Library
REP. 1983-080

RAT CONTROL IN COCONUT-PINEAPPLE INTERCROP

MELANDA M. HOQUE

AUTHOR FILE COPY
DO NOT REMOVE

PHIL. AGR. U.P. LOS BANOS
VOL. 66, No. 1
Jan.-Mar. 1983

PHIL. AGR. 66: 82—89
JAN.-MAR. 1983

ISSN 0031—7454

RAT CONTROL IN COCONUT-PINEAPPLE INTERCROP

MELANDA M. HOQUE

Researcher, National Crop Protection Center, College of Agriculture, University of the Philippines at Los Baños, College, Laguna.

Funded by the National Crop Protection Center, College of Agriculture, University of the Philippines at Los Baños, College, Laguna.

CESC No. 3538. Received for publication 21 September 1982.

Key Words: crown baiting, economic benefits of baiting, ground baiting, pineapple intercrop, rat control, rats in coconut.

Ground and crown baitings in coconut-pineapple intercrop were evaluated to determine cost effectiveness in reducing rat damage to both crops. Ground baiting was more economically effective in a pineapple-coconut intercrop. However, if rat control is intended only for coconut, ground baiting was less economical than crown baiting. If crown baiting is a regular rat control practice, ground baiting can be employed to supplement crown baiting before rats damage pineapples during the latter's flowering stage.

INTRODUCTION

Rat control methods in coconut, including trunk banding (Montenegro, 1962; Hoque, 1972) and ground baiting (Kurylas, 1974) which have been tested in the Philippines, resulted in reduced rat damage. Crown baiting with anticoagulants, however, has been the most specific and economical method of controlling rats that affect nuts in the crown (Reidinger and Libay, 1980; Fiedler et al., 1982). However, the general applicability of these methods to intercrops in which ground crops are also grown has not been evaluated. Ground and crown baiting in coconut-pineapple intercropped areas were evaluated to determine cost effectiveness in reducing rat damage to both crops.

MATERIALS AND METHODS

Three 1-ha coconut plots in Calauan, Laguna, each grown to 156 trees and with a history of rat damage, were visited monthly to estimate rat damage to coconuts and the intercropped pineapple. Coconut trees were 12 to 15 m tall and about 15 years old, while the pineapples, about 11 months old, were in the flowering stage when baiting was started. Two plots, randomly selected as reference and ground-baited, were 150 m apart and situated within a large plantation while the crown-baited plot was 500m

from these two plots. Fallen damaged nuts and those harvested were counted during each harvest, usually every 35 days for both the 7-month pretreatment as well as the 7-month treatment period. One month before baiting, 25 snap traps per plot were placed in two transects near the base of every third tree for three consecutive nights to determine species composition in the area. Rat activity was measured by means of activity boards before each harvesting period and expressed in per cent marked tiles with footprints (Reidinger and Libay, 1980).

One ground-baited plot was baited with 0.005% brodifacoum, 3- (4-bromo (1-1 biphenyl)-4y1- 1, 2, 3, 4, tetrahydro -1- napthalenyl -4-(hydroxy-2-1 benzopyran-2- one in rice shoots. Two coconut husk bait holders, each containing 50 g bait in plastic bags, were placed on each of the four corners of the plot. During weekly checks for bait consumption, four new bait holders were added to each baiting point where more than one-half the previously offered bait was missing and 50-g packets added to each bait holder but with no new bait holders added. The amount of bait added and time spent in baiting were noted.

Twelve marked trees, from every fifth tree in the second and sixth rows, were crown-baited with 200-g 0.005% brodifacoum in plastic bags during the first month but was later reduced to 100 g. Baiting time and the amount of bait used each month were also recorded.

Rat damage in pineapple was appraised near harvest. A 5% sample was taken by randomly selecting row clusters of five fruits (1 x 5). Data were analyzed by two-way analysis of variance and means were compared using Duncan's multiple range test.

RESULTS AND DISCUSSION

Rodent species composition and the number of animals caught were similar in all plots. Thirty-three animals were collected in the three plots including 25 *Rattus rattus mindanensis* (Mearns), 5 *R. exulans* (Peale) and 3 *Suncus murinus*. Reidinger and Libay (1980) obtained similar results in *R. r. mindanensis* and *R. exulans* in coconut crowns. Sultan (1978) found these species in coconut groves near the site of my study. His laboratory study showed that both species consumed coconut bait and therefore did damage to nuts. Over a year, Hoque (1972) caught only *R. mindanensis* in coconut stands near Bay, Laguna.

Rat-damaged fallen nuts in the crown-baited plot markedly decreased at 70 days posttreatment and remained low until September (Figure 1). Pretreatment mean loss of 110.6 (ranged from 7 to 248) nuts per month was greatly reduced during treatment. Posttreatment mean of 43.7 was significantly lower ($p = 0.016$) than the pretreatment mean even if the posttreatment figure represented high damage level at 35 days posttreatment which

was 278 nuts. Damaged fallen nuts from 70 days posttreatment up to September was 1 to 20 nuts per month. Crown baiting results indicated good control at the level used in this study, i.e., one crown-baited tree for every 13 trees. These findings are similar to those of previous studies which showed that coconuts damaged by rats are best protected at baiting ratios of 1:4 (Reidinger and Libay, 1980) and 1:6.25, 1:20, 1:40 and 1:10 (Bruggers, 1979; 1980). Bruggers (1980), however, claimed that baiting ratios of 1:20 and 1:40 were insufficient to prevent the surge of immigrant animals and resident rats that moved from nearby harvested fields to the coconut. He then suggested 1:10 to be the optimum baiting level that provided adequate protection with the least amount of labor and material cost. The baiting ratio 1:13 used in this study was sufficient to stop and prevent rat damage inasmuch as the surrounding areas were mostly planted to coconut and less rat migration might have occurred.

Rat-damaged fallen nuts in the ground-baited plot decreased at 70 days posttreatment and remained at a low level until September (Figure 1). The pretreatment mean loss of 126.6 nuts per month was significantly lower ($p = 0.006$) than the posttreatment mean loss of 53.4 nuts per month. Both ground baiting and crown baiting decreased the number of damaged fallen nuts.

The reference plot suffered a pretreatment loss of 127.9 nuts per month which slightly increased during treatment with a mean of 180 nuts, although this increase was not significant (Figure 1). Damaged fallen nuts decreased in this plot at 70 days posttreatment, although still significantly higher than in the baited plots. This decrease in damaged nuts may be attributed to decreasing rat activity or population from May to September.

Rat activity in the crown-baited plot decreased from a pretreatment level of 12.0 to 6.0% at 35 days posttreatment and remained from 6.0 to 8.0% throughout the baiting period (Figure 2). Mean rat activity of 6.9% during treatment was significantly lower ($p = 0.006$) than the pretreatment level of 12.0%. Crown baiting results indicated optimum rat control as shown by the decreased level of rat activity in the plot.

In the ground-baited plot, rat activity prior to baiting was 18.6% (Figure 2). At 35 and 70 days posttreatment, rat activity in the ground-baited and the crown-baited plots was markedly reduced before it gradually increased at 175 days posttreatment. Mean posttreatment rat activity was 4.5%, significantly lower ($p = 0.006$) than the pretreatment mean. This reduction in rat activity during ground baiting was similar to the trends observed by Reidinger and Libay (1980) who claimed that rat activity in their ground-baited plot varied between months.

Rat activity in the reference plot was similar to that in the treated plots before baiting, with pretreatment rat activity of 10.6% in the reference plot (Figure 2). This increased to 20% at 35 days posttreatment and to 24% at 70 days posttreatment, then gradually decreased until September. Post-

treatment and pretreatment mean rat activity did not differ significantly from each other. Reidinger and Libay (1980) observed a similar trend in their study on coconut.

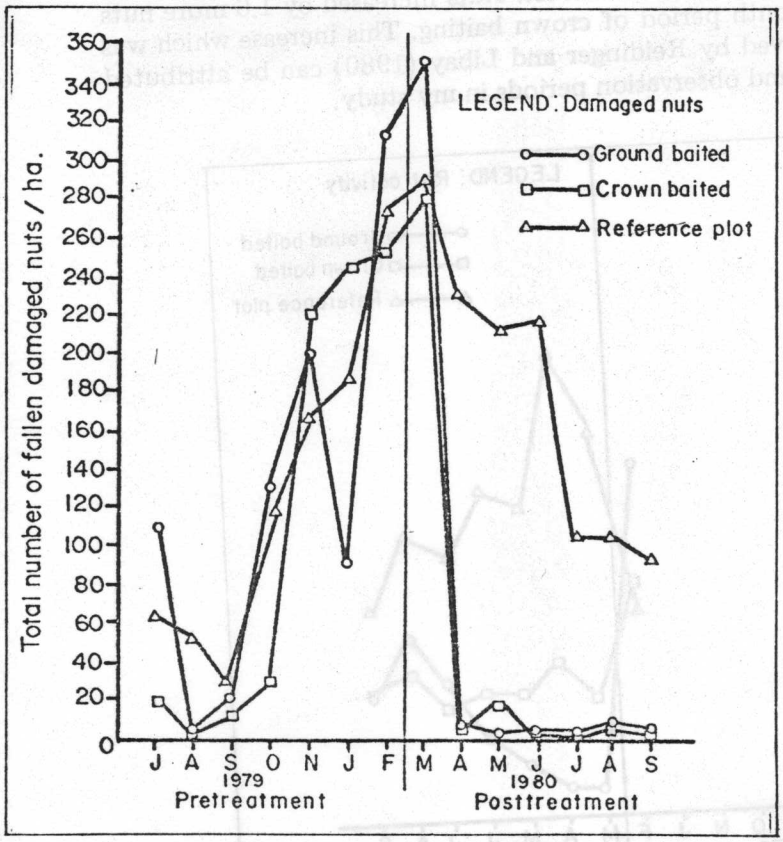

Fig. 1. Total number of fallen damaged nuts in three 1-ha plots with 156 trees and pineapple plants under coconut trees in Calauan, Laguna. All plots did not receive any treatment during the first 7 months, one plot was ground-baited with anticoagulant, one was crown-baited and another served as reference.

The ground-baited plot sustained no rat damage to the pineapples whereas more fruits (4.6%) were damaged in the crown-baited plots. Damage levels in both treated plots, however, were significantly lower ($p = 0.005$) than in the reference plot which sustained a damage level of 10.22%. Baits on the ground were more accessible to rats that are most likely to damage pineapple, whereas baits on the coconut crown were probably less accessible, which possibly explains the lower damage level to coconut in the ground-baited plot.

Table 1 summarizes the number of harvested nuts in three plots. A 7-month pretreatment harvest record (nuts per tree per harvest period) in the crown-baited plot was 416.1 nuts (or 2.7 nuts per tree). Posttreatment harvest was 672.1 nuts (or 4.3 nuts per tree) which was significantly higher

(p = 0.008) than the pretreatment harvest. Nuts increased by 1.6 more nuts per tree during a 7-month period of crown baiting. This increase which was lower than that observed by Reidinger and Libay (1980) can be attributed to the shorter baiting and observation periods in my study.

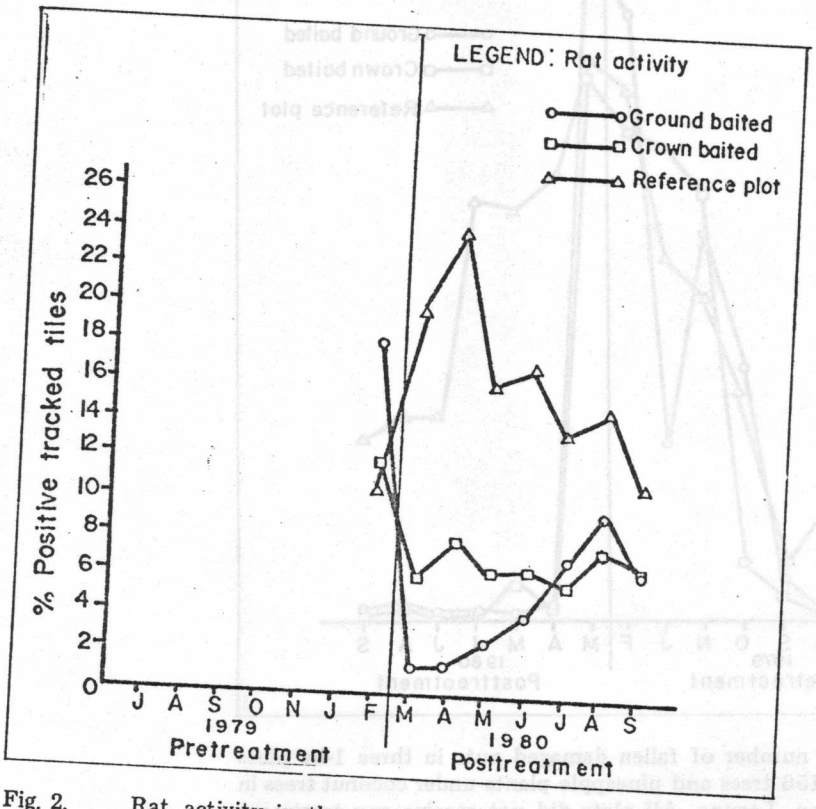

Fig. 2. Rat activity in three 1-ha plots with 156 trees and pineapple plants under the coconuts in Calauan, Laguna. All plots did not receive any treatment during the first 7 months, one plot was ground-baited with anticoagulant, one was crown-baited and another served as reference.

Table 1. Mean number of harvested nuts in crown-baited, ground-baited and reference plots during 7 months pretreatment and 7 months posttreatment observations.

Mean Nuts Per Harvest	Crown-baited	Ground-baited	Reference
Pretreatment			
Nuts/tree/month	416.1	396.4	467.6
	2.7	2.5	3.0
Posttreatment			
Nuts/tree/month	672.1	736.0	418.0
	4.3	4.7	2.7
Difference	+ 1.6	+ 2.2	− 0.3

Pretreatment mean harvest in the ground-baited plot (396.4 nuts) was significantly lower (p = 0.006) than the posttreatment mean harvest (736 nuts). Average production per tree in 7 months before baiting was 2.5 nuts per harvest but this increased to 4.7 nuts or 2.2 nuts more during treatment. Apparently the trees in the ground-baited plot produced slightly more nuts with a mean of 0.3 nut more per tree compared to the trees in the crown-baited plot.

Pretreatment harvest in the reference plot was 467.6 nuts as in the treated plot (Table 1). Harvests in the reference plot varied every month. Mean pretreatment production per tree was 3 nuts and 2.7 nuts for post-treatment. Posttreatment production represented a loss of 0.3 nut per tree. While this reference plot was losing this much, the ground-baited plot was producing more nuts at the rate of 2.2 nuts while the crown-baited plot was producing 1.6 nuts. Apparently baiting with anticoagulants effectively increased nut production.

Based on reported rat activity and counts of damaged fallen nuts and damaged pineapples, anticoagulant baiting effectively reduced rat damage at a significantly lower level in the treated plot. The crown-baited and the ground-baited plots did not differ in terms of rat activity and damaged fallen nuts during treatment. This evidently shows that both bait placements were effective in controlling rats that damage coconuts.

Table 2 summarizes the estimated economic benefits of sustained baiting with brodifacoum in a coconut-pineapple intercrop. Local brokers tagged husked nuts at each harvesting period at ₱0.14 to ₱0.41 each. The monthly gross income which was tallied during the 7-month baiting period represented the total returns for coconut during the study. Pineapples were sold to wholesale buyers at ₱1.00 per fruit regardless of size.

Net return after deducting the total cost of rat control and pineapple production in the ground-baited plot was ₱10,286. The farmer whose plot was ground-baited realized an additional return of ₱1,836 due to rat control on both crops. Most of the additional returns were from more pineapple harvests. The farmer whose plot was crown-baited had a net return of ₱9,623 on both crops or an additional income of ₱1,173 due to rat control. This was not true for the farmer whose plot was used as reference and who obtained a net return of ₱8,450.

Ground baiting was evidently more cost-effective in protecting both crops from rats. However, the cost of rat control using this method was about double (₱107 per 7 months) that of the crown-baited plot (₱48 per 7 months). An additional return of ₱663 for a 7-month period was in favor of ground baiting for both crops. If rat control were for coconut alone and considering that the additional return for 7 months is ₱33 in the ground-baited plot, it will not be economical for the farmer to invest an additional rat control input of ₱54. Hence, with coconut alone, crown baiting is more economical and is still effective in reducing rat damage.

Table 2. Estimated economic benefits of sustained baiting with brodifacoum in coconut-pineapple intercrop. Each plot with 156 trees was ground-baited weekly, crown-baited monthly. One plot served as the control.

Factors	Ground-baited	Crown-baited	Reference
Total harvest[1]			
Coconut	4456	4705	2970
Pineapple	13500	12870	12121
Gross return			
Coconut	₱ 1301	1214	742
Pineapple	13500	12870	12121
Cost of rat control[2]	102	48	0
Net return for both crops[3]	10286	9623	8450
Additional return due to rat control			
Both crops	₱ 1836	1173	0
Coconut alone	457	424	0
Differences in net return for using ground baiting against crown baiting			
Both crops	663		
Coconut alone	33		
Differences in cost of rat control	54		

[1]Total coconut harvest during the 7-month treatment and total number of marketable pineapples.

[2]Materials (bait holders and bait) and labor.

[3]Total net return after deducting ₱4413 for each plot; this amount is the total cost of production for pineapple.

This study showed that ground baiting is more economically effective in a pineapple-coconut intercrop. Baiting should start at the flowering stage of the pineapple (17 to 18 months old). If crown baiting has been a regular rat control practice, ground baiting should be employed to supplement crown baiting before rats damage pineapple during its flowering stage. To substantiate this finding, it may be necessary to further investigate my recommendation in replicated trials.

LITERATURED CITED

BRUGGERS, R.L. (ed.) 1979. Vertebrate damage control research in agriculture. Annual Progress Report 1979. Denver Wildlife Research Center, U.S. Fish and Wildlife Service. Mimeo. 106 p.

———————. 1980. Vertebrate damage control research in agriculture. Annual Progress Report 1980. Denver Wildlife Research Center, U.S. Fish and Wildlife Service. Mimeo. 111 p.

FIEDLER, L.A., M.W. FALL and R.F. REIDINGER. 1982. Development and evaluation of methods to reduce rat damage to coconut in the Philippines. *In* R. E. Marsh, ed., Proceedings Tenth Vertebrate Pest Conference. February 23-25, 1982. Monterey, California. pp. 73-79.

HOQUE, M.M. 1972. Notes on rodent pest affecting coconut. Phil. Agr. 56: 280-289.

KURYLAS, H. 1974. One year of rat control in coconut plantation. Plant Prot. News. 3: 89-97.

MONTENEGRO, J. 1962. How to prevent rodent damage in a coconut plantation. Coffee, Cacao J. 5: 192-193.

REIDINGER, R.F. and J.L. LIBAY. 1980. Crown baiting in coconut trees with anticoagulant rodenticides to reduce rat damage. Proc. Symp. on small mammals: Problems and Control. Dec. 6-8, 1977. National Crop Protection Center, U.P. Los Baños, College, Laguna, Philippines.

SULTAN, Z. 1978. Behavioral studies of rats in relation to coconut damage. M.S. Thesis. University of the Philippines at Los Baños, College, Laguna.