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**FIELD EVALUATION OF POWDERED ROCK LIME TO CONTROL GIANT EARTHWORMS
(*Pheretima elongata*) OF THE IFUGAO RICE TERRACES**

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ABSTRACT

Effectiveness of powdered rock lime for giant earthworm control in infested rice paddies was examined in three (3) municipalities of the province from July 2008 to February 2009.

The study used 3 trials at different dilution rates of 100, 200 and 300 grams powdered rock in 8 and 12 liters of water.

Results showed that dilution rates of 200 and 300 g of powdered rock lime killed the earthworms faster than 100 g dilution rate.

The shortest time the earthworms died was at dilution rate of 300 grams with an average of 8.55 minutes followed by 200 g with an average of 9.44 minutes but with no significant difference. At the lowest dilution rate of 100 grams, earthworms died the longest at an average time of 13.11 minutes. In all the dilution rates used, giant earthworms shrink rapidly except the head, some giant earthworms bled and were cut into two.

Key Words: Giant Earthworms, Powdered Rock Lime

INTRODUCTION

Rationale

The Ifugao Rice Terraces have been declared to be on the list of the world heritage in danger. The ruinous giant earthworms (*Pheretima elongata*) have invaded and destroyed the rice terraces especially in Banaue (Guerrero 2003).



The invaded rice paddies with giant earthworm

Farmers and stakeholders of the terraces are faced with the problem of damaged stonewalls caused by giant earthworms. These earthworms are a problem of rice farmers because they are no longer helpful as their role should be but are now destructive causing bores on the earth which cause water spillage in the rice paddies and causing damage to the stonewalls(<http://www.manila.times.net/>).

The giant earthworms live in moist soil containing organic matter. They usually live in the upper layers of the soil, but during cold weather they penetrate more deeply to escape frost. During unusually hot weather they penetrate downward to avoid dehydration. Earthworms shun daylight but frequently come to the surface of the soil at night to feed and throw off their castings. In the daytime they appear upon the surface of the soil only under unusual conditions, such as the flooding of their burrows by excessive rainfall (Microsoft Encarta 2007)

Powdered rock has been used in Brazil as source of fertilizers mixed with manure and is used to revitalize the soil (Almeida, 2007).

Powdered rock is neither registered as, nor warranted as, nor sold as either an insecticide or a pesticide, however, according to Oregon State University Extension Service, the dust or powder destroys the body water balance of the earthworms. Powdered rock on the other hand practically does not pollute the ground water or streams and also be used to raise pH on acidic soil. (Rado, 1994).

Calcite has numerous uses as a neutralizer of acids. For hundreds of years, limestone and marbles have been crushed and spread on fields as an acid-neutralizing soil treatment ([http\www.Geology.Com](http://www.Geology.Com))

Objectives

The study was undertaken with the primary objective of evaluating the effectiveness of powdered rock lime to control the destructive giant earthworms present in the rice terraces.

Specifically, the study aimed to:

1. find out if the different dilution rates of powdered rock lime with water affect the length of time the earthworms die.

2. determine which of the different dilution rates of powdered rock lime with water is appropriate to control the giant earthworms in the field.
3. determine and analyze the effect of the different dilution rates of powdered rock lime on soil pH.
4. document the population of earthworms per square meter area of infested rice paddies in the different study sites.

METHODOLOGY

Research Methods

Before the conduct of the study, verbal communication with some barangay officials and staff of the municipal agriculture office was made for their information and participation. In Asipulo, a letter was sent to the municipal agriculturist prior to the conduct of the study. In all the areas where the study was conducted, farmers were invited to participate in the conduct of the study.

Powdered Rock Lime Composition

The rock where the lime was derived was identified through Mr. Alfredo Dulnuan, a miner in Antamok Mining



Calcite Rock

Corporation, Baguio City. The powdered rock lime was identified to be Calcite. The composition of calcite rock was search in the internet (Source: Mines & Geosciences Bureau, DENR Comp. Macabalan, Cagayan de Oro City 9000).

Molecular Weight = 100.09 gm Chemical Composition- CaCO_3

Calcium 40.04 % Ca 56.03 % CaO

Carbon 12.00 % C 43.97 % CO_2

Oxygen 47.96 % O _____

100 % 100 % = Total Oxide

Weighing of Powdered Rock Lime

Powdered rock lime was purchased in the public market of Lamut, Ifugao at P30.00 per kilo. The powdered lime was prepared by weighing separately 100 g, 200g and 300 g in the science laboratory using electronic top loading balance weighing scale. This was done one day before the conduct of the study. Measured limes were placed in labeled plastic containers.

Field Preparation and Layout

An area approximately 1 meter away from the dike was made clean by removing weeds to facilitate the infiltration of powdered rock lime solution. The moisture conditions of the soils utilized in the study were moist because the farmer constructed small dikes about 1 meter more or less away from the main dikes damaged by the giant earthworms. The moist condition of the soil is favorable for giant earthworms.

The study area was laid out in Randomized Complete Block Design (RCBD) with 3 treatments replicated 3 times. Each block was further subdivided into three areas measuring approximately 1 x 1 meter to represent the different dilution rates or treatments. The small dikes constructed by the farmers from the main dikes were not exactly 1 meter. Hardened soils were loosened by digging the surface with a spade to avoid spilling and to facilitate fast infiltration of the solution within the soil.

Preparation of Powdered Lime Dilution Rates and Field Application

Measured limes of 100 g, 200 g, and 300 g were diluted with 8 and 12 liters of tap water respectively in the container according to the specified dilution rates. Dilution was done by stirring the solution thoroughly with the aide of wooden stick. The following dilution rates were prepared for each treatment;

T₁- 100g Powdered Rock Lime: 8 liters tap water (Bangaan, Asipulo), 12
liters tap water (Hingyon)

T₂ – 200 g Powdered Rock Lime: 8 liters tap water (Bangaan, Asipulo), 12
liters tap water (Hingyon)

T₃ – 300 g Powdered Rock Lime : 8 liters tap water (Bangaan, Asipulo), 12

liters tap water (Hingyon)

The volume of water used differed in the different places due to the availability of containers in the study sites.

The prepared solutions were poured slowly in the designated treatments laid out in the rice paddy to avoid spilling of the solution.



Measured rock lime dilution is poured slowly near the dikes

Determination of Soil pH

Soil pH of the study sites was determined. Soil samples were collected from before and after the application of the different dilution rates of powdered rock lime. The soil pH was measured in a mixture of soil and distilled water (10g:60ml) with the digital pH meter.

Population of Giant Earthworms per Square Meter

The population of giant earthworms was determined by counting the number of earthworms that surfaced out after the application of powdered rock lime solution per square meter and earthworms in the deeper layer of the soil not affected by the lime solution. The area was dug with a spade to find additional earthworms.

Research Environment

The study was conducted in 4 infested rice paddies, 2 barangays of Banaue, 1 barangay in Hingyon and 1 in Asipulo. The research sites were all infested with *Pheretima elongata*.

Statistical Tool

Averaging was used in determining the length of time the earthworms died and the population of earthworms per square meter.

DMRT was used for mean comparison of the different dilution rates used through the SAS statistical package.

Data gathered

1. Length of time the earthworms died in each dilution rate used and percent mortality of giant earthworms in the different study sites.
2. Soil pH before and after the application of the different dosage rates.
3. Population of *Pheretima elongata* in the study sites.

RESULTS AND DISCUSSION

Effects of the Different Dilution Rates of Powdered Rock Lime on the Average Length of time (Minutes) the Earthworms Died in Bangaan, Banaue and Aspulo, Ifugao.

The effect of the different dilution rates of rock lime on the length of time the earthworms died in Bangaan, Banaue and Aspulo, Ifugao is shown in table 1.

Result shows that the shortest average time the earthworms died was at dilution rate of 300g where the earthworms died after 6.66 minutes. At dilution rate of 200 g, the earthworms died after 7 minutes while the lowest dilution rate of 100 g gave the longest time of 10.33 minutes for the earthworms to die. However, statistical analysis showed no significant difference between dilution rates of 200g and 300 g respectively. A significant result existed between dilution rate of 100g with the two dilution rates of 200 g and 300 g powdered rock lime. In Aspulo, no significant difference existed in the different treatments used. The result suggested that the higher the concentration of powdered rock lime, the faster is its effect in killing the earthworms.



The dying giant earthworms after the application of powdered rock lime

Table 1. Mean length of time (minutes) the giant earthworms died at different dilution rates & % mortality in Bangaan and Asipulo Ifugao

Treatments	Mortality Rate	Mean	
		Bangaan	Asipulo
T ₁ – 100 g powdered rock lime : 8 liters water	100 %	10.33 ^b	12.33
T ₂ – 200 g powdered rock lime : 8 liters water	100 %	7.0 ^a	9.0
T ₃ – 300 g powdered rock lime : 8 liters water	100 %	6.66 ^a	9.0

Means of the same letter superscripts are not significantly different at 5 % level by DMRT

Effects of the Different Dilution Rates of Powdered Rock Lime on the Average Length of time (Minutes) the Earthworms Died & Percent Mortality in Bitu, Hingyon, Ifugao.

It is apparent that dilution rate of 300 g of powdered rock lime killed the giant earthworms the fastest at an average time of 8.55 minutes and 13.11 minutes for the lowest dilution rate of 100 g powdered rock lime. However, statistical analysis indicated no significant difference between treatment 2 and 3 but with significant difference with treatment 1. The mortality rate of giant earthworms in all the dilution rates used was 100 percent. The result indicates that at higher concentration rate of powdered rock lime in water, the faster it kills the giant earthworms.

Table 2. Mean length of time (minutes) the giant earthworms died at different dilution rates & % mortality in Bitu, Hingyon, Ifugao

Treatments	% Mortality Rate	Mean
T ₁ – 100 g powdered rock lime : 12 liters water	100	13.11 ^b
T ₂ – 200 g powdered rock lime : 12 liters water	100	9.44 ^a
T ₃ – 300 g powdered rock lime : 12 liters water	100	8.55 ^a

Means of the same letter superscripts are not significantly different at 5 % level by DMRT

Effects of the Different Dilution Rates of Powdered Rock Lime on the Average Length of Time (Minutes) the Giant Earthworms Died

Comparing the effect of the volume of water used in the study, result showed a significant difference between dilution rates of 8 liters with 12 liters of water. The dilution rates for powdered rock

lime used indicated no significant difference between 200 g and 300 g in the length of time the earthworms died but showed significant difference with 100 g powdered rock lime. The result indicated that at higher dilution rates of 200 and 300 g powdered rock lime diluted with 8 liters of water have a stronger effect on the length of time the earthworms died (Table 4).

Table 3. Mean length of time (minutes) the giant earthworms died at different dilution rates

Treatments	Volume of water Used (liters)		Mean
	8	12	
T ₁ – 100 g powdered rock lime	11.33	14.0b	16.66
T ₂ – 200 g powdered rock lime	8.0	12.33	10.2a
T ₃ – 300 g powdered rock lime	7.8	10.0	8.9a
Mean	9.0a	13.0b	

Means of the same letter superscripts are not significantly different at 5 % level by DMRT

Effect of the Different Dilution Rates of Powdered Rock Lime on the Soil pH in the Study Sites

It is generally known that lime decrease soil acidity. Rice requires a pH range of 5.5 -7.5 for normal growth and development. The soil pH in Banaue and Asipulo are within the required pH for rice production but not in Hingyon where the soil pH is below 5.5. The application of lime generally decreased the acidity of the soil. In Bangaan, the pH of the soil is 6:10 which is slightly acidic. In Asipulo, soil pH is moderately acidic (5.54) same in Bitu, Hingyon. Soil pH in Hingyon is higher than what is required by the rice plant, but with the application of rock lime, the acidity decreased making it favorable for rice production. Result showed that as the dilution rate increases, the effect in decreasing soil acidity increases. Applying lime as a control measure for giant earthworms improves soil pH favorable for the rice plant.

Table 4. Soil pH before and after application of powdered rock lime at different dosage rates in the different study sites

Treatments	Study Sites								
	Bangaan			Asipulo			Hingyon		
	Before	After	>	Before	After	>	Before	After	>
T ₁ – 100g Rock Lime	6.10	6.49	.39	5.54	5.91	.07	5.36	5.53	.17
T ₂ – 200g Rock Lime	6.10	6.80	.70	5.84	6.23	.39	5.36	5.77	.41
T ₃ – 300g Rock Lime	6.10	7.13	1.03	5.84	6.50	.66	5.36	6.10	.74

Population of Giant Earthworms in the Different Study Sites

Giant earthworm population is highest in Bangaan with an average of 6 worms per square meter followed by Asipulo with 5 worms and Hingyon with 4 worms per square meter. The result showed that infested rice paddies may contain 40,000 to 60,000 giant earthworms per hectare (Table 5).

Table 5. Average population of giant earthworms in infested rice paddies in the study sites

Study Sites	Average Population/M2	Hectare
Bangaan, Banaue, Ifugao	6	60,000.00
Bitu, Hingyon, Ifugao	4	40,000.00
Asipulo, Ifugao	5	50,000.00

CONCLUSION

Application of 200 and 300 g powdered rock lime diluted in 8 and 12 liters of tap water significantly killed the giant earthworms faster than 100 g dilution rate. From the findings of the study, both 200 and 300 grams of rock lime diluted in 8 and 12 liters of water could be the appropriate dosage for the control of giant earthworms in the rice paddies. Application of powdered rock lime at different dilution rates decreased soil acidity at varying degrees making it favorable for rice production.

Giant earthworm population in infested rice paddies is highest in Bangaan, Banaue followed by Asipulo and Hingyon.

RECOMMENDATION

To reduce the cost of inputs particularly powdered rock lime, the use of 200g diluted in 12 liters of water is recommended for the control of giant earthworms. It is further recommended that the surface of the soil be loosened before application of lime or better yet application should be done during land preparation.

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