Prevention of bark chewing of pine trees by cattle: the effectiveness of repellents

N. J. MARNANE*, L. R. MATTHEWS**, R. KILGOUR** and M. HAWKE†

ABSTRACT

Reducing "idling" time of cattle, redirecting responses away from bark chewing, or applying a "repellent" substance could be potential management tools for controlling damage to pine trees. Egg-powder, copper carbonate, thiram, cattle dung and scatole were compared as repellents. The dung treatment was the most effective in preventing bark chewing. Egg-treated trees were licked and not chewed.

As a readily available material, cattle dung has a potential use in the control of bark chewing.

INTRODUCTION

Forest farming is a combination of livestock and trees on the same area of land and is aimed at diversifying production and improving profit. *Pinus radiata* is the main tree species used. Sheep can be admitted after tree establishment and cattle can be grazed once the trees are over 2 m. As trees reach 7 years old, the hardening bark reduces the risk of damage by cattle. On the forest farming research area at Tikitere, near Rotorua, cattle have damaged some 7-year-old trees by chewing bark from small areas and stripping it between whorls of pruned branch stubs. Damage to the clearwood sheath will check the trees' growth and downgrade the value of the timber. As cattle trample and break down the slash (prunings and thinnings), they have a complementary role to sheep on forest farms and management procedures should be developed which minimise bark-chewing by grazing cattle.

An initial study showed that reducing the "idling" periods, redirecting the cattle responses away from chewing to licking or applying a repellent substance to the trees had potential for damage control. The present trials tested 5 potential repellents. Copper carbonate and thiram were selected on the basis of an unpublished review on repellents (Knowles and Benson-Cooper, 1975). An egg-powder formulation was chosen as Rochelle *et al.* (1974) and Knowles and Tahau (1979) had reported repellency effects. Cattle dung has been effectively used as a repellent against deer (Schutz *et al.* 1978). Scatole, a decomposition product in faeces, was tested as a possible alternative to cattle dung.

* Department of Psychology, University of Waikato, Hamilton.

** Ruakura Animal Research Station, Hamilton.

† Ministry of Agriculture and Fisheries, Rotorua.

EXPERIMENT 1

Repellents were tested on 20 mixed breed yearling cattle in randomised groups of 4 in 2 plots of 10 carefully spaced, cut and "planted" pine tree trunks. The cattle were fed hay at 8.00 a.m. and the observations started at 9.30 a.m. Each group was observed for 25 minutes. At 15 sec intervals each animal was scored for sniffing, rubbing, licking, or chewing the trees. Five groups of 4 animals were run twice daily.

The 4 repellents used were copper carbonate ($CuCo_3.Cu(OH)_2.H_2O$); thiram (N, N, 1-1 tetramethyl-2-butynlyamine); egg-powder[1] and one-day-old cattle dung. Each was mixed with an adhesive base (rhoplex AC-33) to a smooth paste on a 9 to 1 (v/v) ratio of base to repellent and applied to the trunks of 2 trees selected at random. In a previous trial rhoplex AC-33 was shown to have no influence on cattle responses.

The material was applied with a soft scrubbing brush between 0.5 and 1.25 m above the ground on the day before the trial. Two trees remained untreated as controls. If chewing occurred during the trials, damaged areas were covered with the appropriate repellent before the next group of animals were tested.

RESULTS

When the groups of 4 cattle entered the tree plot they split up and moved among the trees. When the trees were not being licked or rubbed the cattle stood about, ruminated or lay down.

There was no relationship between the bark thickness or texture and either the total damage or the area of bark damaged by chewing.

1) Temco Feeds, Tauranga.

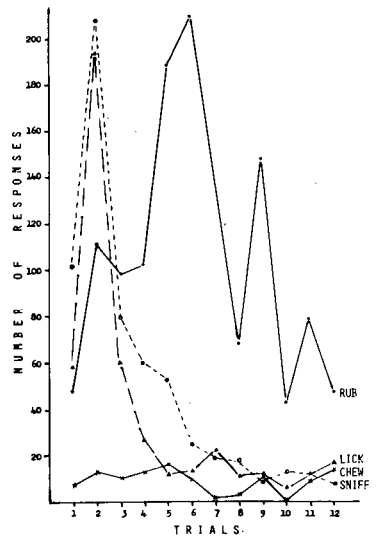

FIG. 1 The occurrence of sniffing, licking, rubbing and chewing summed over animals and treatments on each trial in Experiment 1.

The frequency of each behaviour on each trial, summed over treatments and animals, is shown in Fig. 1. After the initial peak of sniffing and licking in trial 2 these responses fell and remained at a constant low level after trial 6. As these responses declined, rubbing increased to peak levels in trials 5 and 6, thereafter declining to remain slightly more frequent than the other responses. A low but constant incidence of chewing was shown throughout the experiment.

The numbers of responses on each behaviour measure on each treatment were summed over all trials for individual animals. These frequencies were then summed over animals (Fig. 2). Differences between treatments on each measure (Fig. 2) were assessed with a multiple comparison procedure (Wilcoxon signed ranks test; Hollander and Wolfe, 1973) using the individual data. The trees in each treatment and the control trees were sniffed equally often. The untreated trees were rubbed more frequently than all but the copper-treated trees. Dung-treated trees were licked less often than all other treated and untreated trees, while the copper and egg treatments were licked most frequently. The dung- and egg-treated trees were chewed relatively infrequently but only the dung-treated trees were chewed significantly less often than the control trees. Dung-treated trees had the lowest total damage score.

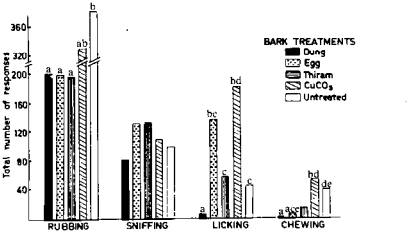

FIG. 2 The frequencies of the responses in each behaviour measure on each treatment summed over trials and animals.

All 4 untreated and copper-treated trees were chewed as were 2 of the thiram and 1 of the egg-treated trees. Not every recorded chew resulted in observable damage to the bark, yet some short duration chewing bouts led to broken bark surfaces and serious damage.

The individual response patterns of cows varied. Four animals did not chew at all while 1 heifer chewed 30 times. Rank correlations between the response categories indicated that those cows which sniffed most chewed most ($r = 0.69$; $P < 0.01$), and those which rubbed most chewed most ($r = 0.59$; $P > 0.01$).

EXPERIMENT 2

Scatole (3 Methyl-indole), one of the decomposition products in cattle dung, was mixed at the rate of 3 g per 5 l of rhoplex AC-33. This concentration was detectable by smell to the experimenters. The experimental procedure was the same as that in Experiment 1.

RESULTS

The numbers of responses on each behaviour measure on each treatment were summed over all trials for individual animals. The total responses on the treated and untreated trees were 354 and 208, 50 and 19, 135 and 79, and 33 and 23 for rubbing, licking, sniffing and chewing, respectively. Sign tests (Siegel, 1956) showed that there was no difference in chewing between the treated and untreated trees but

the animals rubbed, licked and sniffed the trees that were treated more than untreated trees ($P < 0.05$). The cattle were attracted to rather than repelled from the scatole treated trees.

DISCUSSION

Cattle were attracted to resin extrusions from any damaged bark surface. They also approached and chewed at tufts of pine needles growing from the stems of trees. As some animals chewed at bark below the level of 0.5 m, trees should be coated to ground level for full protection.

In Experiment 1, many of the animals which chewed trees did so with little or no preliminary sniffing or licking. Chewing occurred apparently at random and at low levels throughout the trials, while the frequency of rubbing, sniffing and licking peaked early in the trials and then decreased to steady levels. The propensity for chewing was individual specific.

All treated and untreated trees were investigated by sniffing, equally often. The dung, thiram and egg treatments appeared to suppress rubbing. The egg-treated trees had a relatively high level of licking and low rate of chewing. This supports earlier results which indicated a substitution of one response by another rather than a repellent effect. The treatment with copper led to most licking and chewing. The dung treatment was the most effective in reducing both licking and chewing on the trees and was the only treatment with lower rates of licking and chewing than the control trees.

In Experiment 2 scatole was found unsatisfactory as a repellent and therefore cannot be used as a substitute for cattle dung. The application of scatole increased the responsiveness of the cattle to treated trees.

In 2-choice operant studies run indoors (Matthews and Temple, 1979) cattle preferred crushed barley to barley contaminated with the odour of dung. In addition, cattle showed a small preference for barley mixed with scatole or perfused with the odour of scatole to barley alone. Thus, both the laboratory and field data indicated that dung suppresses but scatole enhances, the ingestive responses of cattle.

CONCLUSIONS

While scatole was not effective further tests of excrements or their derivatives are warranted in an attempt to produce a reliable and long-lasting repellent for the control of bark chewing by cattle and sheep. Meanwhile cattle dung remains the best available material and its preparation, application and persistence in the field should be further investigated.

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