International Journal of Agricultural Technology 2016 Vol. 12(7.1):1491-1498
Available online http://www.ijat-aatsea.com
ISSN 1686-9141

Efficiency of Material Types of Box Fences to Prevent Rat Damage in Oil Palm Plantations

Tipawan Thongjua*and Jarun Thongjua*

Faculty of Agriculture, Rajamangala University of Technology Srivijaya, Nakhon Si Thammarat 80110, Thailand

Tipawan T. and T. Jarun (2016). Efficiency of Material Types of Box Fences to Prevent Rat Damage in Oil Palm Plantations. International Journal of Agricultural Technology 12(7.1):1491-1498.

The major problem of immature oil palm plantation is rat damaging, so that it is necessary for farmers to use the barriers such as fence surrounded oil palm trees for preventing continuously. To study on the material types of fence for evaluate the efficacy of method to prevent rat damage was conducted in 1 year oil palm plantation in Thungsong district, Nakhon Si Thammarat province, Thailand, from January to December, 2015. The experimental design was RCBD with 5 replications (one tree per replications) 6 methods (The material types of fence cylinder or boxes, with the size, 40 cm. x 40 cm. x 40 cm, in the 2^{nd}-4^{th} method), as follows:1) wire mesh cylinder 2) polyethylene plastic sheets 3) tin sheets 4) zinc sheets 5) weeding around the base of the trunks about one meter and 6) control (no weeding and no surrounding). Check the infestation of rat every week. The assessment of rat damage were divided into four levels from fresh chewing damage at the trunk of the trees; 0 = no damage, 1 = slight, 2 = moderate and 3 = severe. The highest damage level of rats was control method, showed the damage level from 0.25 to 0.75, followed by weeding around the base of the trunk showed damage level from 0.20 to 0.50 (with effectively 50 percent compare with control) and the method of wire mesh cylinder, polyethylene plastic sheet, tin sheets and zinc sheets were no damaged and significant with the control (with effectively 100 percent compared with control).

Keywords: oil palm, rat damage, wire mesh , polyethylene plastic

Introduction

Oil palms is the one important widely grown crops in SE Asia. The area planted with oil palm in Thailand has been increasing constantly, with an average annual growth rate of 11% from 1981 to 2000 , 9% from 2001 to 2010 and with the average annual growth rate of 9.7% between 1998 and 2008. (Wood 2010). Oil palm can be used as raw material in the process of palm oil production as a form of safe edible vegetable oil used in many food and non-

Coressponding Author: Tipawan T.; **E-mail:** kai_thipawan@hotmail.com.

food products (Doa 2010). Rat infestation is the one important problem for oil palm production. Apart from attacking matured palms, rat also causes damage to young plantings. At the nursery stage, rat feeds on the apical tissue causing death or affecting normal development of the young shoots. On young oil palms, the most favourite part is the petiole that forms the fronds, damage to this suppresses the formation of fronds. In matured palm, attack is concentrated on the inflorescence and the fruit bunch. Damage to inflorescence affects flowering while damage to fruits can reduce yield (Hadler, 1984; Wood, 1984). The rat species responsible for damage in oil palms plantation of Thailand are the wood rat (*Rattus tiomanicus*) and rice field rat (*R. argentiventer*), the wood rat which lives on the ground nesting in the piles of old fronds cut from palms, or in the crowns. It feeds on developing fruit bunches and detached fruit that fall to the ground when ripe (Wood, 2001), and the rice field rat is normally found in young oil palms (Wood, 1984; Liau and wood, 1978). It is also a common species in oil palm formerly planted with rubber (Wood, 1976; Liau *et al*,1993).

Today there are many material types of fence or trunk protectors that are specially for the purpose of protecting young orchard trees. They are manufactured of plastic, aluminum foil, flexible aluminum mesh. Some are more cost-effective than others, especially as they relate to installation time. Because commercial wraps are available and natural materials are labor-intensive to collect and attach. In developing countries, they continue to be used other resources are unavailable or costly and labor is relatively inexpensive such as feed and fertilizer bags have also been used as trunk wraps protection. (Wood, 2001).

Protecting individual plants or small clumps of plants with some type of protective material are often much less expensive than fencing an entire garden or crop or netting over the entire area to prevent damage by such species (Rex *et al*,1990). The methods include various materials suite directly on the tree trunks, the larger loose-fitting protective cylinders or other individual exclosures, shields, or bands to prevent access to the upper tree portions the trunk, or other materials around the base of trees to restrict feeding or to make the habitat less favorable to pest species. To solved the problem of rat damage of oil palms farmers, the study on the suitable material types of fence protection for the barriers such as boxes or cylinders fence surrounded palm trees for rat prevention, reduce the using of chemical rodent and herbicide control.

Materials and methods

The study on the material types of fence to prevent rat damage was conducted in 1-year oil palm plantation in Thungsong district , Nakhon Si Thammarat province, Thailand from January to December, 2015. The experimental design was RCBD with 5 replications (one tree per replications) 6 methods (material types of fence/treated methods), as follows:

1) wire mesh cylinder
2) polyethylene plastic sheets
3) tin sheets
4) zinc sheets
5) weeding around the base of the stem about one meter
6) control (no weeding and no surrounding)

Preparation fence cylinder or boxes, with the box size, 40 cm. x 40 cm. x 40 cm, in 2^{nd}-4^{th} method, and placed the protector fence on the ground around the trunk of oil palm. Surveyed the infestation everyweek before and after placed fence on the treated plots. Recorded rat damage level, that were sorted into 4 groups based on visual determinations of fresh chewing damage, as follows : 0 = no damage, 1 = slight, 2 = moderate and 3 = severe.

Means rat damage level was compared by using analysis of variance (ANOVA) and means difference were compared by using the Duncan's Multiple Range Test (DMRT).

Calculated the efficiency of method (%), compared with control (non treated) which was adapted from Handerson and Tilton(1995) .

$$\text{Efficiency of method (\%)} = \frac{C_2T_1 - C_1T_2}{C_2T_1} \times 100$$ (Handerson and Tilton, 1995)

C_1 and C_2 : average of rat damage level before and after treated on the control (no weeding and no surrounding)

T_1 and T_2: average of rat damage level before and after treated on the oil palm plots

Results

The study on the assessment of rat damage and efficiency of material types of box fences to prevent rat damage in oil palm plantations in Nakhon Si Thammarat province, Thailand from January to December, 2015. Results from the average of rat damage level shown that the highest level of damage was control (no weeding and no surrounding), showed the damage level from 0.25

to 0.75, with average of rat damage 0.39, followed by weeding around the base of the stem showed damage level from 0.20 to 0.50, with average of rat damage 0.20, and the other methods that using of wire mesh cylinder , polyethylene plastic sheet, tin sheets and zinc sheets were found no damage. (Table 1)

Table 1 Average percentage of rat damage levels of fences to prevent rat damage in oil palm plantations in Nakhon Si Thammarat province, Thailand from January to December, 2015

Method/ Month	Average percentage of rat damage levels [1]												
	Jan.	Feb	Mar.	Apr.	May.	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	Average
1. wire mesh cylinder	0	0	0	0	0	0	0	0	0	0	0	0	0.00
2. polyethylene plastic sheets	0	0	0	0	0	0	0	0	0	0	0	0	0.00
3. tin sheets	0	0	0	0	0	0	0	0	0	0	0	0	0.00
4. zinc sheets	0	0	0	0	0	0	0	0	0	0	0	0	0.00
5. weeding around the base of the stem about one meter	0	0	0	0	0	0.20	0.20	0.25	0.25	0.50	0.50	0.50	0.20
6. control (no weeding and no surrounding)	0	0	0.25	0.25	0.25	0.50	0.50	0.50	0.50	0.50	0.75	0.75	0.39

[1] Means from 5 replications (one tree per replications)

Results from the effectiveness of methods revealed that the methods with fence surrounding such as wire mesh cylinder, polyethylene plastic sheet, tin sheets and zinc sheets were high effectiveness, and could protected rat infestation at 100 percentage. The lower effectiveness method, weeding around the base of the stem was 50 percentage compared with control)no weeding and no surrounding. (Table 2)

Table 2 Efficiency of material types of fences (%)to prevent rat damage in oil palm plantations in Nakhon Si Thammarat province, Thailand from January to December, 2015

Method/ Month	Average percentage of rat damage prevention (%)												Efficiency of method
	Jan.	Feb	Mar.	Apr.	May.	Jun.	July	Aug.	Sep.	Oct.	Nov.	Dec.	
1. wire mesh cylinder	100	100	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100
2. polyethylene plastic sheets	100	100	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100
3. tin sheets	100	100	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100
4. zinc sheets	100	100	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100[a]	100
5. weeding around the base of the stem about one meter	100	100	100[a]	100[a]	100[a]	80[a]	80[b]	75[b]	75[b]	50[b]	50[b]	50[b]	%50
6. control (no weeding and no surrounding)	100	100	75[b]	75[b]	50[b]	50[b]	50[c]	50[c]	50[c]	50[b]	25[c]	25[c]	-
F-test	-	-	**	*	**	**	**	**	**	**	**	**	
C.V.(%)	-	-	4.60	10.14	8.15	16.00	5.33	10.57	8.30	10.58	9.17	5.57	

/Means from 5 replications (one tree per replications)

Number in the column with same letters not significantly different ($p>0.05$)

*significantly different ($P<0.05$) ** significantly different ($P<0.01$)

Effectiveness of method(%) = $\frac{C_2 T_1 - C_1 T_2}{C_2 T_1}$ X 100

C_1 and C_2 : rat damage levels before and after treated to prevent rat in control plot) non treated/ no weeding and no surrounding (

T_1 and T_2: rat damage levels before and after treated to prevent rat in treated plot) treated-plot)

Discussions

For the cost of protectors, now several types of specially designed and inexpensive trunk protectors are available commercially. Commercial tree protectors commonly used today are designed to be left on young trees year-round, at least for the first couple of years when the trees are most vulnerable to animal damage, providing they are not so tight as to restrict growth. As the trunk grows in diameter and the bark thickens, it is less prone to severe kinds of damage. Cylinders for individual trees are often used to protect young trees. Although these may be constructed from a variety of materials, poultry netting , plastic netting are the most commonly used and be currently extensively used

for protecting forest tree seedlings from girdling, gnawing, clipping, and/or browsing pest damage (Wood, 2001)

Wire cylinders are the most commonly suggested protectors against rat and inexpensive compare with other material types. The most suitable sizes are 40-50 cm.in high. The height needed varies with the pest species. Most sources recommend burying the bottom few inches, generally 10 to 15 cm. of the cylinders. Wire cylinders are generally considered effective if properly installed. The initial investment for these devices is often higher than for most types of wraps and other materials applied directly to the trees. Most individual cylinders, or cages are designed for long-term use (generally for several years). Wire mesh guards can be reused on other trees once (Quick, 1990 ; Wood, 2001) , no longer needed to protect the existing trees. Once in place, cylinders require little maintenance except checking to make sure they aren't injuring the tree or have been damaged while performing cultural practices such as pruning, or picking and making any necessary repairs. Wire cylinders may restrict tree development so it is important that the diameter of the guards allows for tree growth and that the guards be removed or enlarged as the trees grow into them (Marsh and Salmon 1979).

Wire screening cylinders can also be used to exclude rat although the cylinders may need to be taller, tree guards can be made using wire netting with larger (1/2 to 1-in) mesh sizes, which generally lower their cost. Guards made of 20-gauge chicken wire/poultry netting with 1-in mesh are commonly used (Johnson 1964, Marsh and Salmon 1979). Cylinders generally extend to 1-1/2 to 3-ft tall with the diameter varying with the size and type of tree being protected. The height and diameter may depend on the distance from the ground where tree branching start. Cylinders should be tall enough and of large enough diameter so that the trunk and lower young branches are screened from rat and rabbits. Cylinders should also be braced with 1 or 2 stakes or spreaders to prevent pest from pressing the wire against the trunk and damage the trees through the mesh. Three-foot high poultry netting may also be used to encircle haystacks to protect them from damage (Marsh and Salmon 1979)

Even so, some protectors are not considered effective tree protection because some species of rat feed on the roots well below the practical depth of most installed cylinders. So that , the diameter of cylinder should be used varies with the age, type, and branching structure of the tree. Recommendations often suggest cylinders with 6-in diameters for young orchard trees (1 1/2 to 2-in in diameter), while others prefer cylinders somewhat larger in size (Mills ,1929: Wilkinson 1945).

In Malaysia chicken-wire guards on oil palms have been used for rats (*Rattus* spp.) and red-bellied squirrels *(Callosciurus notatus)* (Wood, 1976).

However, such devices were not highly effective for preventing damage by rats (Wood, 1976; Singleton, 1999)

Shields Metal flashing and other types of shields are used on mature trees to prevent animals from climbing the trunks to defoliate trees or damaging or consuming fruits, nuts, or pine cones. Bands of galvanized metal or aluminum flashing have been used to prevent rats (Wood, 1985) from climbing crop trees. Popenoe (1913) recommended 12-in wide bands beginning 3 ft. above ground to protect against rats, and the bands should be 16-in wide for that purpose. These types of protectors can be effective as long as there are no drooping branches providing access from the ground and no nearby unbanded trees permitting tree-to-tree travel. These bands and shields also need to be adjustable to accommodate expansion as the trees grow. (Wood, 1988)

Acknowledgement

This research project had been supported by Office of National Research Council of Thailand (NRCT).

References

DOA. (2010). Good agricultural Practice (GAP) for oil palm. [online] http://www. doa.go.th. [September 1, 2015]. (in Thai).

Gillbanks, R. A., Turner, P. D., and Wood, B. J. (1967). Rat control in Malaysian oil palm estates. *Planter*, 43(7): 297-315.

Hadler, M. R. (1984). Rodents and rodenticides. *Span* 27(2), 74-76.

Johnson, W.V. (1964). Rabbit control. Proc. Vertebr. Pest Conf. 2:90-96

Liau, S. S., Chung, G. F., Sim, S. C., and Ho, C. T. (1993). Rat species composition and distribution in Western Malaysian Plantations (with particular reference to oil palm plantations). Proceedings 1991 PORIM International Palm Oil Conference – Agriculture (Module 1): 511-516. Palm Oil research Institute of Malaysia, Kuala Lumpur.

Liau, S. S. and Wood, B. J. (1978). Increased rice production through control of field rats. Planter 54(624): 149-159.

Marsh, R.E., and T.P. salmon. (1979). The control of jack rabbits in California Agriculture, pp. 842-857 In: Proc. World Lagomorph Conf., Guelph, Ontario, Canada.

Mills, E.M. (1929). Do you know that the annual loss from field mice exceeds $6,000,000? Fruits and Gardens 12:4,10.

Popenoe, P.B. (1913). Date Growing in the old world and the New. West India Gardens, Altadena, CA. 316 pp.

Powell, T., and B. Powell. (1977). Your Garden Homestead. Houghton Mifflin Co., Boston, MA. 272 pp.

Quick, G. R. (Ed.) (1990). Rodents and rice. Report and proceedings of an expert panel meeting on rice rodent control, Los Banos, September 10-14, 1990. 132 pp. International Rice Research Institute, Philippines.

Rex E. Marsh, Ann E. Koehler and Terrell and P. Salmon.(1990). Exclusionary methods and materials to protect plants from pest mammals. Proceedings of the Fourteenth Vertebrate Pest Conference.

Singleton, G. R., Hinds, L. A., Leirs, H., and Zhang, Z. (eds.) (1999). Ecologically-based management of rodent pests. Monograph No. 59. Australian Centre for International Agricultural Research, Canberra: 1-494.

Thomas, J.W., and R.M. degraaf. (1974). Raccoons on the Roof. pp. 153-168 In: Gardening with Wildlife, National Wildlife Federation, Washington, DC. 190 pp.

Wilkinson, A.E. (1945). Fruits, Berries & Nuts and How to Grow Them. The Blakiston Co., Philadelphia, PA. 271 pp.

Williams, C.N., and Y.C. hsu. (1979). Oil palm cultivation in malaya. University of Malaya Press, Kuala Lumpur. 205 pp.

Wood, B. J. (1976). Vertebrate pests. In: Oil palm research (Ed. R. H. V. Corley, J. J. Hardon and B. J. Wood). Elsevier Press, Amsterdam. :395-418.

Wood, B. J.(1984). A long-term study of *Rattus tiomanicus* (Miller) populations in an oil palm plantation in Johore, Malaysia. I – Study methods and population size without control. Journal of Applied Ecology 21: 445–464.

Wood, B. J. and Liau, S.S. (1984). A long-term study of *Rattus tiomanicus* (Miller) populations in an oil palm plantation in Johore, Malaysia. III – Bionomics and natural regulation. Journal of Applied Ecology 21: 473–495.

Wood, B. J. (1985). Biological control of vertebrates – a review and an assessment of prospects for Malaysia. Journal of Plant Protection in the Tropics, 2(2): 67-79.

Wood, B. J. (1988). Wood rat strikes again. Planter 64(744): 131-132.

Wood, B. J. and Liau, S. S. (1978). Rats as agricultural pests in Malaysia and the tropics. Planter 54(631): 580-599.

Wood, B. J., Chung, G. F. and Sim, S. C. (1990). The occurrence and control of warfarin-resistant rats in oil palms. Proceedings of 1989 International Palm Oil Development Conference .

Rex E. Marsh, Ann E. Koehler ,Terrell P. and Salmon. (1990). Exclusionary methods and materials to protect plants from pest mammals. Proceedings of the Fourteenth Vertebrate Pest Conference .