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DESTRUCTION OF RICE TILLERS BY RATS IN RELATION TO STAGES OF RICE DEVELOPMENT IN LUZON

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DESTRUCTION OF RICE TILLERS BY RATS IN RELATION TO STAGES OF RICE DEVELOPMENT IN LUZON[1]

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To determine the extent of rat damage to growing rice, counts of damaged tillers were made from the time of transplanting to harvest in 35 paddies located in three provinces of Luzon. Tiller destruction by rats during the vegetative growth period was light, but it increased appreciably during the reproductive and ripening stages. In preharvest samples of paddies where surrounding rice had been harvested, damage was significantly greater than those paddies where surrounding rice had not been harvested.

INTRODUCTION

The destruction of food crops by rodents, particularly members of the genus *Rattus*, has long been organized as a serious problem in the Philippines (Otanes and Sison, 1952)[3]. Sanchez and Alfonso (1966)[4] estimated a 10% annual loss of rice to these rodents. Current methods of rice protection, employing standard lethal agents, have resulted in only temporary and limited benefits (Alfonso et al., 1966)[5].

Two species, *Rattus rattus mindanensis* and *Rattus argentiventer*, are responsible for much of the losses in lowland rice crops of central Luzon and Cotabato, Mindanao, respectively. The distribution of *Rattus exulans* appears to be spotty, and this species probably causes only local losses (Barbehenn, 1969)[6]. Only limited documentation on these animals and their

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[3] Otanes, F. K., and P. Sison. 1952. Pests of rice. (Agr. Nat. Res., Manila). No. 42. p. 55.

[4] Sanchez, F., and P. Alfonso. 1966. Toxicity of norbromide to the Philippine field rat, *Rattus argentiventer*. Robinson and Kloss (unpbl.).

[5] Alfonso, P. J., J. L. Morales, and J. P. Sumangil. 1966. The control of ricefield rats, p. 344-362. *In* Rice Production Manual. Univ. Philippine, College of Agr.

[6] Barbehenn, K. 1969 Personal communication.

destructive capacities is available. Marsh (1965)[7] states that rat damage to rice occurs at different stages of rice growth, depending on cultural practices. He reports that in California, damage to growing rice occurs shortly after planting when the water level is temporarily lowered to increase seed germination and stand establishment. The rats pull sprouting plants and eat the seeds. Later, during the milk stage, additional losses are incurred, but these are less severe. Marsh further states that in Indonesia, rice losses caused by *Rattus rattus brevicadatus* are negligible during the early growth stages, but severe losses occur from the milk stage through ripening. The same is true in California if the water level is not lowered to increase seed establishment.

The objectives of this study were to determine if a relationship existed between the stages of rice development and tiller destruction by rats, and to develop reliable methods for estimating rat damage to rice crops.

MATERIALS AND METHODS

The 35 paddies which were used as samples were in seven areas: six in Tarlac and Nueva Ecija and one in Laguna. These paddies were initially selected at random from the seven areas which contained 104 recently planted paddies. The 35 paddies contained five varieties of rice maturing in 130 to 150 days. The cropland surrounding the study areas was of two types: in areas B, C, D, and G the surrounding rice was harvested at the same time or after that in the sample paddies, while in areas A, E, and F the surrounding rice was harvested 1-2 weeks before that in the sample paddies.

The 35 paddies were sampled at 2, 5, 8, 10, 12, and 14 weeks after transplanting (booting began at about the eighth week). Samples consisted of 100 randomly selected hills in each paddy; a total of 21,000 hills were examined during the six sampling periods. If rat-damaged tillers were found in a hill, all of its damaged and undamaged tillers were counted; if no damaged tillers were found a zero was recorded for that hill. After each sampling period, damage estimates for each paddy were calculated as the mean percent of damaged tillers per hill.

Rat-damaged tillers are readily distinguishable by their characteristic oblique cut (Fig. 1). The remaining stub is clean cut except for the apex

[7] Marsh, R. E. 1965. Methods of controlling rodents and birds in rice fields. Compt. Rend. Congr. Protect Cutl. Trop., p. 633-637.

where a few hair-like strands of plant tissue often project. Clipping was most frequently done at 8-10 inches above the ground and at about a 40-degree angle to the long axis of the tiller.

RESULTS AND DISCUSSION

Destruction of tillers by rats during the vegetative stage was slight in the seven areas sampled (Table 1). By the eighth week, cutting had increased appreciably in area E, perhaps as a result of the partially booted rice in the sample paddies; in the other areas tiller destruction remained negligible. By the tenth week all sample paddies were in the reproductive growth period and a marked increase in rat-cut tillers was recorded for all areas except A. Areas C and D had particularly heavy damage (21.3% and 17.4%, respectively), possibly because rice in the surrounding paddies had not yet booted; damage decreased on these areas on the twelfth week as surrounding rice began to boot. When the contributions of these five severely-cut paddies are deleted for the tenth and twelfth weeks, cutting from transplanting to harvest showed a smooth increase, as indicated by the broken line in figure 2. Cutting in the fourteenth week, during the late ripening stage, exceeded 1% in all areas and averaged 4.1%

It is interesting to note that 11 of the 35 paddies showed damage greater than the mean of 4.1% during the fourteenth week and that 10 of these were in areas A, E, and F where surrounding rice had already been harvested. Damage was significantly higher (.05) in areas E and F than in the areas where the surrounding rice had not yet been harvested.

The marked increase in tiller destruction by rats during the reproductive and ripening stages of the rice suggests that reductional rat control might best be accomplished just before booting. The significantly greater damage found in areas where surrounding rice had been harvested before that in the study area, suggests that more damage per unit area can be expected when isolated patches or islands are planted than when large tracts of land are uniformly farmed. This assumption was also substantiated by the striking increase in damage in areas C and D at the tenth-week examination, before surrounding rice had booted.

Further studies are needed to determine the effect of rat cutting in relation to rice yield. It is possible that light to moderate tiller clipping

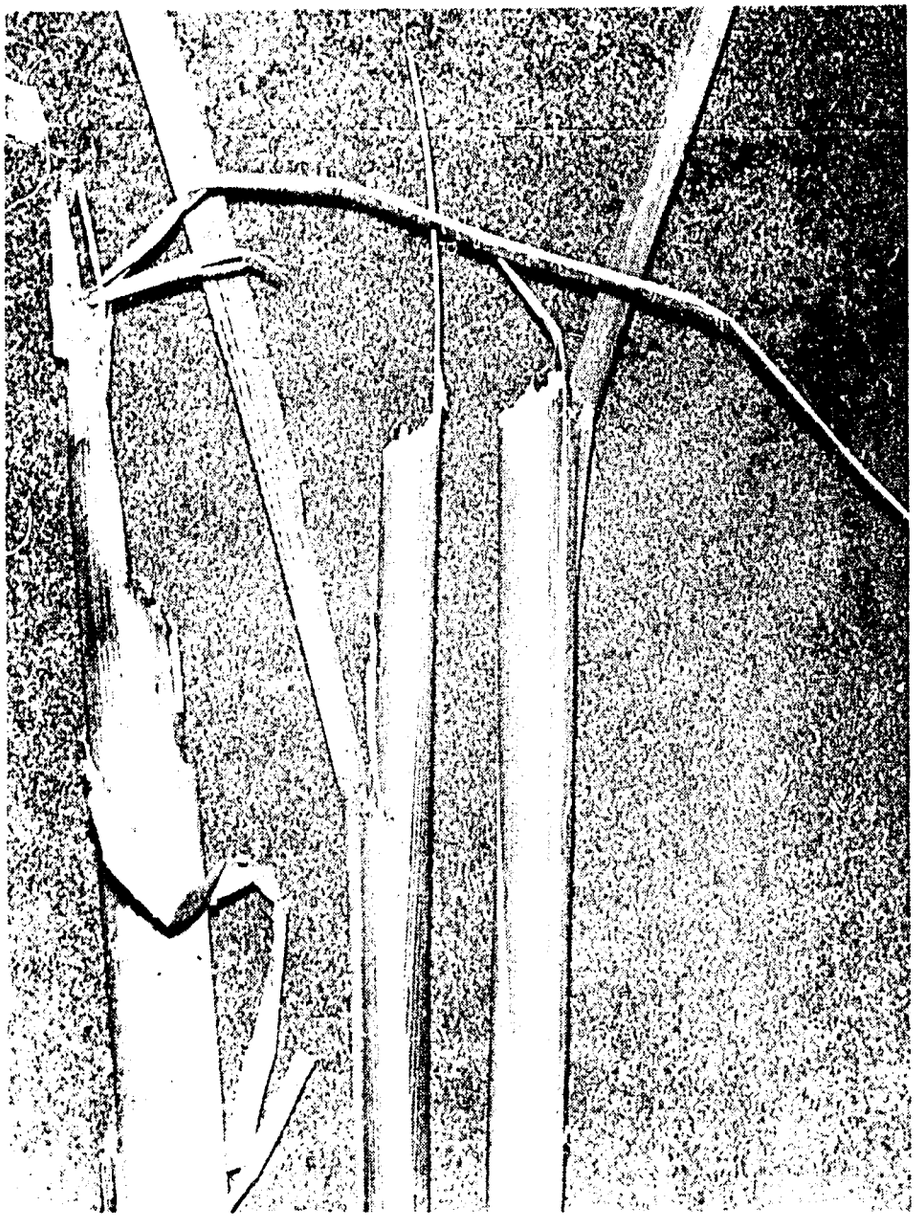

Fig. 1. Rice tillers showing characteristic oblique cut by rats.

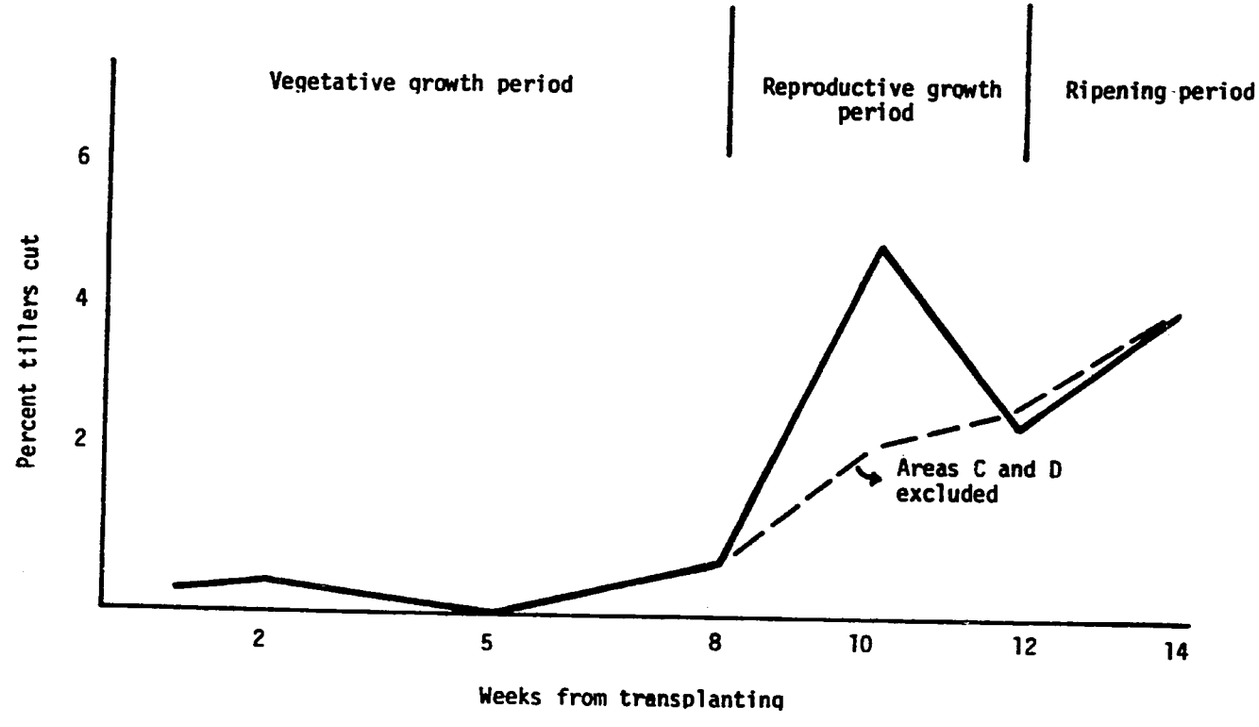

Fig. 2. Per cent of tillers cut by rats in relation to periods of rice development.

TABLE 1. *Percentage of tillers cut by rats in 35 paddies from transplanting to harvest*

Area	Variety	Paddy Number	Per Cent Tillers Cut by Rats — Week After Transplanting 2	5	8	10	12	14
A. Bay, Laguna	C-4	1	2.9	0.4	0	0	0	0.6
		2	0.8	0.1	0	0	0	0.3
		3	0.5	0	0	0	0	1.0
		4	0.6	0.1	0.3	0	0	0.3
		5	0.3	0.1	0	0	0.1	6.1
		6	3.6	0	0	0	0.1	1.8
Average			1.5	0.1	0.1	0	0	1.7
B. Muñoz, Nueva Ecija	IR-5	7	0	0	0	0	0.2	0.1
		8	0	0	0	0.1	1.3	2.3
		9	0	0	0	0.1	0.9	1.8
Average			0	0	0	0.1	0.8	1.4
C. Muñoz, Nueva Ecija	Raminad	10	0.3	0	0	24.3	0.1	2.2
		11	0	0	0	22.0	0.4	2.0
		12	0	0	0	17.6	0	0.3
Average			0.1	0	0	21.3	0.2	1.5
D. Muñoz Nueva Ecija	C-4	13	0	0	0	14.7	1.1	2.9
		14	0	0	0.1	20.2	0	0.7
Average			0	0	0.1	17.4	0.6	1.8
E. Maligaya, Nueva Ecija	BPI-76	15	0	0	1.5	1.0	4.0	2.0
		16	0	0	4.8	1.4	5.8	2.6
		17	0	0	1.0	3.2	7.8	10.2
		18	0	0	0.8	2.9	6.7	5.2
		19	0	0	1.6	10.4	0.1	0.5
		20	0	0	0	3.8	3.6	7.7
		21	0	0.1	6.4	7.4	7.9	13.4
Average			0	0	2.3	4.3	5.1	5.9
F. La Paz, Tarlac	IR-8	22	0	0	0.3	2.2	3.3	14.0
		23	0	0	0	3.4	6.8	3.8
		24	0	0	2.8	2.7	6.1	6.1
		25	1.0	0	0	2.4	1.4	9.6
		26	0	0	0	3.7	6.7	20.5
		27	0	0	0	2.1	5.1	7.2
		28	0	0	0	1.3	1.3	4.0
Average			0.1	0	0.4	2.5	4.4	9.3

Area	Variety	Paddy Number	Per Cent Tillers Cut by Rats Week After Transplanting 2	5	8	10	12	14
G. La Paz, Tarlac	IR-8	29	0	0	0	1.0	0.5	8.4
		30	0	0	0	0	0	1.1
		31	0	0	0	0	0.5	0.3
		32	0	0	0	2.3	0.8	1.4
		33	0	0	0	4.7	1.8	2.1
		34	0	0	0	6.2	1.1	1.0
		35	0	0	0	5.7	1.0	0.5
Average			0	0	0	2.8	0.8	2.1
Total Average			0.3	0	0.6	4.8	2.2	4.1
Adjusted Total Average[a]			0.3	0	0.6	2.3	2.5	4.1

[a] Areas C and D deleted for tenth and twelfth weeks.

during the early vegetative stage may not result in decreased yield at harvest time.

The sampling method proved satisfactory and adequate for measuring the existing level (within two to three weeks) of rat cutting within a paddy. However, rapid regeneration of the surviving cut tillers and rapid deterioration of the dead ones precluded the measurement of cumulative tiller cutting. For this purpose, a modified procedure will be required.