INTERNATIONAL CONFERENCE ON

BALANCED NUTRIENT MANAGEMENT FOR TROPICAL AGRICULTURE

↗ 12-16th APRIL 2010

↗ SWISS GARDEN RESORT & SPA, KUANTAN, PAHANG, MALAYSIA

ABSTRACT

Organized by

PERSATUAN SAINS TANAH MALAYSIA · MALAYSIAN SOCIETY OF SOIL SCIENCE

UPM · UNIVERSITI PUTRA MALAYSIA · BERILMU BERBAKTI

INSTITUT MONDIAL DU PHOSOHATE · IMPHOS

INTERNATIONAL CONFERENCE ON

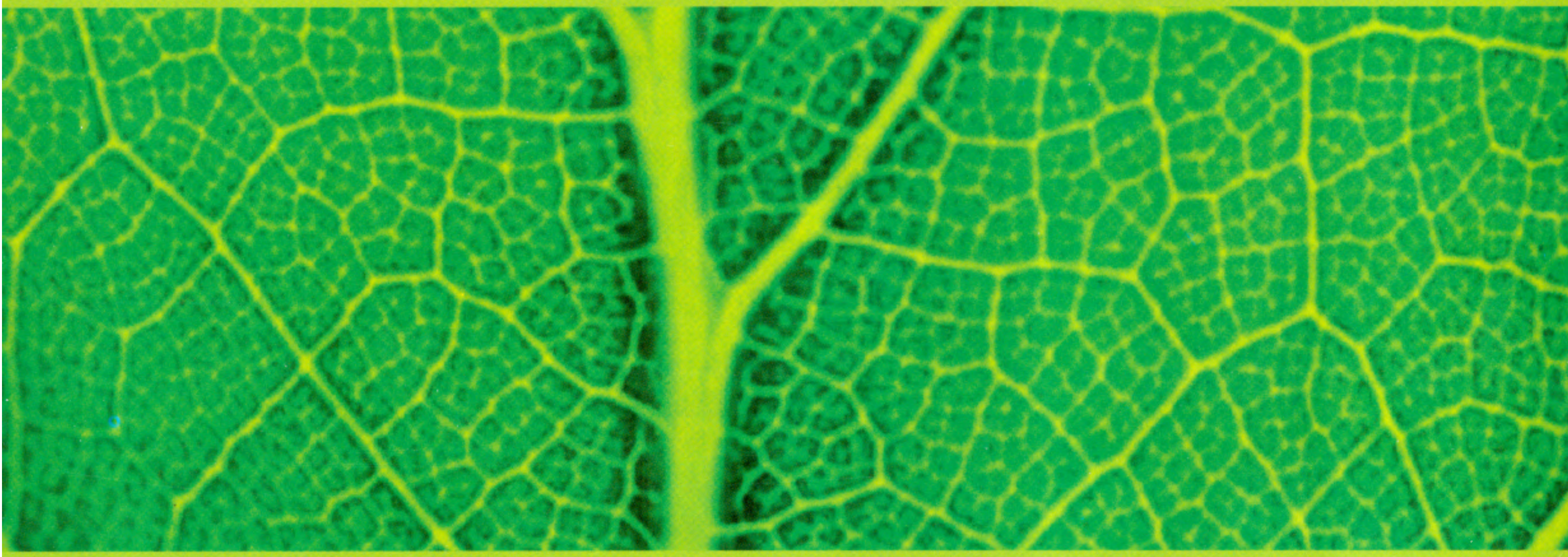
BALANCED NUTRIENT MANAGEMENT FOR TROPICAL AGRICULTURE

- 12-16th APRIL 2010
- SWISS GARDEN RESORT & SPA, KUANTAN, PAHANG, MALAYSIA

ABSTRACT

Organized by

UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI



The Secretariat
International Conference on Balanced Nutrient
Management For Tropical Agriculture
Department of Land Management
Faculty of Agriculture
43400 UPM, Serdang, Selangor
MALAYSIA

[T] 603-8946 6978   [F] 603-8943 4419

ISBN 978-967-9945-32-4

<u>POSTERS:</u>

EFFECTS OF DIFFERENT SOIL CONSERVATION PRACTICES ON SOIL FERTILITY

Abolfath Moradidalini [1], Christopher Teh Boon Sung [2+], Ahmad Husni Mohd Hanif [2], Che Fauziah, Ishak [2] and Goh, Kah Joo [3]
Moradi1373@gmail.com

INTRODUCTION

Due to the slope and high rainfall intensity, sloping lands are faced with nutrient and water losses through runoff which may result in reduction in soil fertility. Soil fertility is the status of a soil with respect to its ability to supply adequate and balanced amount of elements essential for plant growth without a toxic concentration of any element (Foth and Elis, 1997). Any decrease in soil fertility may adversely affect plant nutrition. Therefore, Proper soil conservation practices are needed to maintain and improve soil fertility on sloping lands. Organic mulches (Empty Fruit Bunches (EFB) of oil palm and Eco-Mat) and silt pit are among the recommended soil conservation practices to maintain and improve soil fertility. EFB is one of the major wastes of the oil palm fresh fruit bunches after oil mill process. In spite of the beneficial effects of EFB on soil characteristics and fertility (Lim and Zaharah, 2002; Rosenani and Wingkis, 1999), it has a disadvantage of being bulky, making its storage, transportation and filed application cumbersome and expensive. One recent method is to compress EFB into a carpet-like material known as Eco-Mat. Eco-Mat is less bulky but more flexible and easier to handle than EFB. Therefore, its storage, transportation, and field application is easier and cheaper than EFB.

Silt pit is another method to conserve soil water and nutrients on sloping land oil palm plantation which is constructing long and wide trenches into the soil between planting rows across the hill slope to collect runoff water and eroded soils and redistribute the collected water and nutrient back into the plant root zone after rainfall event. Information on the effects of Eco-Mat and silt pit on soil fertility and oil palm nutrition is limited. According to MPOB (2003), Eco-Mat increased growth rate and N, P and K uptake by young oil palms. In an experiment carried out in India (George et al. 2003), silt pit improved soil N, P and K, but did not increase plant growth, leaf nutrient content and rubber yield over a period of 18 months.

Although much has been researched on the effects of EFB (but to a much lesser degree for Eco-Mat and silt pit) on soil fertility, there is no single study, to our knowledge, that compares the effects of these soil and water conservation methods on soil fertility. Therefore, the objectives of this experiment were to compare the effects of these conservation practices on soil fertility and oil palm nutrition.

METHODOLOGY

A field experiment was conducted at Balau Estate near Semenyih (2°55′57″ N and 101°52′56″E), Selangor in Malaysia with a slope of 6°. Effects of four conservation practices, EFB, Eco Mat, palm fronds and silt pit on fertility of a sloping land cultivated with 8-year old oil palm trees and plant nutrition were examined. The experimental layout was strip-strip plot arranged in a completely randomized block design with three replications. The silt pits were constructed by digging a trench along the hill contour, so that each one had a dimension of 4, 1, and 0.5 m in length, width, and depth respectively. EFB applied as 1000 kg per plot and four pieces of 1× 2 m Eco-Mat having 2 cm thickness were placed on the soil surface between the trees in each plot.

[1] Agricultural and Natural Resources Research Center of Hormozgan, Bandar Abbas, Iran
[2] Department of Land Resource Management, Faculty of Agriculture, University of Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
[3] Applied Agriculture Research, Locked Bag 212,Sungai Buloh, Post Office, Sungai Buloh, Selangor, Malaysia

Soil samples from three depths, 0-15, 15-30 and 30-45cm were taken in each treatment plots every three months for one year from Dec 2007 until Dec 2008. The samples then were analyzed for soil pH, CEC, total C and N, available P, exchangeable- K, Ca, and Mg. Soil C:N ratio was also calculated. The data was analyzed statistically by SAS and means separation test was done by LSD.

RESULTS AND DISCUSSION

Soil pH

Average soil pH across the time and soil depth in EFB was 5.72, significantly higher than Eco-Mat 4.70, silt pit 4.42 and control 4.42. In comparison to control and silt pit, EFB increased soil pH by an average of 28.9 %, while, the increasing rate due to Eco-Mat was only 5.85 %. Silt pit did not increase soil pH. The increase rate in soil pH due to the EFB was 23.05 % higher than Eco-Mat.

Soil total C, available P and Exchangeable Ca

Conservation practices had significant effect on soil total C, available P and Exchangeable Ca at only 0-15 cm soil profile depth. At this depth, soil total C was significantly higher in EFB than other conservation practices in nearly all of the time (Fig.1 (a)). There were no significant differences among the Eco-Mat, silt pit and control.

Changes in soil available P due to the conservation practices over the time for 0-15 cm soil depth are shown in Figure 1(b). Except in March where soil available P was significantly higher in silt pit than other conservation practices in other months there was no significant different among the conservation practices.

For soil exchangeable Ca, although mean comparison by LSD showed that there was no significant different among EFB, Eco-Mat and silt pit, they generally, increased that significantly higher than control (Fig.1(b)).

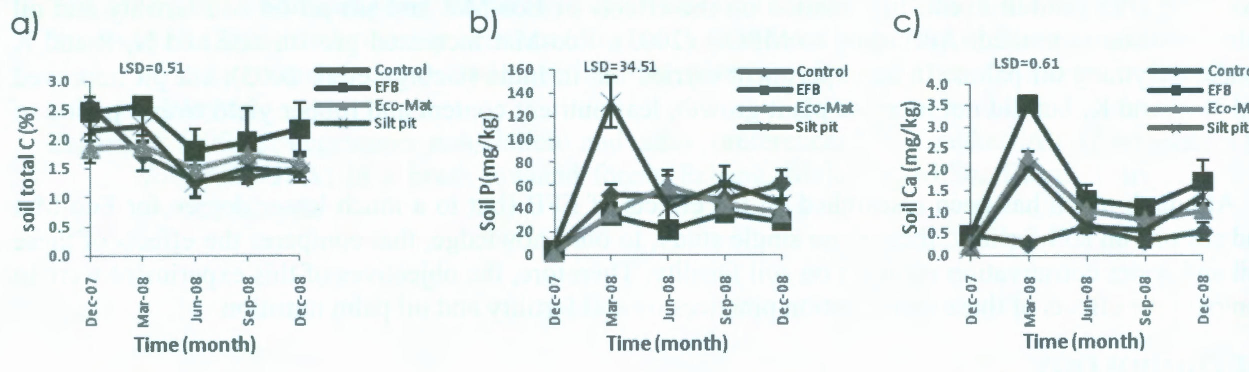


Figure 1. Changes in soil total C (a) and available P (b) and exchangeable Ca (c) due to the different conservation practices over time for 0-15 cm soil depth.

Soil Exchangeable K

Figure 2 shows changes in soil exchangeable K over the time for different conservation practices at average soil depth (a) and time (b). As shown in Figure 2 (a), in the first six month after field application, EFB increased soil potassium significantly higher than the Eco-Mat, silt pit and control. After that, however, soil potassium was higher in EFB; it was not significantly different from other conservation practices. There were no significant different among Eco-Mat, silt pit and control during the experiment. Changes in soil exchangeable K with depth across the time are shown in Figure 4(b). Soil exchangeable K was significantly higher in EFB than Eco-Mat, silt pit and control for all of the depths. There was no significant difference in soil K between Eco-Mat, silt pit and control at all of the soil depths.

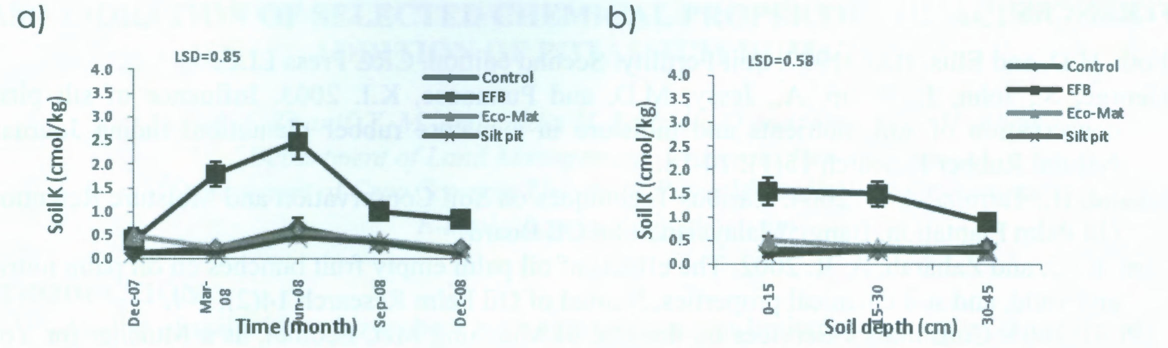


Figure 2. Changes in soil exchangeable potassium due to different conservation practices over the time (a) and soil depths (b)

Soil Exchangeable Mg

Figure 3 shows changes in soil exchangeable Mg averaged across the soil depth (a) over the time and averaged across the time (b) with soil depth, for different conservation practices. In general, soil Mg was significantly higher in EFB than Eco-Mat, silt pit and control over the time. There were no significant differences between Eco-mat, silt pit, and control. As shown in Figure 3 (b), Soil exchangeable Mg was significantly higher in EFB than the other conservation practices at only 0-15 cm soil depth. There were no significant differences among the conservation practices at 15-30 and 30-45 cm soil depths.

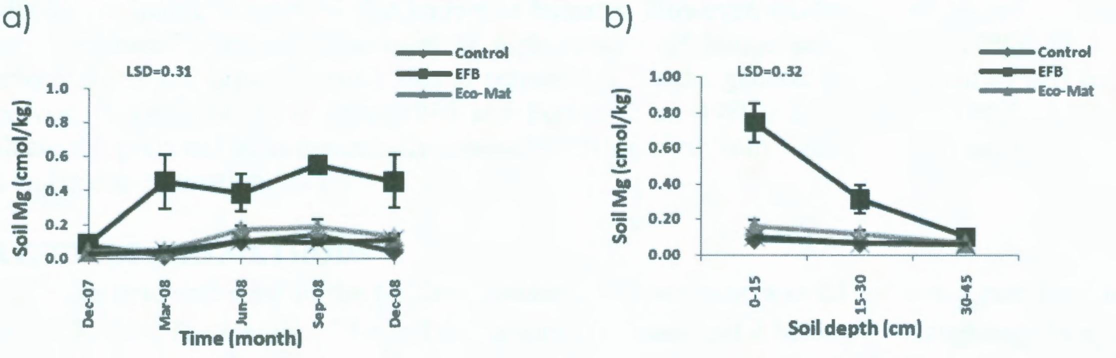


Figure 3. Changes in soil exchangeable magnesium under different conservation practices over the time (a) and soil depth (b).

Soil pH, total C, exchangeable- K, Ca, Mg, available P and oil palm leaf K, Mg and P content were significantly affected by the conservation practices. However, soil total N, C:N ratio, CEC and leaf N and Ca levels were not affected. EFB improved soil fertility by increasing soil pH, total C, exchangeable K, Mg and to a lesser extend Ca significantly higher than control, Eco-Mat and silt pit. EFB also increased oil palm leaf K and Mg and P contents. In most cases, Eco-mat and silt pit were as effective as control. Therefore, the use of EFB is environmental friendly and recommended to improve soil fertility and oil palm nutrition as it is a good source of organic matter and basic plant essential nutrients.

ACKNOWLEDGEMENTS

This research is funded by the Ministry of Science , Technology and Innovation, Malaysia (Project No.05-01-04-SF0632).We are grateful to Mr. Subra and his field workers at Balau Estate, Madam Petronella Gerald Ah Tung at Applied Agriculture Research Sdn. Bhd.,Sungai Buloh, and the laboratory staff at the Dept. of Land Management, UPM for their help in this research.

REFERENCES

Foth, H.D. and Ellis, B.G., 1997. Soil Fertility. Second edition. CRC Press LLC.

George, S., John, J., Philip, A., Jessy, M.D. and Punnoose, K.I. 2003. Influence of silt pits on conservation of soil, nutrients and moisture in a mature rubber plantation. Indian Journal of Natural Rubber Research 15(1): 14-18.

Khalid, H., Tarmizi, A.M. 2004. Various Techniques on Soil Conservation and Moisture Retention in Oil Palm Plantation. Bangi: Malaysian Palm Oil Board.

Lim, K. C. and Zaharah, A. R. 2002. The effects of oil palm empty fruit bunches on oil palm nutrition and yield, and soil chemical properties. Journal of Oil Palm Research 14(2), 1-9.

MPOB. 2003. Consultancy Services on the Use of Mulching Mat, Ecomat, as a Mulcher for Young Palm. Bangi: Malaysian Palm Oil Board.

Ortiz, R. A., Villalobos, E. and Fernández, O. 1992. Mulch and Fertilizer Effects on Soil Nutrient Content, Water Conservation and Oil Palm Growth. ADS Oil Palm Papers, No. 6.

Rosenani, A.B. and Wingkis, R. 1999. Empty fruit bunch application on newly transplanted oil palm: its decomposition and nutrient release. In S. Zauyah, A.B. Rosenani and H.M. Saud (Eds.), Proceedings of Soil Science Conference of Malaysia (p. 112-129). Kuala Lumpur: Malaysian Society of Soil Science.

Sharpley, A.N., and S. Rekolainen. 1997. Phosphorus in agriculture and its environmental implications. p. 1–54. In H. Tunney, O.T. Carton, P.C. Brookes, and A.E. Johnston (ed.) Phosphorus Loss From Soil To Water. CABI Publ., Wallingford, UK.