THE IMPACT OF VETIVER GRASS (*Vetiveria zizanioides* Nash) INTEGRATED WITH COVERED PLANTS ON SOIL AND WATER CONSERVATION IN MANGO ORCHARD AT PAKCHONG RESEARCH STATION, THAILAND

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Abstract

Pakchong Research Station is located in the Northeast of Thailand which altitude 350 m above mean sea level. The area for growing mango, longan and avocado is slopy area 5-10 degree. In rainy season, soil erosion takes place in these area. The objective of this experiment was to study the utilization of vetiver grass and covered plants to diminish soil erosion and increase soil fertility for fruit crop production, This experiment was conducted at Pakchong Research Station during March 2010 to September 2010. Vetiver grass (*Vetiveria* zizaniodes Nash) "Surat Thani" were grown in semi-circle with 2 m radius around mango "Namdokmai See-Thong" cultivar along contour line with 15 cm spacing. Covered plants: jack bean (*Canavalia ensiformis* (L.) and lablab bean (*Dolichos lablab* Linn.) were grown 1 month later and were mixed into the soil after 2 months. The experiment was conducted with 2x3 Factorial in Randomized Complete Block Design (RCBD) with 6 treatments (Tr.) and 3 replications.
The results revealed that vetiver grass and lablab bean could promote growth of mango: height,circumference and canopy size after 5 months, but it was not significantly different. Growing vetiver grass could decrease the amount of total runoff, fresh and dry weight of soil loss when compared to the others. Combining 2 factor, it could minimize fresh and dry weight of soil loss in Tr.1: vetiver + no covered plant (7.97 kg and 5.68 kg), whereas the rest 9.12-13.07 kg and 5.97-8.48 kg, respectively. The total runoff was also decreased when vetiver grass had been grown. Nevertheless, it was not significantly different among treatments. Moreover, vetiver grass and covered plants affected the soil humidity content after investigation. Thus, vetiver grass could be promising mango production in slopy area for soil and water conservation. When co-culture with covered plants, it could possibly decrease the consumption of chemical fertilizer, maintain soil humidity and eventually prevent the soil erosion.

Keywords**:** mango production, water conservation, miracle grass, land erosion, covered plant

Introduction

The area for growing mango, longan and avocado at Pakchong Research Station is slopy area 5-10 degree. In rainy season, soil erosion takes place in these areas. According to His Majesty King Bhumipol has initiated idea to use vetiver for soil, water, and environmental conservation. (Vasuvat, 2000) Vetiver grass is a tropical plant that has a high potential

since it revives the environment. In addition to conserve soil and water, vetiver can absorb carbondioxide and other pollutants in the air (Tantivejkul, 2000) This experiment aimed to decrease the deterioration of the soil in slopy area and also study the effect of vetiver and covered plant to soil fertility and soil moisture in fruit orchard.

Materials and Methods

This study has been done during March 2010 to August 2010 at Pakchong Research Station, Pakchong District, Nakhonratchasima, Thailand with rank 47P 0760004 UTM 1623789 (GPS map 76 CSX).

After soil preparation in March 2010, 120 plants of mango "Namdokmai See-Thong" cultivar were planted at 4x8 m spacing. One month later, 4,000 tillers of vetiver grass (*Vetiveria* zizaniodes Nash) "Surat Thani" were planted in semi-circle 2 m radius around the mango tree along contour across the slope 15 cm apart. Sediment ditches were installed 0.3x0.5x4 m. along the row of mango across the slope and covered with polyethylene sheets, 3 ditches/treatment. One month later, covered plants: jack bean (*Canavalia ensiformis* L.) and lablab bean (*Dolichos lablab* Linn.) were planted by direct seeding, followed by cutting and mixing them into the soil after 2 months. Soil fertility and soil moisture were checked before and after growing covered plants. At two-month intervals, leaves of vetiver were cut until the height 20 cm. remained and utilized for mulching to mango trees in Tr.1, Tr.2 and Tr.3. Growth of mangoes was checked once a month and total run off also collected whenever it rained including fresh weight and dry weight of sediment from sediment ditches. The experimental design was 2x3 Factorial in Randomized Complete Block Design (RCBD) consisted of 2 factors, factor A which 2 level of vetiver : a_1= grow vetiver , a_2= no vetiver . Factor B consist of 3 level of covered plants : b_1= no covered plant, b_2 = jack bean, b_3 = lablab bean. There were totally 6 treatments (6 plants/1 treatment) 3 replications, as following:

Tr.1 vetiver grass+ no covered plant
Tr.2 vetiver grass+ jack bean
Tr.3 vetiver grass + lablab bean
Tr.4 no vetiver grass + no covered plant
Tr.5 no vetiver grass + jack bean
Tr.6 no vetiver grass + lablab bean

Results and Discussion

After 2 months, vetiver could grow so well.(Fig.2) When the leaves were cut, the weight of the leaves were 963.38 1,546.67 and 1,632.22 g in Tr.1, Tr.2 and Tr.3, respectively. After another two months, vetiver grew in big clumps and produced inflorescences (Fig.5). The weight of leaves in Tr.1,Tr.2 and Tr.3 were 13.00, 13.31 and 13.67 kg, respectively.

Fig.1 vetiver grass after grown 1 mth.

Fig.2 leaf cutting after 2 mths.

Fig.3 utilize for mulching

Fig.4 vetiver after the first cut

Fig.5 vetiver after grown 4 mths.

Fig.6 vetiver after cut in the second time

Table 1 shows soil moisture content before and after investigation in the first year, Soil moisture content after investigation increased in all treatments. Jack bean + no vetiver (Tr.5) showed the highest 17.42% soil moisture content, however non-significantly difference was found among treatments. It showed the highest percentage of soil moisture content increasing 7.60% when planted vetiver alone (Tr.1) and significantly difference were found as well. No vetiver + no covered plant showed higher soil moisture content after investigation as a result of the weed in the plot. This study could not perform the effect of vetiver and covered plant in soil moisture preserve clearly, long period 2-3 years would probably reveal the better result.

Table 2 shows fresh weight, dry weight and total runoff from sediment ditch in average. Vetiver could reduce the weight of sediment and total runoff, but there is not any significant difference. The lowest total runoff came from treatment that grew jack bean nevertheless; there was no significantly difference in fresh weight, dry weight and total run off between covered plants. When vetiver integrated with covered plants, it indicated clearly that vetiver alone (Tr.1) could decrease fresh weight, dry weight and total runoff.
Jack bean alone (Tr.5) showed the lowest total runoff 132.62 kg due to the leakage of the ditch. Treatment without vetiver (Tr.4, Tr.5, Tr.6), also revealed more fresh weight and dry weight of sediment (11.95-13.07 kg) including total runoff compared to the rest. Nevertheless, it was not significantly different among treatments.

Table 1. Soil moisture content before and after investigation during March - August 2010

experimental unit	soil moisture content (%)		
	before	after	increase
Vetiver grass			
grown	10.99 a	16.57 b	5.57 a
not grown	11.03 a	17.13 a	6.09 a
F-test	ns	**	ns
Covered plant			
no	9.57 b	16.92 a	7.35 a
jack bean	10.83 b	16.85 a	6.02 a
lablab bean	12.65 a	16.78 a	4.13 b
F-test	**	ns	**
Vetiver x covered plant			
grown no	9.04 b	16.64	7.60 a
grown jack bean	11.29 ab	16.28	4.99 bc
grown lablab bean	12.66 a	16.80	4.14 c
no no	10.10 ab	17.20	7.10 ab
no jack bean	10.37 ab	17.42	7.05 ab
no lablab bean	12.64 a	16.76	4.12 c
F-test	*	ns	*
CV (%)	8.65	2.84	14.04

*** = Significantly different at 1% level*, ** = Significantly different at 5% level*, *ns = Non significant*

Table 2. The average of fresh weight , dry weight and total runoff from sediment ditch

experimental unit	fresh weight (kgs.)	dry weight (kgs.)	total run off (kgs.)
Vetiver grass			
grown	8.75	5.94	135.40
not grown	12.60	8.14	152.18
F-test	ns	ns	ns
Covered plant			
no	10.52	7.08	147.46
jack bean	10.96	7.18	134.21
lablab bean	10.55	6.86	149.70
F-test	ns	ns	ns
Vetiver x covered plant			
grown no	7.97	5.68	133.42
grown jack bean	9.12	6.17	135.79
grown lablab bean	9.15	5.97	136.98
no no	13.07	8.48	161.90
no jack bean	12.79	8.19	132.62
no lablab bean	11.95	7.74	162.42
F-test	ns	ns	ns
CV (%)	30.43	29.95	14.63

Table 3 shows growth of mangoes in term of height, circumference and canopy size. The results revealed that the height and canopy (wide) of mangoes performed the highest 102.56 cm and 43.38 cm when grew vetiver + lablab bean, whereas growing lablab bean + no vetiver showed the highest circumference 21.63 mm. Nevertheless, there was no significant difference among treatments.

Table 3. Growth of mango Namdokmai See-thong after 5 months.

Experimental unit		height (cm)	circumference (mm)	Canopy size (cm)	
				wide	narrow
Vetiver grass					
grown		101.22	19.80	42.52	28.05
not grown		99.74	20.40	42.23	25.79
F-test		ns	ns	ns	ns
Covere plant					
no		101.12	20.43	41.93	27.59
jack bean		99.10	19.40	42.07	26.48
lablab bean		101.22	20.47	43.15	26.70
F-test		ns	ns	ns	ns
Vetiver x covered plant					
grown	no	102.41	20.54	41.20	29.40
grown	jack bean	98.68	19.54	42.98	26.76
grown	lablab bean	102.56	19.31	43.38	27.98
no	no	99.83	20.32	42.67	25.78
no	jack bean	99.52	19.26	41.16	26.20
no	lablab bean	99.87	21.63	42.92	25.41
F-test		ns	ns	ns	ns
CV (%)		4.30	4.96	7.47	11.23

Conclusions

Soil moisture content increased the most 7.6% when vetiver had been grown alone and showed significantly different. Growing vetiver could decrease the amount of fresh weight, dry weight and total runoff, but it was not significantly different. Vetiver alone or vetiver integrated with covered plant slightly promoted growth of mango, but non- significant difference had been found.

References

Anusontpornperm, S, Supattanakul, W, and Kawilaves, P. 2000. Effects of vetiver grass and Leucaen on soil erosion control in sugarcane, maize and cassava crop practices. In: Proceedings of the Second International Vetiver Conference (ICV2) Thailand. pp 219-222.

Tantivejkul, S. 2000. His Majesty The King and Vetiver Work for the Environment. In: Proceedings of the Second International Vetiver Conference (ICV2) Thailand. pp 3-4.

Vasuvat Sitilarp.2000. The role of vetiver grass for soil and water conservation in Thailand. Proceedings of the Second International Vetiver Conference (ICV2) Thailand. pp 8-11.

A Brief Introduction to the First Author

Miss Pinit Karintanyakit, researcher, is the chief of Pakchong Research Station, Inseechandrasthitya Institute for Crops Research and Development (IICRD), Kasetsart University, Thailand. In the past 15 years, she has experiences in plant tissue culture of some tropical crops, flowering and ornamental plants. She also has experiences in vetiver research by using vetiver oil for vegetables pest management and use vetiver as green fuel.

She is still working with vetiver integrated with covered plants for soil and water preservation in mango orchard.