Use of Vetiver for Soil Erosion Control and Better Water Quality in Farm Ponds in Salt Affected Sandy Areas of Northeast, Thailand

Santibhab Panchaban, Pol. Col. Winit Phuaphan, and Mongkon Ta-oun
Department of Land Resources and Environment,
Faculty of Agriculture, Khon Kaen University, Thailand

Abstract: On sandy and saline soils, erosion can take place easily and drastically. For the steep slopes of farm pond banks, eroded sediments that get into farm ponds can make the pond shallower with low quality water. The objective of this research was to investigate the role of vetiver in reducing the quantities of sediments and nutrients entering into farm ponds in salt affected sandy soil of Northeast Thailand.

In this experiment, various rows of vetiver from 0 to 3 were established along the inner side of the steep pond bank with more than 100 % slope. Songkhla-3 ecotype was planted with spacing of 30 cm between rows and 10 cm between plants. Results indicated that the ratio of sediment collected from 0:1:2:3 rows of vetiver plots was 4:3:2:1 respectively. Planting at least 2 rows of vetiver was found to be satisfactory in reducing soil sediments hence decreased soil erosion, which resulted in better water quality under sandy and saline soils of Northeast Thailand.

In relation to nutrients leached into the ponds, nitrogen, phosphorus and potassium concentrations in the soil sediments were not significantly different among the treatments. However, nutrient loss varied according to sediment dry weights, i.e. nutrient loss increased with the quantity of sediment. Planting 3 rows of vetiver reduced nutrient loss into the pond effectively.

Key words: vetiver grass, salt affected soils, saline soil, water quality, sediment, erosion

Email contact: Santibhab Panchaban <santibha@kku.ac.th>

1 INTRODUCTION

The northeast region composes of 17 million hectares, which is one-third of the country. This region is known to be the poorest in Thailand due mainly to poor soil and persistent drought. Most soils in the region are sandy, low in plant nutrients, poor physical and chemical properties.

Besides, sandy in nature, these soils are also salty. Nowadays, the salt affected area is about 17 % of the region and increasing year by year due to deforestation.

To solve the main problem of drought, farmers must construct their own farm ponds. However, being sandy with poor soil structure, erosion can take place easily and soil sediments will be eroded into the ponds. This results in the pond becoming shallow faster and nutrients that get into the pond cause Eutrophication processes or “aging lake” effect that often results in poorer water quality.

Growing vetiver on the inner side steep bank of farm ponds can be managed easily by farmers, resulting in less soil sediments flowing into farm pond and could improve farm water quality.

The objective of this research was to investigate the role of vetiver in reducing the quantity of soil sediments and plant nutrients that get into farm ponds in salt affected sandy areas of Northeast Thailand.

2 MATERIALS AND METHODS

On the inner side steep banks of farm pond, Songkla-3 ecotype vetiver (*Vetiveria zizanioides*) seedlings were planted for 0, 1, 2 and 3 rows on the contour lines with spacing of 30 cm between rows and 10 cm between plants. Sediments that passed through vetiver rows was collected during August, 1998 to October, 1998 for the total of 7 times with 2 week intervals. Nutrients in sediments were analyzed. Total rainfall was recorded. Plants were grown naturally, no fertilizer was added to vetiver but they were trimmed to 30 cm height every month. Sediments were collected after vetiver stems were more or less touching each other.

3 RESULTS AND DISCUSSIONS

Table 1 shows soil properties at Prayoon, Khon Kaen province. Soils are slightly acidic with high electrical conductivity. The EC was 18 dS/m, which is considered highly saline soil. Soils were also poor in plant nutrients especially N and P but high in Na and Cl.

Table 2 shows sediment weight from seven collections with different treatments. The total weight of sediment from the controls (no vetiver) for, 1 row, 2 rows and 3 rows of vetiver were 208.1, 160.6, 123.8 and 54.4 tons/Ha respectively. This was in the ratio of 4 : 3 : 2 : 1 that is to say the more vetiver planted, the less soil erosion. Planting 1, 2 and 3 rows of vetiver can reduce sediment erosion into the pond as much as 47.5, 84.4 and 153.8 tons/ha. respectively.

Table 1 Soil properties in the experiment

Properties	Analysis
pH (1 : 2.5)	6.0
ECse (dS/m)	18.0
OM (%)	0.2
Total N (%)	0.04
Available P (ppm)	3.7
Exch. K (ppm)	31.0
Na (ppm)	3750
Cl (ppm)	720
Ext. SO_4 (ppm)	6.4
Ca (me/l)	8.3
CEC (cmol/100 g)	1.2
Classification	Typic Natraqualfs
Texture	Sandy loam, loamy sand
Structure	Weak fine platey no structure
Drainage	Poor
Permeability	Moderate

Table 2 Soil sediment collected from the different treatments (tons/ha)

Time / Tmt	1	2	3	4	5		7	Total
Control (no vet.)	13.1^{a}	18.1^{a}	95.6^{b}	16.3^{b}	52.5^{b}		12.5^{c}	208.1^{c}
1 row vetiver	10.6^{a}	15.6^{a}	62.5^{ab}	11.9^{ab}	51.9^{d}		8.1^{bc}	160.6$_{bc}$
2 rows vetiver	13.1^{a}	20.6^{a}	43.1^{a}	10.0^{ab}	31.9^{b}		5.0^{ab}	123.8^{ab}
3 rows vetiver	10.0^{a}	8.8^{b}	25.0^{a}	4.4^{a}	5.0^{a}		1.3^{a}	54.4^{a}
CV (%)	25.2	32.4	34.2	38.1	34.8		32.2	28.2

*Means followed in each column by the same letter are not significantly different at the 5% level by DMRT

N, P and K were leached through vetiver rows into the pond attached to the sediment but in small quantities due to low initial concentrations. When vetiver rows thickened, nutrient losses decreased but these were not significantly different between the treatments. The plants took up most nutrients. Nutrient losses into the pond were not enough to cause Eutrophication levels, which lead to poorer water quality.

4 CONCLUSIONS

On steep slopes (more than 100%) the inner bank of farm ponds in saline sandy soils which are slightly acidic with low fertility, growing vetiver helps to reduce soil sediment erosion into farm ponds. The more vetiver rows, the less sediment collected. Planting 1, 2 and 3 rows of vetiver can reduce soil sediment erosion into ponds as much as 47.5, 84.4 and 153.8 tons/Ha. respectively. Plant nutrients were attached with eroded sediment however was low in quantity and could not stimulate Eutrophication. This low quantity was due in part to low concentrations of nutrients in these saline sandy soils used in the experiment together with vetiver grass uptake.

References

Greenfield JC. 1992. Early experience with vetiver Hedgerow Innovation in Agriculture. World Bank, US. 11p

Intaphan P, Boonches S, and Vatthatum S. 1996a. Study of optimum rows and different plant spacing of vetiver grass for soil erosion control on sloping land

World Bank. 1987. Vetiver grass, A Method of Vegetative Soil and Moisture Conservation. Technical Handbook, New Delhi. 72p

Xinbao Z. 1992. Vetiver grass in China. Paper presented at Vetiver Field Workshop, Kuala Lumper. 8p

Yoon PK. 1992. Extracts from A Look-See at Vetiver Grass in Malaysia. Vetiver Newsletter, 6: 86-96

A Brief Introduction to the First Author

Dr. Santibhab Panchaban is now an Associate Professor at the Faculty of Agriculture, Khon Kaen University. He is teaching soil fertility and fertilizer technology classes as well as Graduate Seminar and thesis work. He has published almost 100 scientific papers in Soil Fertility & Fertilizer, saline soils, sandy soils vetiver and cropping systems. He was also on the committee for the 17th World Congress of Soil Science held at Bangkok, Thailand last August.