Utilization of Vetiver Grass and Soil Analysis as a Tool for Bulk Blended Fertilization in a New Rubber Plantation on Sloping Land

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Introduction

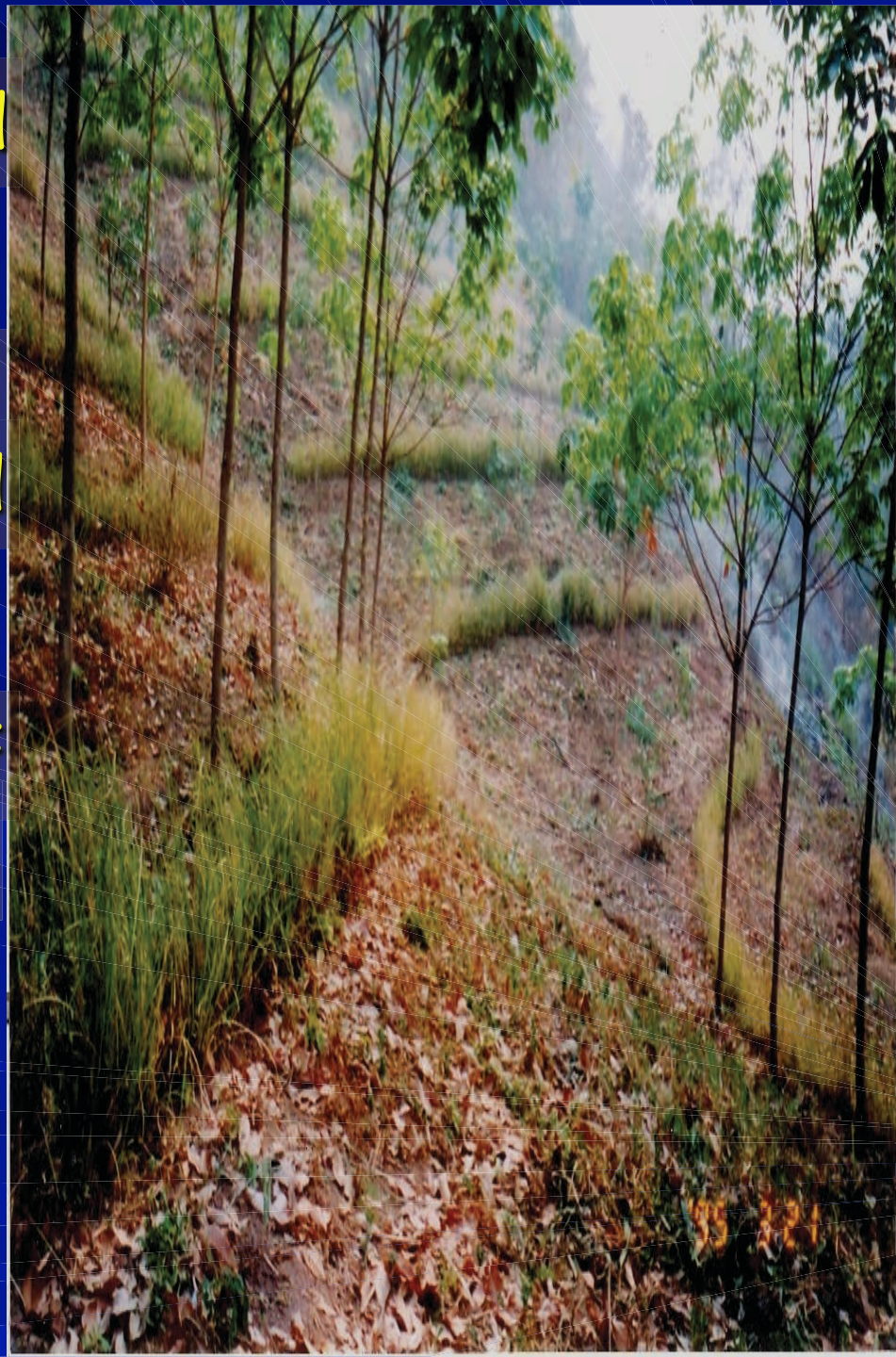
Farmers living on sloping highland practice **Slash-and-burn** to grow cash crops for several years before leaving the land fallow and moving to grow the crops in a new land. The practice is called **shifting cultivation** which caused a serious erosion problem.

Slash and burn

Purpose

The purpose of this study was to establish experimental-cum-demonstration plots to show farmers how to develop a new pararubber plantation on a sloping land using vetiver grass and how to apply fertilizers by using bulk blended and/or self-mixed fertilizers according to the soil analytical results. This is to help save some cost as well as to increase the capability of the trees to grow and give a higher yield.

Vetiver grass was planted along the contour lines during the early growth stage of pararubber tree to reduce soil erosion and nutrient loss. Moreover, the investigators had studied the absorption of CO_2 by vetiver grass as a way to slow down the global warming, and also the biodiversity of the soil under vetiver grass.



Materials and Methods

Materials

1. Compound fertilizer formula 20-10-12
2. Single fertilizer formula 46-0-0, 0-46-0 and 0-0-60
3. Soil sampling tools for physical and chemical analysis
4. Rainfall measuring gauge
5. Instruments for soil and plant analysis
6. Tools to analyze soil microbes

Method

The experimental plots with an area of 5 rai (0.8 ha) were constructed in the field of farmer, the pararubber trees were grown from June 2003, with vetiver grass included from the beginning. The slope gradient of the area was approximately 15-20%. The area was equally divided into 4 plots with the following treatments

1. Application of compound fertilizer (20-10-12) as recommended by the Thai Rubber Research Institute (1998) at the rate of 216-240 kg/ha/year.
2. Application of bulk blended fertillizer (20-10-12) as recommended by the Thai Rubber Research Institute (1998)
3. Application of bulk blended fertilizer according to the soil analytical results.
4. Application of bulk blended fertilizer according to the soil analytical results, with an addition of 2 kg of cow dung to each tree every year.

The pararubber trees were planted at a spacing of 2.5x7.0 m. Vetiver was planted along the countour lines between the rows of rubber trees.

Experiment Site

The field of farmer (Mr.Tab Piraban)

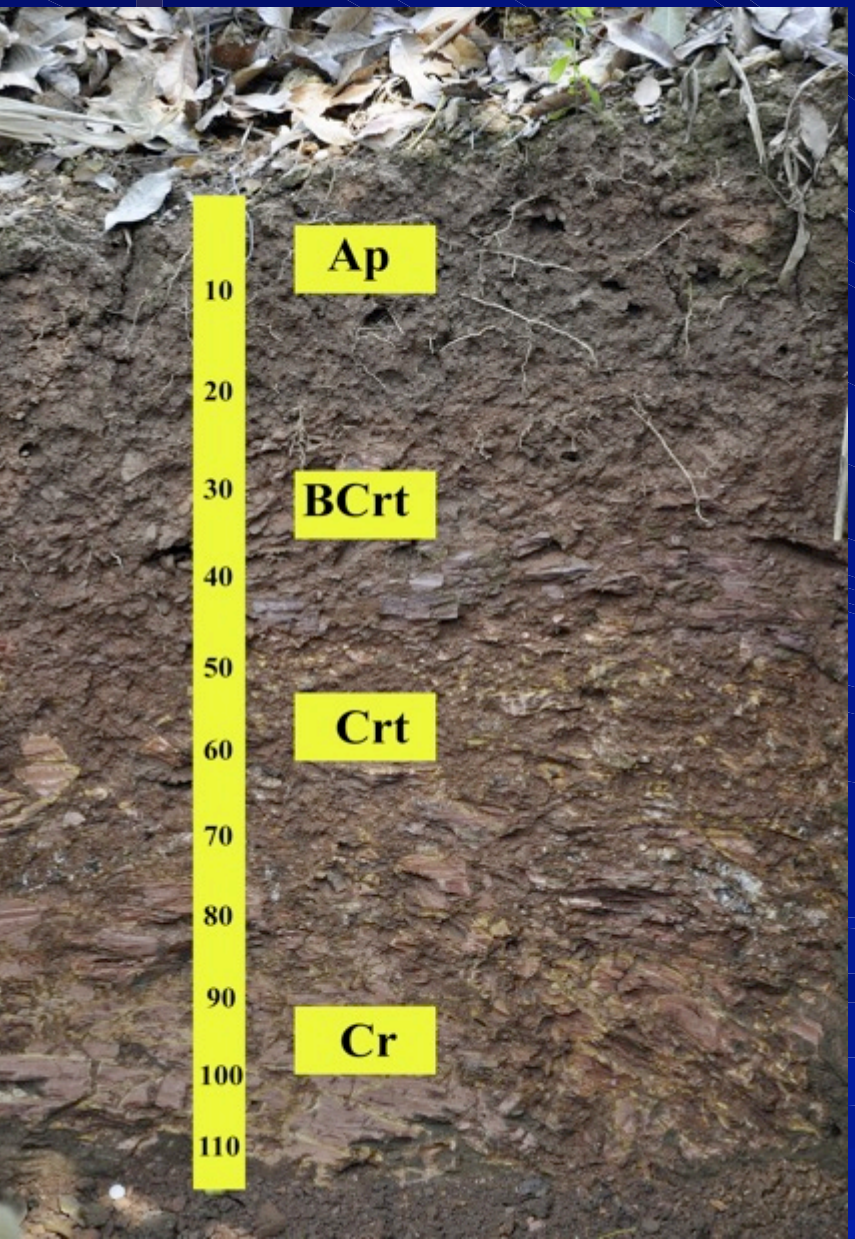
Tambon TabToa, Amphur Thoeng, Chiang Rai Province.

Period of the Experiment

October 2003-September 2010

Results and Discussion

Soil Chemical Properties



Soil Depth:
0-5, 0-10, 10-20, 20-30, 30-50, 50-70, 70-90, 90-100 cm

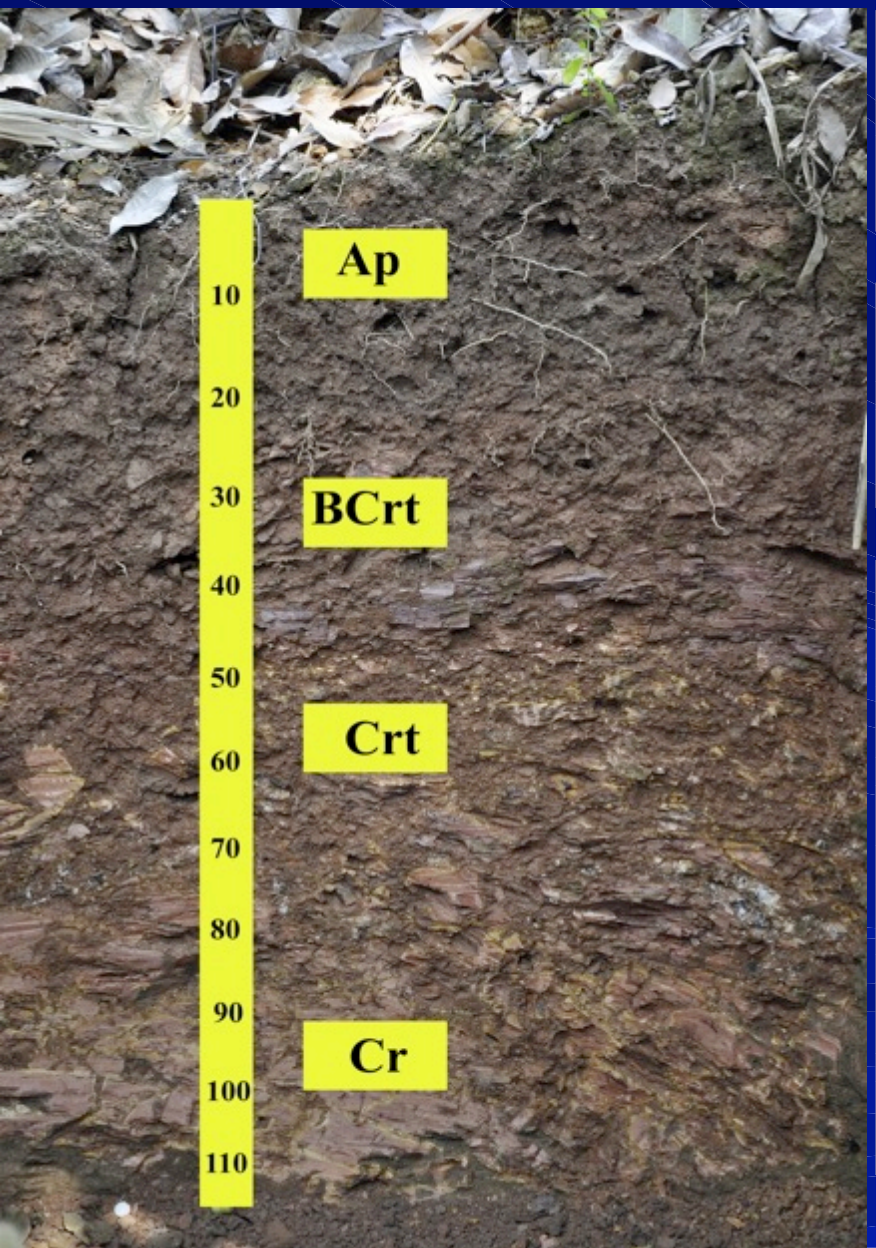
pH: 4.6-5.6

Organic Matter: 0.1-3.5%

Available P: 0.9-5.7 mg/kg

Available K: 31.2-184.2 mg/kg

Soil Physical Properties



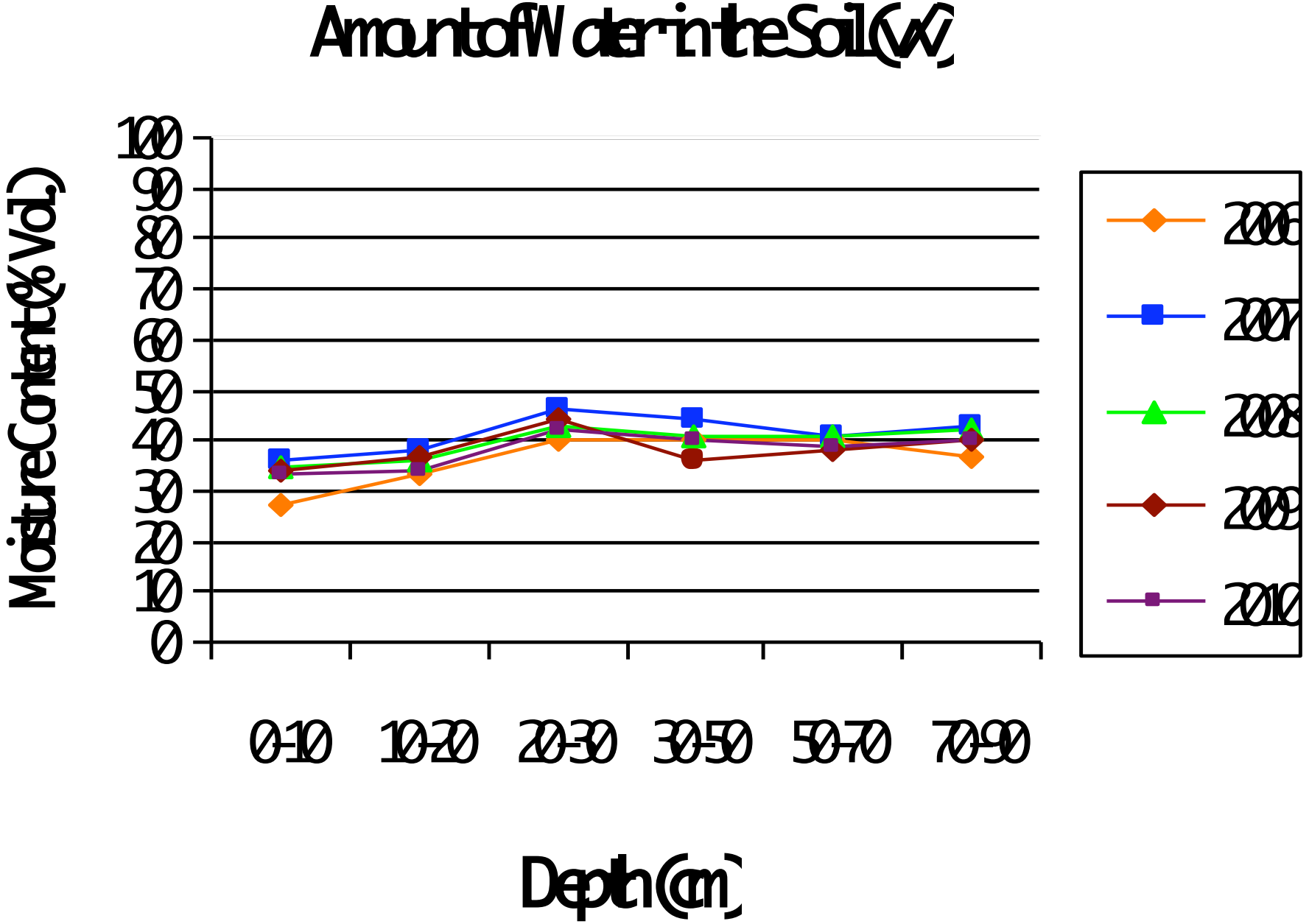
Soil Depth:
0-5, 0-10, 10-20, 20-30, 30-50, 50-70, 70-90, 90-100 cm

Permeability: 0.04-63.40 mm/hr (Extremely slow-Rapid)

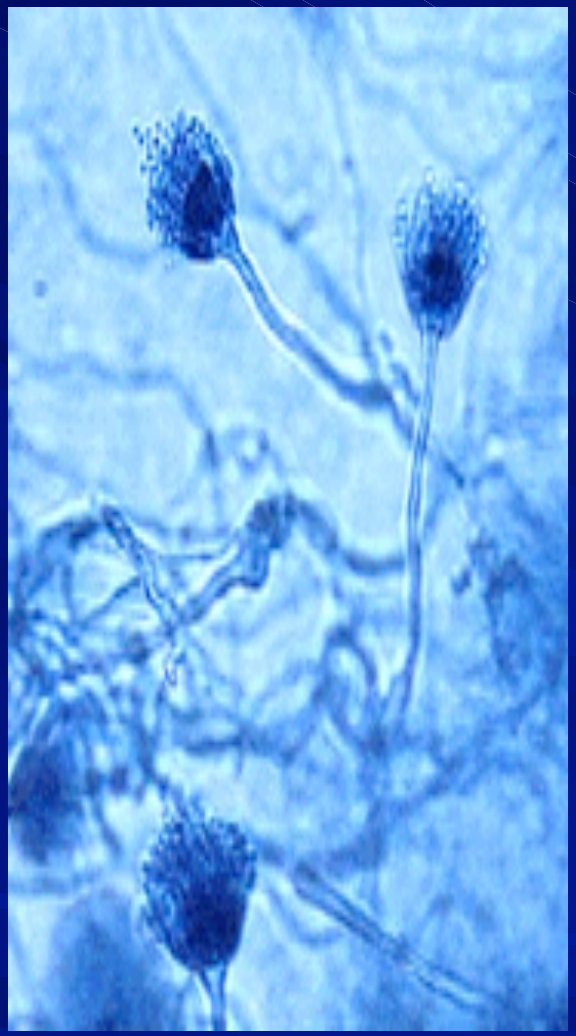
Texture: Sandy Clay Loam-Clay

Bulk Density: 1.29-1.74 g/cm^3

Plant Available Water:
2.91- 6.98 %Vol.


Amount of Water in the Soil (v/v)
Moisture Content (% Vol.)
0
10
20
30
40
50
60
70
80
90
100
0-10
10-20
20-30
30-50
50-70
70-90
Depth (cm)
2006
2007
2008
2009
2010

Biodiversity of the Soil under Vetiver

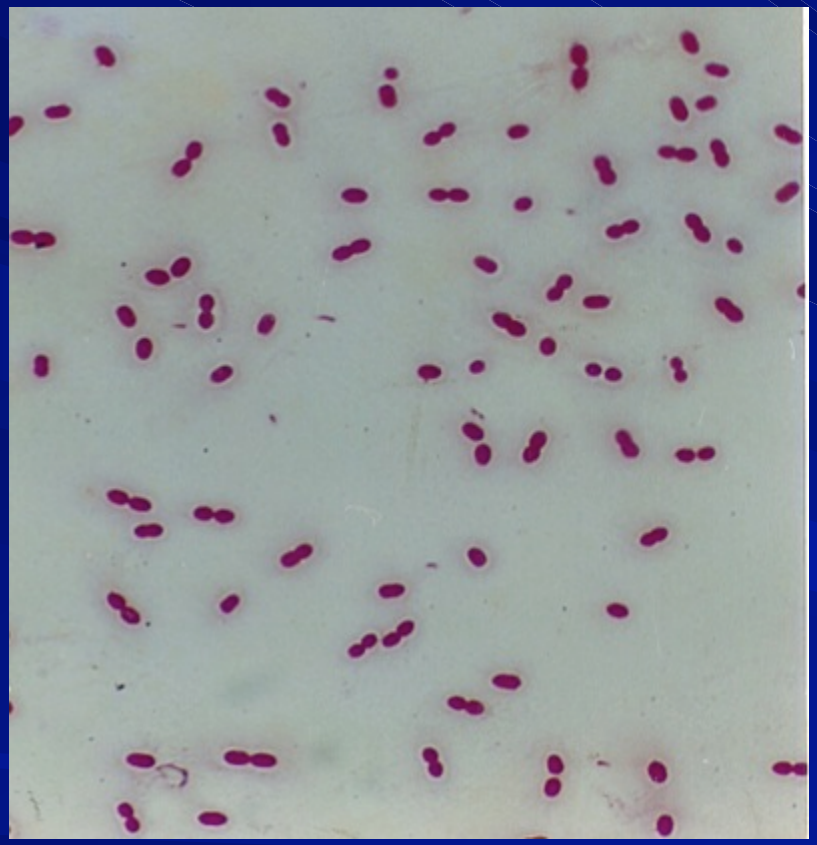


Genus *Aspergillus*

Genus *Penicillium*

Genus *Streptomycetes*

Types and amounts of N-fixing Bacteria



Genus *Azotobacter*

Genus *Azospirillum*

Accumulation of C in Vetiver

Sample	OC(%)	C/N ratio	P (%)	K (%)
Upper Slope	51.57	70	0.05	0.87
Lower Slope	49.92	57	0.07	0.98
Average	50.74	63.5	0.06	0.93

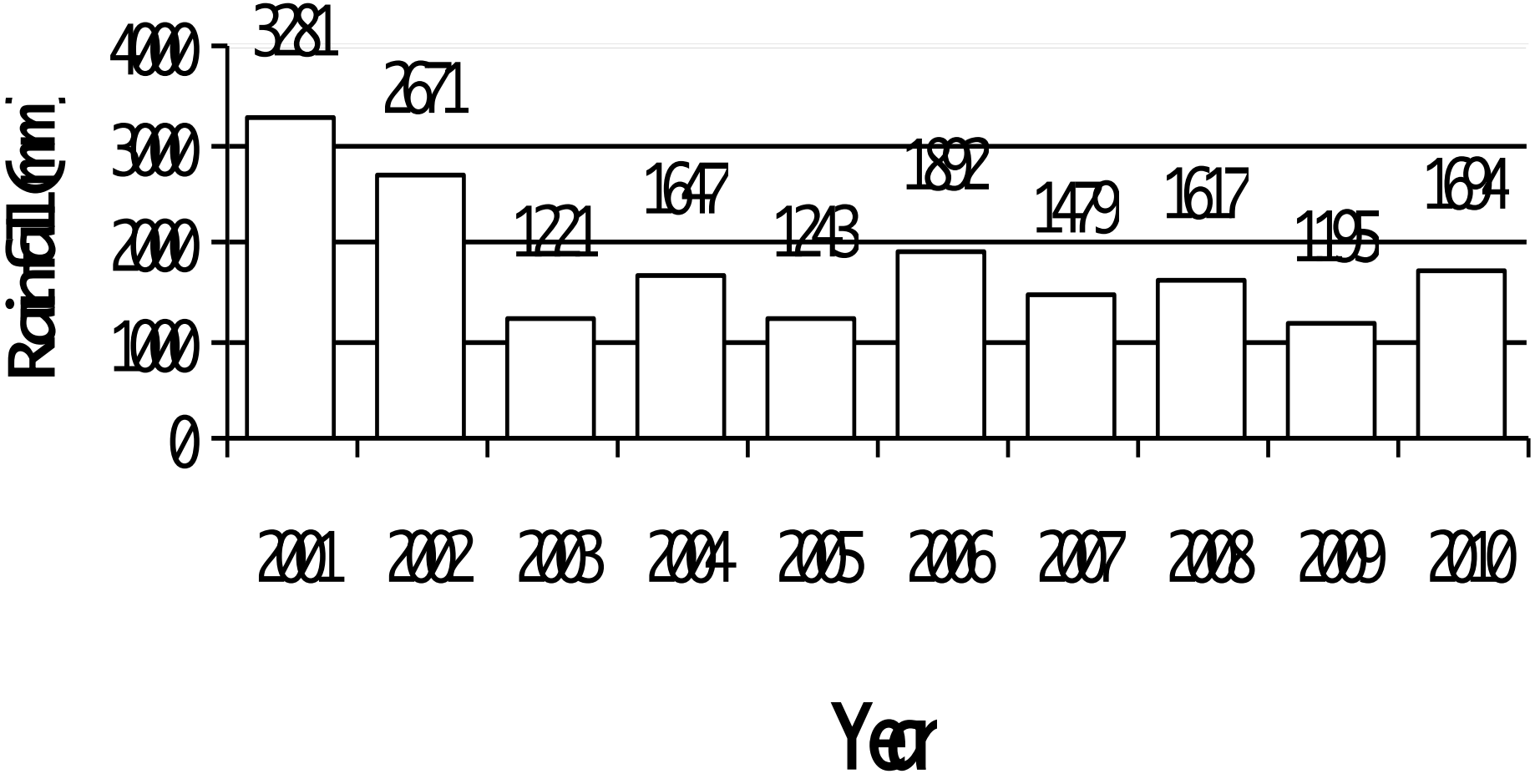
Source: Laboratory for analyzing plants, fertilizers and soil amendment materials, Land Development Department, Bangkok, Thailand.

Accumulation of C in Rhizosphere

Sample	OC(%)	OM (g/kg)	N (g/kg)
Average1st row	1.50	25.74	3.80
Average2nd row	1.54	26.42	3.90

Source: Soil Analysis Laboratory, Soil Science Department, Kasetsart University, Bangkok, Thailand.

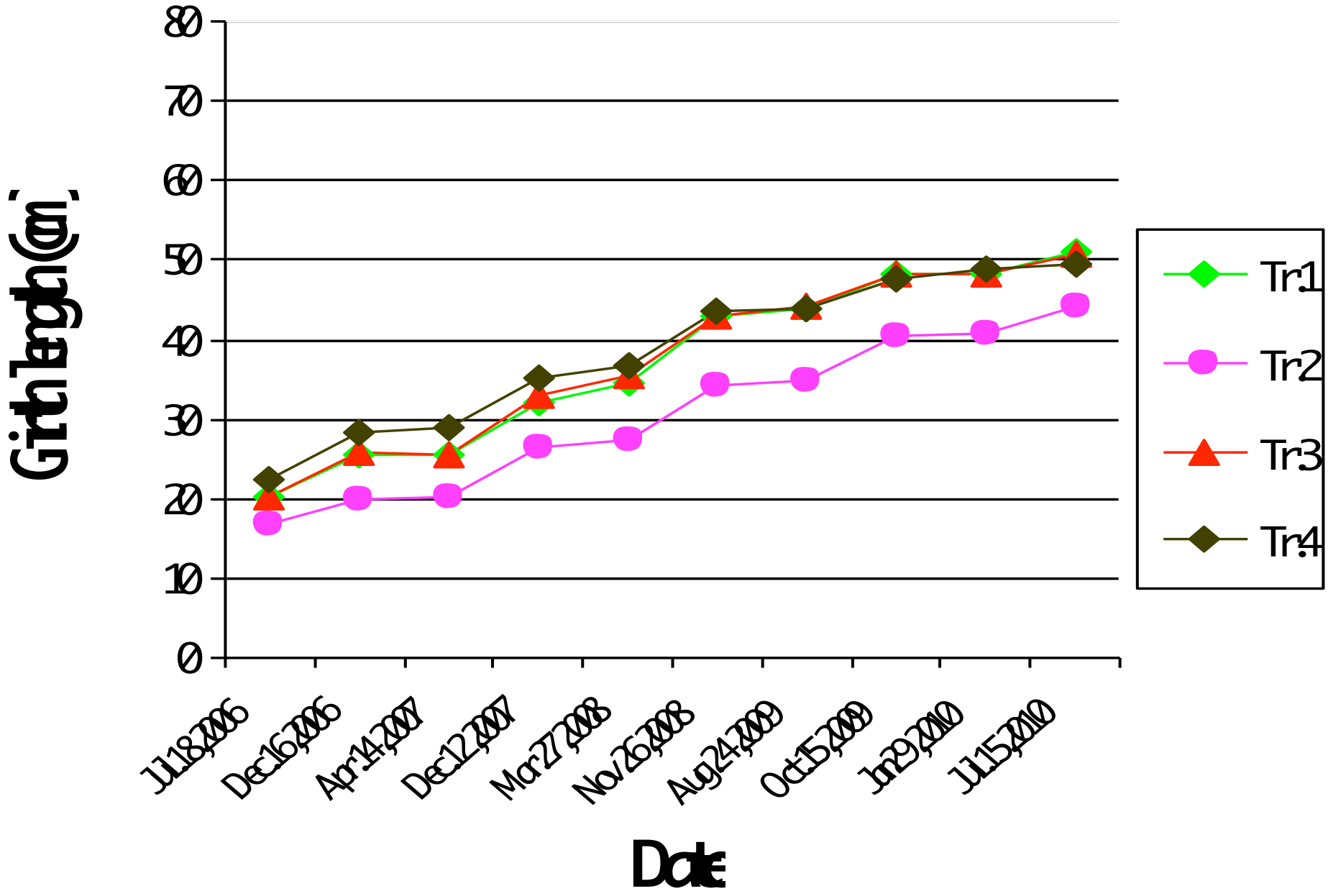
Annual Rainfall (2001-2010)



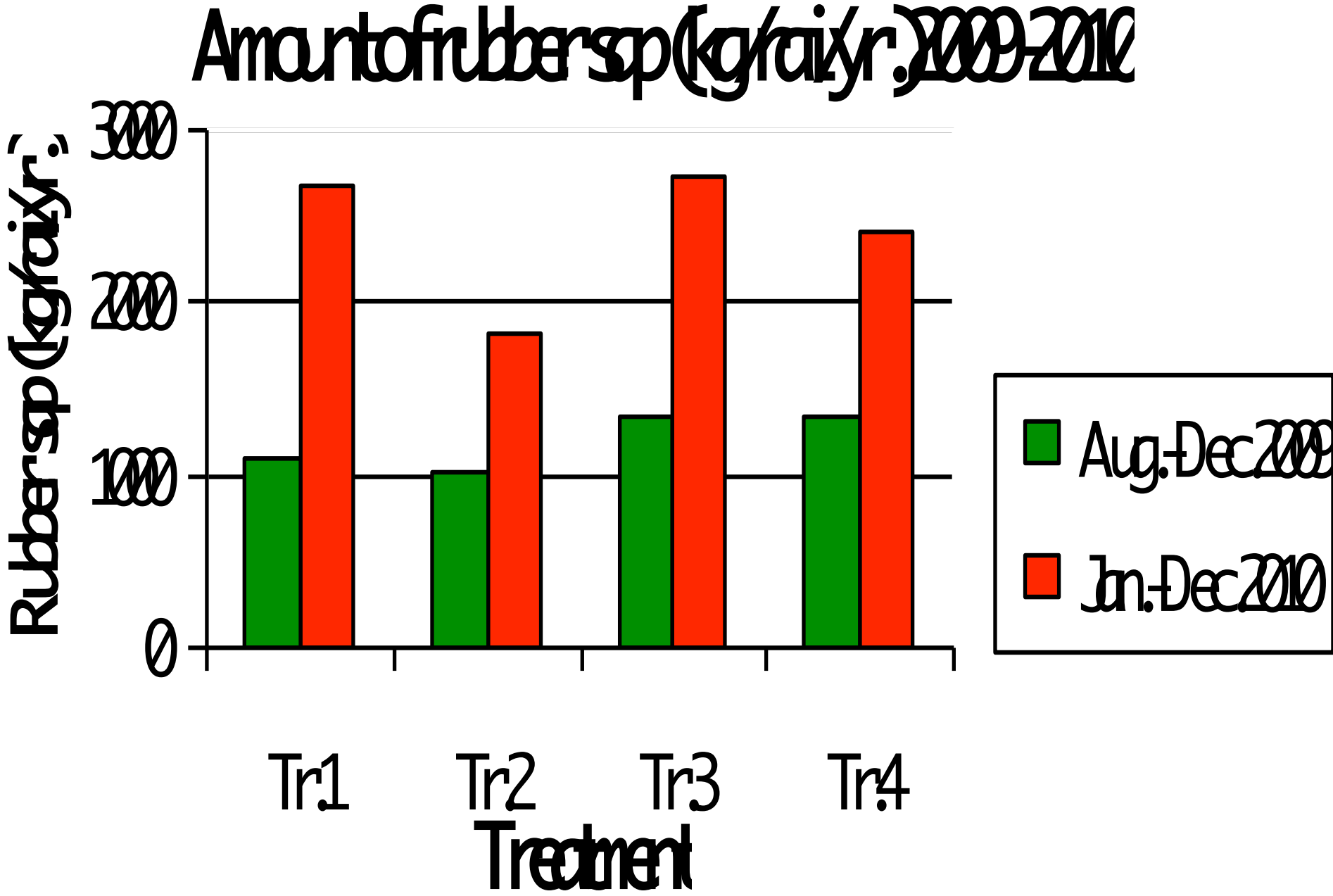
Soil Erosion Collection

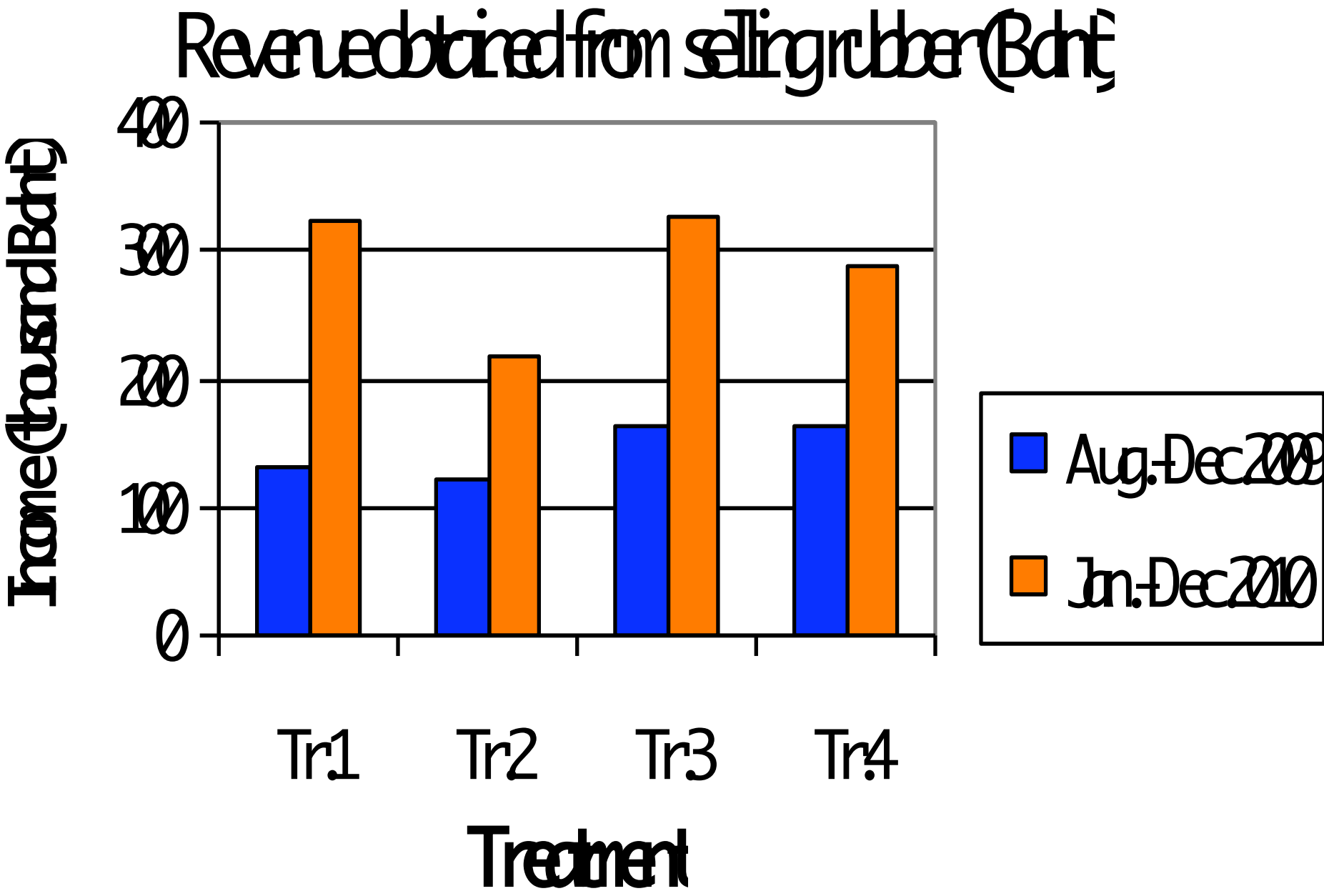
Amounts of eroded soil collected from the sediment collecting basins for the years 2006-2008(kg/rai/yr.

Sediment Trap Instruments	kg/rai/year		
	2549	2550	2551
Basin 1 (without vetiver)	6.87	14.39	42.71
Basin 2 (with vetiver)	3.87	11.83	15.32
Basin 3 (with vetiver)	8.28	15.12	3.93
Basin 4 (without vetiver)	19.67	59.44	20.57
Basin 5 (with vetiver)	13.74	31.00	11.97
Basin 6 (without vetiver)	401.44	31.50	18.29
Basin 7 (with vetiver)	4.32	4.90	8.38
Basin 8 (without vetiver)	109.11	13.37	10.67
Average (with vetiver)	7.55	15.71	9.90
Average (without vetiver)	134.27	29.67	23.06


Girth of para rubber trees at 1.50m above ground
Girth length (cm)
0
10
20
30
40
50
60
70
80
Jul 18, 2006
Dec 16, 2006
Apr 14, 2007
Dec 12, 2007
Mar 27, 2008
Nov 26, 2008
Aug 24, 2009
Oct 15, 2009
Jun 29, 2010
Jul 15, 2010
Date
Tr 1
Tr 2
Tr 3
Tr 4

Yield of rubber sap (kg/rai/day) year 2009-2010


Amount of rubber sp (kg/rai/yr.) 2009-2010
Rubber sp (kg/rai/yr.)
3000
2000
1000
0
Tr.1
Tr.2
Tr.3
Tr.4
Treatment
Aug.-Dec.2009
Jan.-Dec.2010


Revenue obtained from selling rubber (Baht)
Income (thousand Baht)
400
300
200
100
0
Tr.1
Tr.2
Tr.3
Tr.4
Treatment
Aug.-Dec.2009
Jan.-Dec.2010

Conclusions and Recommendation

- Growing pararubber trees in the North is a kind of ‘economic forest’ can increase income for farmers and add the ‘forested’ areas to compensate for the encroached and slash-and-burn areas, which may seriously cause global warming and soil erosion problems.

- Growing vetiver along the contour may substantially decelerate the runoff and decrease the amount of soil loss.
- Growing vetiver in agricultural areas can help lower the global warming problems because this grass has an ability to absorb high amount of CO_2, as high as 50.7% C and store in the form of organic carbon (OC)

- Vetiver can uptake Phosphorus and Potassium equal to 0.06% P and 0.93% K, respectively.

Application of Research Results

Growing pararubber trees on a sloping land in the North of Thailand needs to have vetiver grown along the contour lines to begin with to help reduce soil erosion and the loss of plant nutrients, and vetiver help reduce CO_2 in the atmosphere as did the pararubber trees.


Thank You