

The Use of Vetiver to Reduce Soil Erosion and Improve Water Quality of Farm Pond in Salt-affected Sandy Area of the Northeast, Thailand

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Abstract

On sandy and saline soil, erosion can take place easily and drastically. For the steep slope of farm ponds bank, eroded sediments that get into farm pond 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 into farm pond in salt affected sandy soil of the Northeast, Thailand.

In this experiment, various numbers of vetiver from 0 to 3 rows was 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. Planting vetiver at least 2 rows was found to be satisfactory for reducing soil sediments hence decrease soil erosion and bring about better quality of water under sandy and saline soil of the Northeast, Thailand.

For nutrients leached into pond, nitrogen, phosphorus and potassium concentrations in soil sediments were no significantly different among the treatments. However, nutrients lost varied according to sediment dry weights, i.e. nutrients loss increased with the quantities of sediments. Planting 3 rows of vetiver could reduce nutrients loss that can get into pond effectively.

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

Introduction

Northeast region composed of 17 million hectares which is one-third of the country. This region said to be the poorest of the nation 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, soils are also salty. Now-a-day 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 constructed there own farm pond. However, being sandy and poor structure of soil, erosion can take place easily and soil sediment will be eroded into pond. This makes pond shallow faster and nutrients that get into pond can bring into Eutrophication process or “aging lake” that could make poorer water quality.

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

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

World Bank. (1987). Vetiver growing around the bridge neck can work as erosion control for 30-40 years. Yoon. (1992). Vetiver can protect soil erosion in Malaysia in rubber and oil palm. Xinbao. (1992). Planting vetiver on the contour line can reduce run-off by 56% and reduce soil erosion 95%. Greenfield. (1992). Planting vetiver on contour line had no effect on first season but later. Plant must grow until no space between them in order to be effective.

Materials and Methods

On the inner side steep bank 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 thru vetiver rows was collected during August, 1998 to October, 1998 for the total of seven times with two-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 into 30 cm. height every month. Sediments was collected after vetiver stems were more or less touching each other.

Results and Discussion

Table 1 shows soil properties at Prayuen District, Khon Kaen province. Soils are slightly acidic with high electrical conductivity the ECe was 18 dS/m which is considered to be 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. For total weight of sediment from control (no vetiver), 1 row, 2 rows and 3 rows vetiver planting the total sediment weight was 208.1, 160.6, 123.8 and 54.4 tons/ha. which 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 eroded into pond as much as 47.5, 84.4 and 153.8 tons/ha. respectively.

For nutrients leached and get into pond that came with sediment. N, P and K were leached thru vetiver rows but in small quantity due to low concentration at the beginning. When number of vetiver rows increased, nutrient losses decreased but these was no significantly different among the treatments. Most nutrients were taken up by plant and the amount that came together with sediment was low. This amount was not enough to cause eutrophication that can deteriorate water quality.

Table 1 Soil properties in the experiment.

Properties	analysis
pH (1 : 2.5)	6.0
ECe (dS/m)	18.0
OM (%)	0.2
Total N (%)	0.04
Available P (ppm)	3.7
Exch. K (ppm)	31.0

Na (ppm)	3,750
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 platy no structure
Drainage	Poorly
Permeability	Moderate

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

Time	1	2	3	4	5	6	7	Total
Tmt								
	----- tons/ha.* -----							
Control (no vet.)	13.1 ^a	18.1 ^a	95.6 ^b	16.3 ^b	52.5 ^b	0	12.5 ^c	208.1 ^c
1 row vetiver	10.6 ^a	15.6 ^a	62.5 ^{ab}	11.9 ^{ab}	51.9 ^d	0	8.1 ^{bc}	160.6 ^{bc}
2 rows vetiver	13.1 ^a	20.6 ^a	43.1 ^a	10.0 ^{ab}	31.9 ^b	0	5.0 ^{ab}	123.8 ^{ab}
3 rows vetiver	10.0 ^a	8.8 ^b	25.0 ^a	4.4 ^a	5.0 ^a	0	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.**

Conclusion

On the steep slope (more than 100%) of the inner bank of farm pond in saline sandy soil which is slightly acidic with low in fertility. Growing vetiver helps to reduce soil sediment eroded into farm pond. The more vetiver row, the less sediment collected. Planting 1, 2 and 3 rows of vetiver can reduce soil sediment eroded into pond as much as 47.5, 84.4 and 153.8 tons/ha. respectively. Plant nutrients came with eroded sediment was low in quantity and could not stimulate eutrophication. This low quantity due to low concentration of nutrients at the beginning of this saline sandy soils used in the experiment together with vetiver take-up.

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Brief introduction of the author

Dr. Santibhab Panchaban is now an Associate Professor at the Faculty of Agriculture, Khon Kaen University. He is teaching in Soil Fertility and Fertilizer Technology classes as well as Graduate Seminar and Thesis. He published almost 100 scientific papers in Soil Fertility & Fertilizer, saline soils, sandy soils, vetivers and cropping systems. He was also a committee on the 17th World Congress of Soil Science held at Bangkok, Thailand last August. His e-mail address is : santibha@kku.ac.th.