Community intervention: each of the critical sites under contract with a local farmer responsible for its maintenance in exchange for access to Vetiver leaves for thatch or handicrafts



CONTRAT DE GESTION DE POINT NOIR

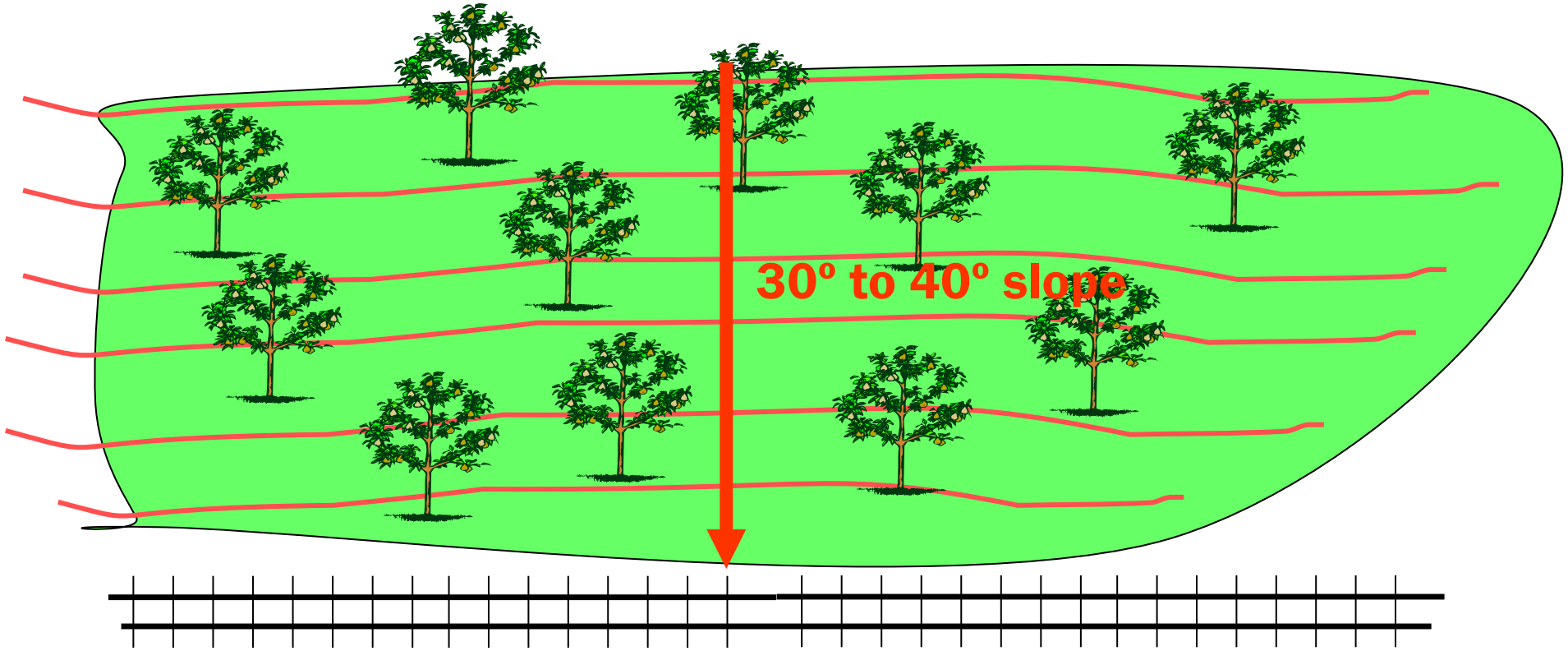


Farmer intervention to protect rail embankments

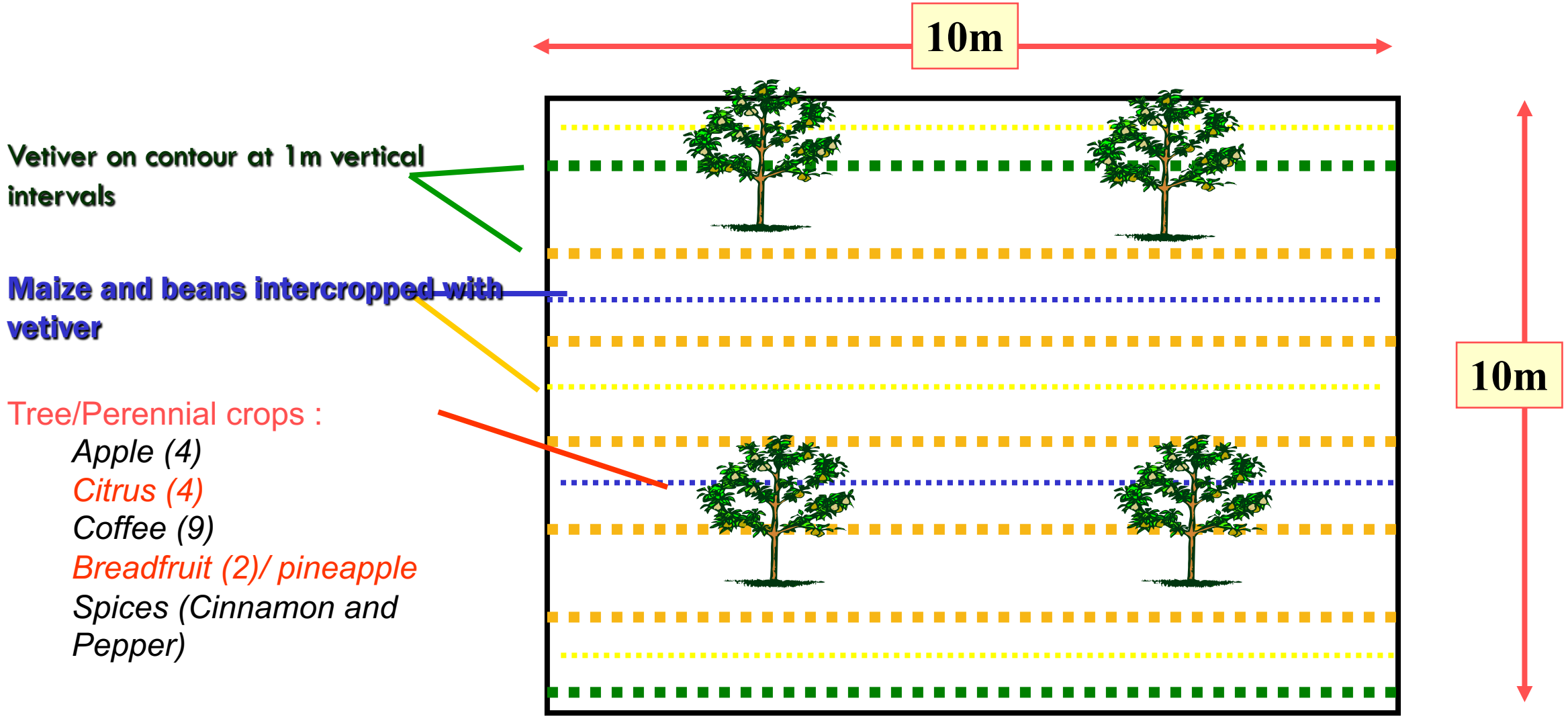
Problem: hundreds of farmers cultivating steep slopes along the railway; erosion-inducing crops (rice, cassava)

Solution: work with farmers to replace annual crop systems with a Vetiver-based, sustainable crop system that protects and stabilizes vulnerable batters

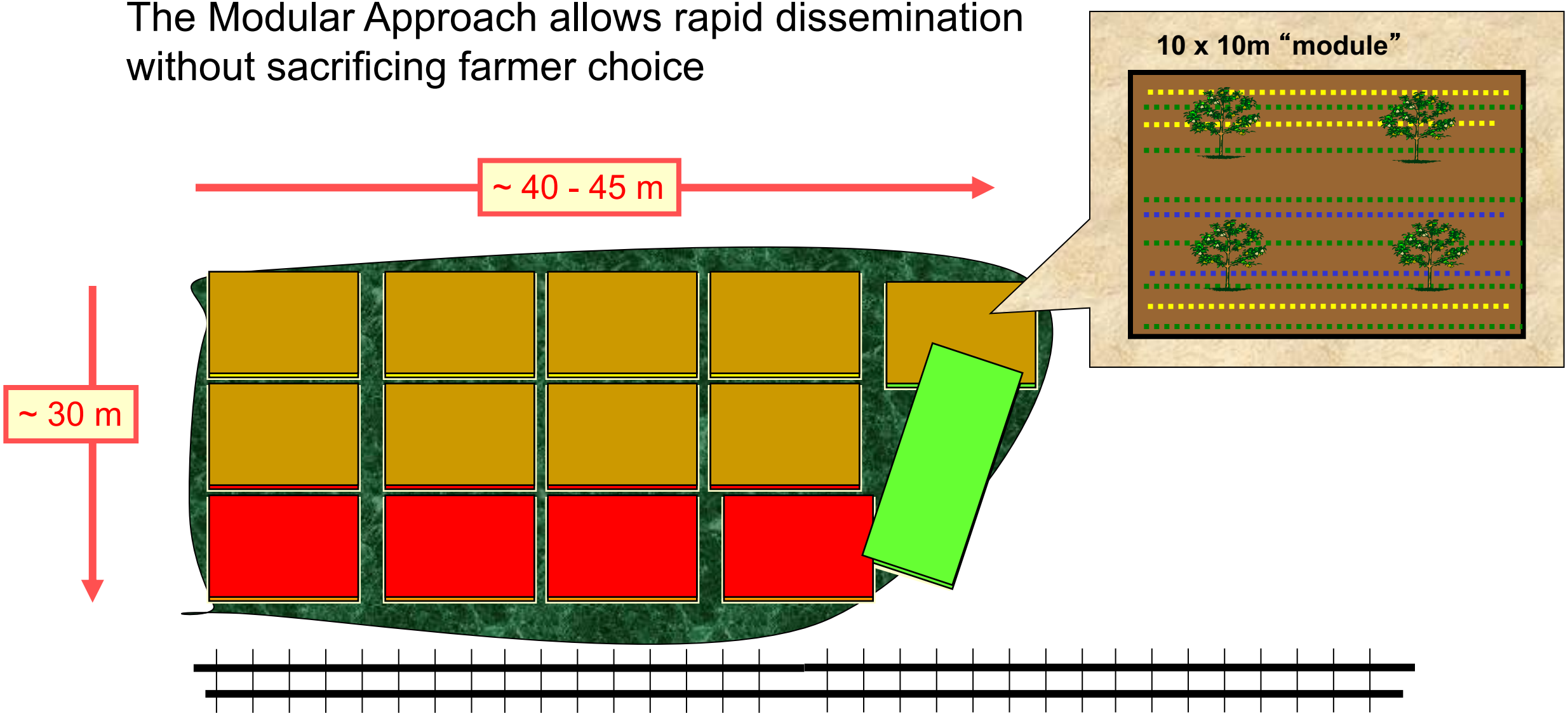
Overall Goal: stabilize steep hill-slopes adjacent to railway line with vetiver and fruit trees



Modular Approach: 10x10m modules allowing each farmer to customize his/her intervention according to individual needs and preferences, choosing from 6 crop models (all with Vetiver).



The Modular Approach allows rapid dissemination without sacrificing farmer choice

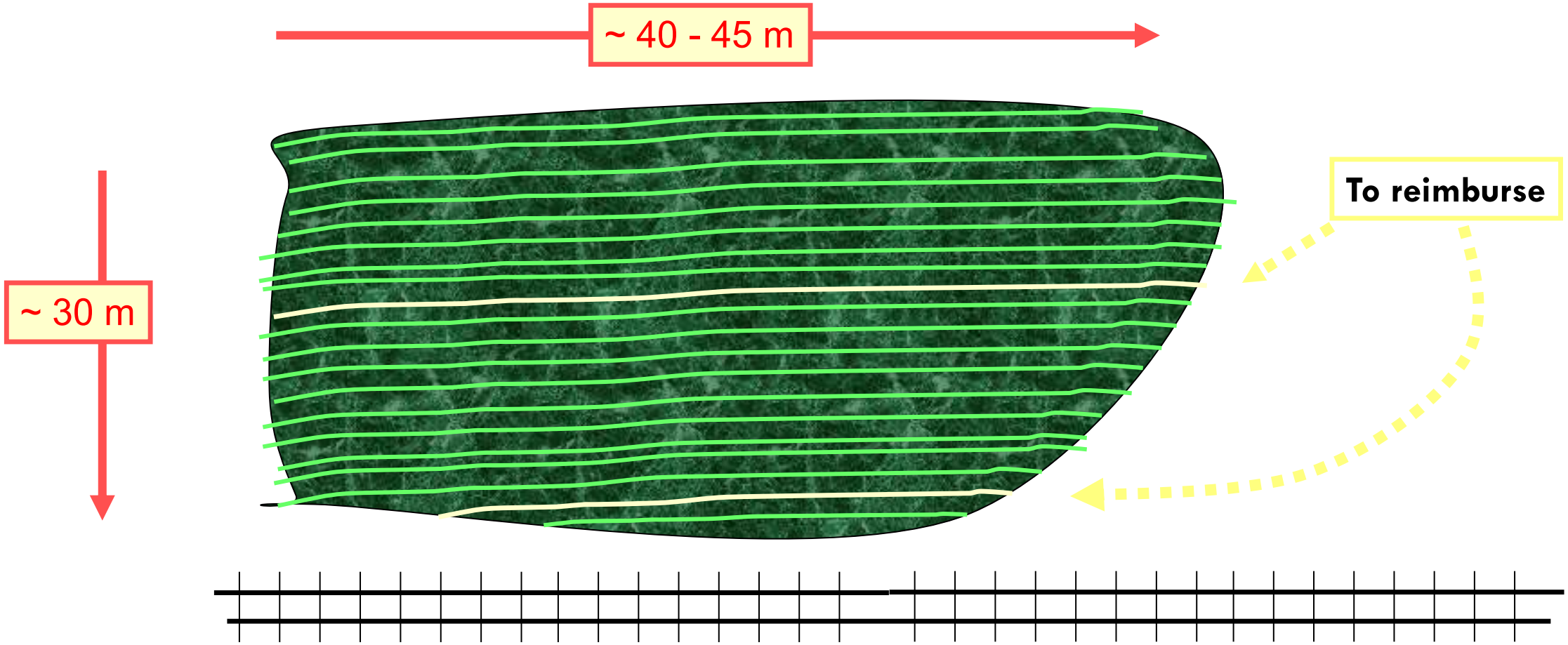


Farmer A :
4 spice, 4 citrus, 4 apple, 2 breadfruit

Farmer B :
9 coffee, 1 breadfruit, 4 apple

Example:

Farmer borrows 9,800 vetiver slips; will reimburse ~ 490 clumps = 1 to 1½ lines in his field of vetiver hedges



Mulching between the rows of vetiver

Fully stabilized batter and culvert

Culvert drainage protection

Step 2: Fields to be stabilized are identified with farmers (priority to most erosion prone, and where rice or manioc was planted in previous year)

Step 3: Farmer obtains 10-year use rights to field from FCE company (all land belongs to 50 m railway right-of-way), with clearly defined rights and responsibilities of farmer and FCE

Step 4: With village agent, farmer measures the field, determines how many modules s/he can use, and selects modules according to personal choice (subject to certain technical constraints)

FICHE D'AMENAGEMENT
(Tolongoina)

Razanatsoa, Jeannette **PK 67+400**

Dimension de la parcelle : Longueur 40 (m)hauteur 20 (m)superficie 600 (m^2)modules 08

Dessin de la parcelle :

2 citrus 2 apple 2 coffee 2 spice

Besoins en plantes :
Vétivers : 08 modules x 700 pots/mod **5600 vetiver**

Modules agrumes	02 x	1 thomson 1 Valencia 1 Clementine 1 Dancy		30 m maïs		20 m haricot	
Modules pommes	____ x	2 Anna 2 Dorsett		20 m maïs		30 m haricot	
Modules café	02 x	12 Robusta 1 Ombrage		XXX	XXX	30 m haricot	
Modules Fruits à pain	02 x	12 Robusta 1 Ombrage		30 m maïs		30 m haricot	
Modules épices	02 x	5 cannelles 10 poivres 5 tuteurs poivres		20 m maïs		20 m haricot	

Total maïs _____m _____kg Total maïs _____m _____kg

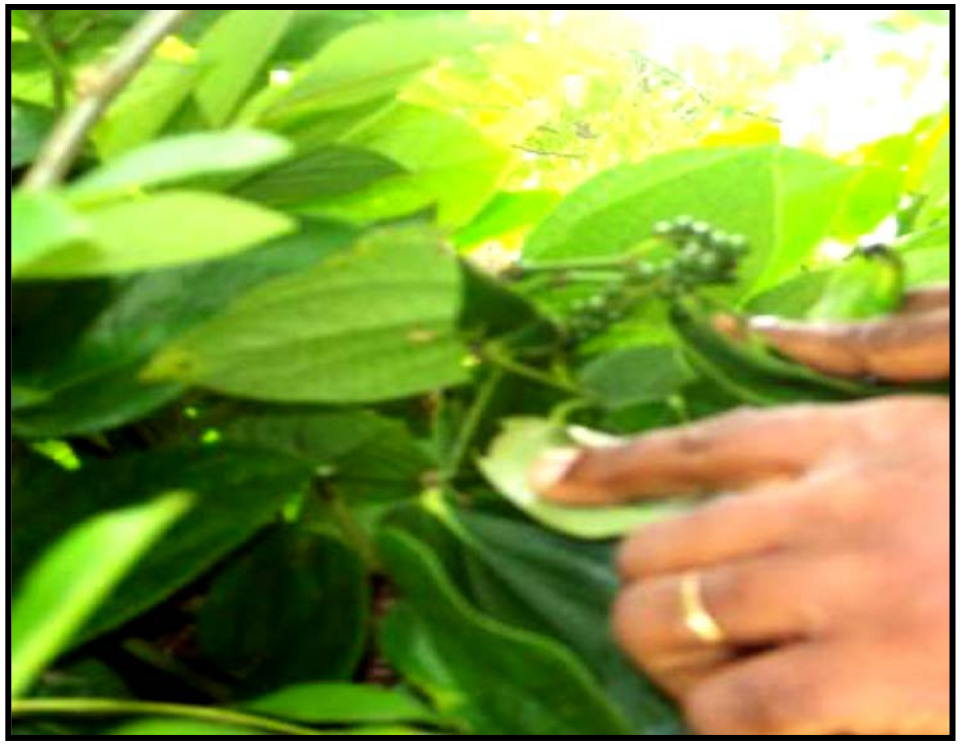
Le paysan veut emprunter les graines de maïs NON
Le paysan veut emprunter les graines de haricots NON

Step 5: Farmer clears field and plants vetiver (received as a loan from the project) on contour lines at 1-meter vertical intervals

Step 5: Farmer plants annual crops and perennial tree crops between the vetiver rows according to module "map"


03/03/2010

Follow-up: Farmer reimburses (and replants) vetiver in second season, keeps vetiver well-pruned, correctly maintains tree and spice crops



Well trimmed vetiver hedgerow

Result:

- Project has few, if any, costs to purchase vetiver after year 1
- Farmers understand that they can “vetiverize” their own fields away from the train line, or help others in the village, at low cost

Thanks to vetiver, the FCE railway and the 100,000 people who depend on it for their livelihoods no longer dread the next cyclone season.

With special thanks from the FCER project and the people of Madagascar
to His Majesty the King of Thailand and the Royal Development Projects Board