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TILLER CUTTING BEHAVIOR OF RATS IN GROWING RICE

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The rate at which field-caged rats (*Rattus rattus mindanensis*) cut tillers (stems) was measured in six different ages of transplanted rice under both wet and dry season conditions. More cutting occurred during the earlier growth stages (6 to 12 weeks after transplanted), while tillers were still developing after the panicles matured, feeding shifted to the grains and significantly less tiller cutting was observed. Cutting rates in growing rice ranged from 1 to 309 tillers per rat per night and were generally higher during the wet season crop. The variation in behavior among animals may explain partially the difficulty of relating observed crop damage to the number of animals present.

INTRODUCTION

Much has been written about the agricultural losses caused by rat populations, but little information has been available on the capacity of individual animals for causing crop damage and on the factors which might affect this behavior. Several authors (LaVoie et al, 1970; Marsh, 1966; Taylor, 1972 and Barbehenn, 1971) for example, have noted the sporadic and rather unpredictable nature of rodent damage to growing rice. Interactions of a variety of factors must influence such damage and one would assume, as suggested by Barbehenn (1971), that the amount of damage would tend to be proportional to the pests' general abundance. However, in several preliminary field studies we have not been able to discover a direct relation between estimated damage to growing rice and several indices of relative population levels of a widely occurring species of Philippine field rat (*Rattus rattus mindanensis*). Such difficulties have also been reported in relating population levels to rodent damage in other crops like sugarcane, (Hood, et al, 1965)[1] and coconut (Hoque, 1972). However, the methods of estimating damage and populations were crude in all cases.

Lack of an apparent relationship between numbers of animals, or some index of population level, and the amount of crop damage could mean that there is such a relationship which we have been unable to detect by the methods used, for that the capacity of different populations to do damage is primarily related to some variable(s) other than population size. Clarification of this problem is, of course, important if losses are predicted from estimates or indices of population sizes or in determining economic thresholds.

[1] G. Hood. (Unpublished report, Hilo Field Station, Wildlife Research Center, Denver, Colorado, 1965).

It has been noted (Goot, 1951) that a single rat can destroy as many as 100 stems of 4-to 6-week old rice in one night. West[2] found that several rats in a 20-m square enclosure containing 8-week old rice damaged an average of about 60 tillers per rat per night. La Voie et al (1970) studied the relationship between age of the rice crop and field damage by rats, but had no information on the numbers of rats present. We conducted the present study to determine how cutting rates varied among individual animals, and how this variation might be affected by the age of animals, age of the rice and time of the year.

MATERIALS AND METHODS

Rats *(R. r. mindanensis)* were placed individually in field cages (2 x 1 x 1 m) in irrigated fields of a local high-yielding rice variety (C4-63G) at 6, 8, 10, 12, 14, and 16 weeks after transplanting. The night before each test, animals (3 males and 3 females at each age of rice) were live-trapped from ricefields of the same age as the rice in the field cages and transported directly from their capture site to the cages. A series of tests were conducted during the dry season and were repeated during the succeeding wet season. In all tests a small sheltered platform was provided in each cage to provide limited protection for the animals during daylight. In the second test series, a small piece of sweet potato tuber was placed in each shelter to determine whether an alternative food would be eaten in the presence of growing rice. Each animal was caged for 24 hours, then removed the number of cut tillers within each cage was recorded.

RESULTS AND DISCUSSION

The number of growing tillers cut by individual rats varied greatly (table 1), but the general pattern of cutting was the same during both the dry and the wet seasons. Analysis of variance showed no significant interaction between season and age. However, differences due to both season and age were highly significant ($L = 0.01$).

During most of the growing period of the rice crop, cutting rates remained relatively high. In both the wet and the dry season tests, the mean number of tillers cut dropped at 8 weeks and began a steady decrease at 12 weeks, when rice panicles had emerged and begun ripening. We have no biological explanation for the value at 8 weeks. Possibly it was due to sampling error or was simply another indication of the variable response of rats to younger rice. However, the similar pattern in both tests would suggest a real effect. The decline in cutting rate from 12 weeks through harvest suggests that rats were cutting only tillers in the 6-to 12-week old rice, both tillers and panicles in the 14-week old rice and only panicles in the 16-week old rice. The feeding residues observed on the platform in the cages tended to support this hypothesis.

The difference between seasons was largely a reflection of the higher mean cutting rates during the wet season, although this effect was not uniform for all ages. Again, we, have no clear biological explanation; however, field damage during the wet season is also

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[2] R. West. (Unpublished Monthly Report, Rodent Research Center, College, Laguna, 1972.)

commonly observed to be higher than during the corresponding dry season. We have assumed previously that such difference reflected changes in the total numbers of rats present, in different seasons rather than in different behavior patterns. Certainly both hypotheses need further consideration.

Table 1. *Rice tillers cut by rats caged for 24 hours in growing rice of six different ages under wet and dry season conditions. Six rats were used in each test*

Weeks after transplanting	Dry season* Range	Mean	Wet season* Range	Mean	Over-all Mean**
6	7 – 226*	71	11 – 252	130	101 c, d
8	13 – 199	44	1 – 129	40	42 a, b
10	21 – 138	70	32 – 309	164	117 d
12	32 – 119	66	30 – 97	54	60 b, c
14	4 – 46	24	4 – 37	23	23 a, b
16	1 – 7	3	2 – 20	9	6 a
	Mean = 46		Mean = 70		

* Data are expressed as tillers cut rat per night

** Means followed by the same letter are not significantly different by Duncan's New Multiple Range Test at the 0.05 protection level.

Rats ate the sweet potato tuber provided in the wet season tests when the rice was 6, 8, 10, and 12 weeks old but did not consume any when the rice was 14 and 16 weeks old. This result suggests that the abundant, mature rice grains are very attractive food and that acceptance of toxic baits might be expected to decline when rice matures. Indeed, we have noted in recent field tests that consumption of untreated bait decreases sharply when rice panicles begin ripening.

The significant decrease in the cutting rate when the rice began to mature makes us suspect that LaVoie et al (1970), who reported that four out of seven widely dispersed groups of test rice paddies showed the highest percentage of cut tillers during the 14th week, were actually recording cumulative damage. Their surveys, conducted at 2-week intervals throughout the crop, were discussed with the assumption that either regeneration of cut tillers or rapid deterioration of dead ones prevented detection of damage that was more than 2 weeks old. However, our observations on the recovery of cut rice tillers showed that of 320 tillers that were cut 9 weeks after transplanting and did not regenerate, 303 (95%) were still readily detected when the rice was examined before harvest 7 weeks later. We also observed that regenerating tillers remained distinguishable from normal tillers for longer periods as the age at which they were cut increased.

Confining the rats in these tests may have exaggerated their natural cutting patterns. Results indicate that great variation in individual behavior should be expected in the field. Apparently, some rats cut very little rice during feeding, while others are highly destructive. In the field, further variation could result because not all tiller cutting is related to feeding. Rats incorporate rice stems and leaves into their nests

and use them to build resting platforms in the paddies. In addition, rats disturbed during tiller cutting probably interrupt their activity and resume cutting later at another plant.

The fact that some individuals have particularly high cutting rates could partially explain how small areas of young rice are sometimes heavily cut in a few nights, even when the general rat population appears low. This high rate of cutting usually does not continue long, suggesting that the animal (or animals) responsible has moved to a new location or is no longer cutting at the accelerated rate. Follow-up observation with a few of the test animals indicated that rats in 24-hour tests maintained roughly the same cutting rate for up to 4 consecutive days, but it is not known if this would be true in open fields.

The greatly reduced incidence of tiller cutting when rice was of harvestible age (16 weeks after transplanting) leads us to question the occasional reports of large areas of rice being destroyed by rats 1 or 2 nights before harvest. Even if cutting averaged 9 tillers per rat per night, as in the wet season test, it would require more than 100,000 rats to accomplish such a feat on one hectare.

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LITERATURE CITED

GOOT, P. VAN DER. 1951. Over levenswijze en bestrijding van sawan-ratten in het laagland von Java (English Summary). *Landbouw,* Bogor, Java 23: 123-284.

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

LAVOIE, G. K., F. M. SWINK and J. P. SUMANGIL, 1970. Destruction of rice tillers by rats in relation to stages of rice development in Luzon. Phil. Agr. 54:175-181.

MARSH, R. W. 1966. Methods of controlling rodents and birds in rice fields. *Congres de la Protection des Cultures Tropicales, Marseille,* March 23-27, 1965. pp. 633-637.

TAYLOR, K. D. 1972. Rodent problems in tropical agriculture. PANS 18:81-88.

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