

Organic Waste Disposal Experiment  
By: Jessy and Nyssa

SICENCE

*Question: How much organic waste can worms eat for a week?  
Revised Question: How long would it take for a 9g banana to be eaten by worms?*

Hypothesis:

*Jessy- I just know the worms live under the ground, after a rainstorm, they appear from the wet soil. They might eat soil and water but I am not sure they will eat the food leftovers such as rice and noodles. So the first guess is 0g food, the second answer is 100g-200g food. If there is no soil and water, the worms will eat food.*

*Nyssa- I believe that worms might be able to eat at least 7 pounds (3175.15g) of organic waste. I learned from a website that a pound of*



Taken: 4/1/17

*worms could eat 0.5 (226.796g) pounds. If one (normally healthy) person were likely to produce 1 pound per day during Sunday to Saturday, it would add up to 7 pounds by the end of the week.*

Procedure:

I have about 100 worms at my house that I got from a person in Burnaby. It is really hard to buy the worms in this cold and snowy winter. So my parent search that where can buy the worms in Vancouver using Google. Then we called a few gardening stores to see if they had any worms. Sadly, the gardening stores didn't have any worms. Then we bought the worms by a person who takes care of the worms.

I will build worm "farms", and then test how much organic waste the worms can process, and how fast they can do it for about 2 weeks,(The

amount of organic waste can be quantified by its mass.The time will be measured as the number of days it takes for the food to disappear.The rate can then be calculated by dividing the amount of organic waste by the time it took for the food to disappear ,like 500 grams [g] in 10 days.)G is our variable .We will put soil and banana in a plastic box with 80 worms and weigh the banana after four days has passed. We will write the weight down and do it until the banana has disappeared. During the lab,I do not think we have any real risks because we are only using a plastic box, banana, worms and electronic scales. There is a bit of a concern if the worms climb out. After we are done, I will put the worms in the family garden.



Taken:4/1/17

#### Observations:

Jan 4th

Jessy-I prepare a box ,and I put about 9g banana on the box which one has the worms and some soil. After about a week,I will pick up the piece of the banana and then I used the electronic scales to see how heavy the pieces of banana were. The formula I used was  $Y=9g-X$ .We use the x to equal the banana weight after four days.Y is the answer, How much organic waste can worms eat for a week.



Taken: 8/1/17

Jan 8th

Jessy: Today, I weighed the banana. The banana is 4.8g. I see a lot of white things in the banana and soil and worms it's really disgusting. I do not know what it is.

Nyssa: I noticed the white-webbing like material on the banana when I got the picture through my second e-mail account. I thought that was fungi that was also decomposing the banana.



Taken: 8/1/17

Photo Taken on: 12/1/17



Jan 12<sup>th</sup> 2017

Jessy-I can't find the banana in the box. I just put 9g banana because I did not think worms can eat more than 9g for 8 days. I just weight the banana before on Jan 4<sup>th</sup> then I weighed the banana on Jan 8<sup>th</sup>. The weight was 4.8g. The last time is on Jan 12<sup>th</sup>, it weighed 0g. The banana had been eaten.

My way is not very perfect because at the end, I can not find any banana in the box. I should give them another banana that was more than 9g. The experiment wasn't good since we it is the low temperature (any temperature lower than 5 ° C will keep the worms dominant.) The worms will not eat a lot of food.

If I get a chance to do the lab again, I will prepare 2 boxes and I will put about 100g banana on the box which one has the worms and some soil. I will also put 100g banana in another box and weigh the banana everyday.

Nyssa: I would also try to stick to the original plan and try to get more photos or access to the worm farm to get more data.

## Data Analysis

The aboriginal principle that we used the most during the process of our project is how learning is supposed to be connected to information learned prior and how it's connected to our universe. The idea of seeing how much of a banana could red wiggler worms could eat in 12 days is connected to the idea of the food chain.

The food chain is made of four tertiary levels: producers, primary consumers, secondary consumers and tertiary consumers/top carnivores. We also know that decomposers,



Taken: 12/1/17

such as worms can exist on any level of the food chain. Eating away the animals who die without being someone's *lunch*. The 9 gram banana we used is a producer, a organism that uses the sun to gain energy.

The energy is eventually taken by the worm when it eats the banana. It turns the banana into nutrients by making it into worm casting ( otherwise, worm poop) and poops it into the dirt. Giving the soil more nutrients for the plants. Other than using science, we also used math and computer programs (Microsoft Word etc.)

In the *production stage* of our project, I learned from an online source that a 1000 worms can eat 1 pound of food. I used a mathematical formula to estimate how much can multiple (any number) worms eat in a day:  $\text{amount of worms}/1000 \times 0.5 = \text{amount they could eat in a day in pounds}$  (it can be converted to grams.) We also had another formula for how much the worms ate:  $9g - x = y$ . X being what is left of banana and Y for how much of a banana can the 80 worms eat in a week.

The temperature range for the worms to be doing their job is 5-30°C, anything lower than 5 would make them dormant and anything below 0°C would mean death. There was no change of temperature inside the box that we used, it stayed at 2°C. That means the worms will eat a lot more slowly.

My partner, Jessy, took care of the worms over the period of 12 days. Checking on the banana every four days and by 12 days, the banana was gone. The amount of banana eaten between the 4<sup>th</sup> and 8<sup>th</sup> day is 4.2g.

There were a few inconsistencies during the project: first, Jessy didn't put in any soil during the first day we started doing the project. On the second day, 3 worms climbed out of the box and died. Then she also put in a second banana after the last one disappeared. There was also some white-webbing like thing over the banana that I thought was fungi.

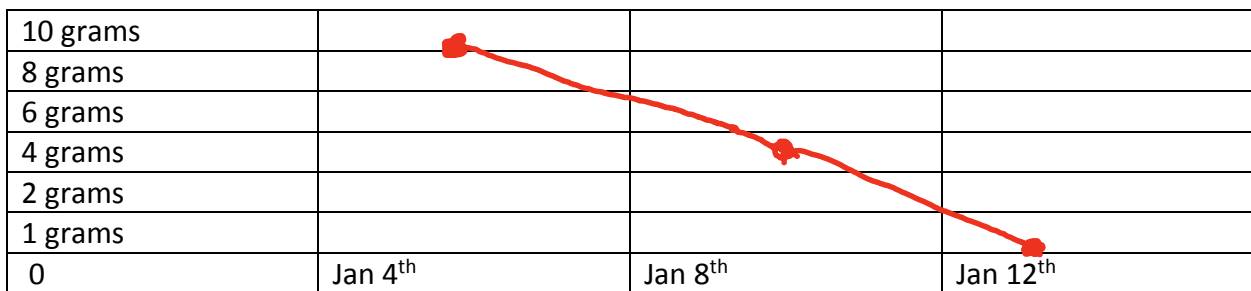
To summarize this; 77 worms can eat a 9g banana in 8 days.

### Tables/Charts:

	Jan 4 <sup>th</sup> (start)	Jan 8 <sup>th</sup>	Jan 12 <sup>th</sup>
Banana	9g	4.8g	0g
Worms	80 worms	77 worms	77 worms
Soil	No soil	Soil	Soil
Temperature	2°C	2°C	2°C

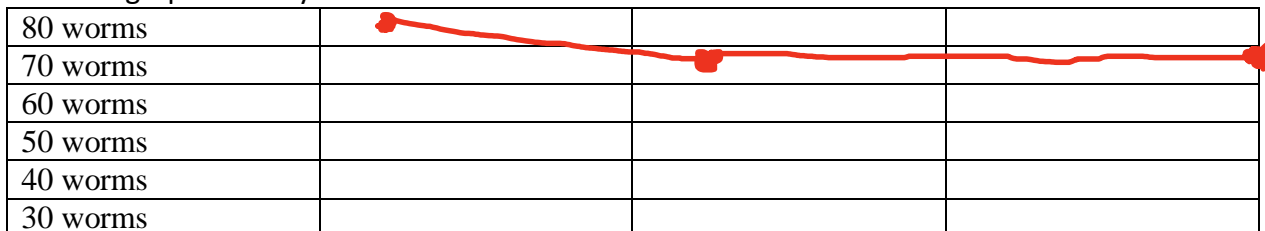
How Much Of A Banana Can 80 Worms Eat In 8 Days

Scale for graph 1: Every 10g.



How Many Worms Were In The Box

Scale for graph 2: Every 10 worms



20 worms			
10 worms			
0	Jan 4 <sup>th</sup>	Jan 8 <sup>th</sup>	Jan 12 <sup>th</sup>

## Science Project Conclusion

Yes, the 9g banana was eaten whole after 8 days by 80 worms or the banana was entirely eaten by the worms.

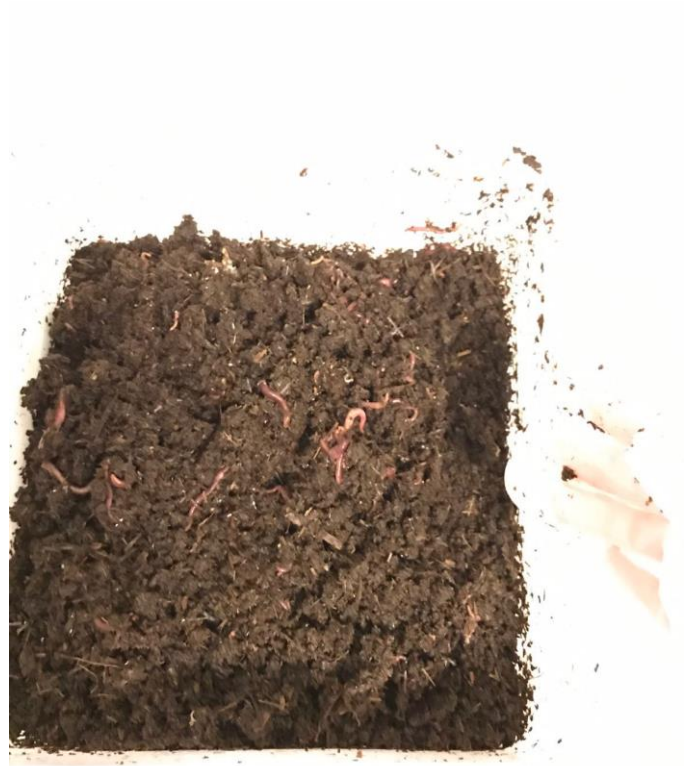
Temperature was kept at 2°C, proving that low temperatures will still keep the worms eating at the banana. The farm was indoors with the temperature at 2°C (below 5°C), meaning that the worms didn't eat as fast. Jessy didn't put any soil in during the first day of the project. Then on the second day, three worms climbed out and died. She also added a second banana after the first one disappeared.

There was uncertainty on both sides of the partnership: I didn't record what the banana looked like over there because I didn't have a photo to see what it looked like sometimes. There was uncertainty on Jessy's side due to some worms may have been ill or weak, so they won't be able to eat. There were few small errors like Jessy putting in the soil on the second day of doing the project and she adding the second banana.

There was also error on my side too: if I helped out with building the worm farm, I would have been able to add the soil. If I also exchanged the worm farm with Jessy and asked for the photos earlier, I would have gotten a lot more data and kept the variables constant. Other than that, there were no confounding variables but I did think the amount of worms also could have been a factor in the experiment.

I learned that a pound of worms (about 1000) can eat 0.5 pounds of waste (226.796g). If we have 80 worms, they would eat 0.04 pounds a day but again, that and how fast may depend on the weather.

Jessy also suggested that we should have had two boxes: one with a 100g banana and worms in soil along with a box with just the banana. I noticed that this was similar to our original idea for this investigation. We should have also had a clear hypothesis when we started this project.



Sources:

[-http://www.cathyscomposters.com/faq.htm](http://www.cathyscomposters.com/faq.htm)

[-http://www.wormcompostinghq.com/start-here/how-many-composting-worms-do-i-need](http://www.wormcompostinghq.com/start-here/how-many-composting-worms-do-i-need)

[-http://www.wormcompostinghq.com/feeding-your-worms](http://www.wormcompostinghq.com/feeding-your-worms)



## Waste disposal of earthworm articles -----

---- OF: tomato source: category: recycling and reuse date: A doctor in the United States inspected nearly 20 countries after thousands of rubbish Hill pointedly pointed out: do not know how to deal with garbage disposal and application, the waste as a waste and burden Of the people belong to the original nation; and garbage as a resource, and understand the use of people who can belong to the advanced countries. According to statistics, more than 380 cities in China, two-thirds of the mountain has been caught in a tight encirclement garbage. Therefore, China's garbage disposal forced in the eyebrows slightly. The composition of urban waste China's current urban waste mainly to the main garbage, and garbage in the kitchen-based garbage. Because of kitchen waste and everyone, every day emissions, so a large quantity. China's municipal solid waste has the following categories: paper, plastic, cloth, rubber, wood, metal, stone sand and kitchen waste (including ash and residual animals and plants, etc.), and these garbage useful things Were picked up for picking up more money, and the rest is mainly not money for kitchen waste and a small amount of bad collection of shredded plastic. Therefore, the final need to deal with urban garbage is mainly kitchen waste. The drawbacks of the traditional approach China's current means of dealing with urban garbage is the essence of garbage from the city moved to the city to store up, and then processed. Under the current technical conditions, 81.5% of the waste can be processed, mainly in health landfill, supplemented by composting and incineration. With statistics, the proportion of sanitary landfill about 70%, about 5% composting, burning about 6%. But experts pointed out that the above methods of dealing with garbage there are some or that drawbacks. Such as sanitary landfill covers an area of large investment in China every year for this loss of billions of dollars, to build a sanitary landfill general investment in the early 200 million yuan, while the use of only fourteen years; Can be burned garbage power generation, but invested more, and a large number of "dioxins" and other gas serious pollution of the atmosphere; composting method has the characteristics of resources, pollution, but the construction cost is quite high, such as a daily processing 400 tons of organic waste compost plant investment at every turn on the billion. Earthworms research and development of urban waste from the 1970s, people started with the earthworm garbage disposal research, so the earthworms to deal with urban life garbage and garbage resource industrialization green line came into being. In recent 20 years, the use of earthworms in life activities to deal with perishable organic waste, has been of great concern around the world, countries on the earthworm research and use in a wider range, and developed into a new industry. Such as Japan in 1978 built an area of 16,500 square meters of earthworm farms, organic waste per month to deal with more than 3,000 tons, and 1983 also found that from earthworms available with antithrombotic activity of lumbrukinase, which led to earthworm physiology New Breakthrough in Biochemical Research. China since 1980, engaged in earthworm outdoor aquaculture and organic waste treatment with earthworms in 1983, Shandong Haiyang design and construction of more than 100 acres of open-air earthworm farm, was a success. In 1984, he went to the Environmental Department of Tsinghua

University in Beijing to collaborate on the research on the disposal of rubbish in Beijing with earthworms. In 1989, he was appraised and awarded by the State Environmental Protection Administration and the State Science and Technology Commission. During this period, with the Shanghai Academy of Agricultural Sciences, with a large area of earthworm dairy farms in Shanghai to deal with environmental pollution test cattle, to be successful and identified by the Shanghai Science and Technology Commission. In 1987, for the Jiangxi pharmaceutical factory in the extraction of lumbrokinase, in Jiangxi Nanchang built a large area of earthworm farms, become the country's first open-air mass production of earthworm farms. Since then has been built in Beijing, more than 10 earthworms, with a total area of 50 0 acres. From 1990 to 1998, more than 7,000 tons of pig manure, cow dung and rice straw were treated annually. Since 1999, more than 14,000 tons of organic matter have been treated annually. The benefits of the development of earthworm industry Earthworm can be a large number of garbage in the swallowing of organic matter, such as meals, paper, a family of three a day of garbage generated, thousands of adult earthworms can be all "consumed." Earthworms eat garbage at the same time will produce tasteless, harmless and efficient multi-functional bio-fertilizer. Lomophilous fertilizer for flowers, can significantly prolong flowering, flowers more vivid; for fruit and vegetable production, not only can improve production, but also improve quality and storage time. Studies have shown that earthworms for organic waste for food, yield per acre of 2 to 2.5 tons, fresh earthworms containing protein 8.5 ~ 10.19%, with the survival of eight essential amino acids, is the full price of protein. From the nutritional standard, the earthworm fresh body and beef, eggs are equivalent, earthworm protein can replace fish meal poultry, the effect and Peru, Chile fish meal quite. Earthworms can be 50% of the organic waste to energy consumption or transformation into storage of their own nutrition, and the remaining 50% of the form of excretion in feces. Vermicompost rich in humic acid, can slowly dissolve in the soil of insoluble minerals, the formation of plants for the absorption and utilization of trace elements system to maintain the balanced nutrition of plants. Which also has not yet determined the presence of growth factors, can stimulate plant yield. Imported golf course dedicated fertilizer prices more than 3,000 yuan a ton, the main component of the test is vermicompost. Experts give a set of figures: 40-60 tons of raw materials can raise 1 ton of earthworms. 2 tons of earthworms can swallow a ton of organic waste a day. 3 tons of organic waste can be a ton of earthworm manure. Environmental experts on the earthworm garbage disposal problems, a daily processing of 400 tons of the factory, for example, a detailed calculation of the sum of accounts: the total investment during construction of the project is about 24 million yuan, the plant operating expenses of about 5.84 million yuan; Annual income: the Government to give the annual garbage disposal allowance to 40 yuan per ton, about 584 million; sales of vermicompost income of 400,000 yuan; sales of live worms income of 100,000 yuan. The total annual income of 6.34 million yuan. Experts are very optimistic estimates, the construction of an earthworm garbage disposal plant annual profit of up to 50 million -100 million. Construction investment for 10 years to recover the full cost, and can solve the employment problem of 100 people. The earthworms industry chain, such as earthworm aquaculture - earthworms fine chemical industry: including pharmaceutical, cosmetics, health care products industry -

earthworm fertilizer deep processing industry: including long-term organic fertilizer, lawn fertilizer, Flower special fertilizer, foliar fertilizer and agriculture, As well as pesticides - deep processing of earthworm protein feed industry: human food additives for food industry - earthworms related to the cultivation of aquaculture industry - earthworms processing municipal solid waste by-product recycling plant - Earthworm Integrated Development Research Center. Earthworms to deal with municipal solid waste strategy and composition of the framework 1, which is a must be strongly supported by the government system engineering. To go through the pilot, promotion, socialization of the three stages of the development process. French Association of mayors support, the French environmental protection industry to form a multinational enterprise groups, employment accounted for the national total 1/10000. This is worth our government departments learn from. 2, urban waste management approach should be incorporated into the legal system track, resulting in all aspects of waste sharing according to the law to deal with the cost of garbage. The implementation of target sanitation funds management responsibility. 3, the source treatment and garbage mountain transformation separately. On the urban and rural areas of the old garbage mountain, the appropriate treatment of the surface, the introduction of earthworms or garbage covered with earthworm manure, and then planted on the vegetation gradually transformed into park green, so that the deterioration of the environment has been inhibited and reversed. Strictly implement the source of waste in the city community classification, organic waste or in situ feeding earthworms, or concentrated transported to earthworms. 4, to strengthen the municipal waste management order process. Beijing suburbs have a group to acquire useful garbage for the industry of private owners, in this group of people under the command of a large to pick up garbage for the livelihood of the workers to make a living team. The government should come forward to organize these people, the use of these workers on the garbage mountain surface for the initial order, for the introduction of earthworms and green to do the preliminary work. 5, the establishment of comprehensive development of earthworm research institutions, so that the earthworm industry, industrialization of waste resources to the deep-seated development. 6, starting from the development of China's national conditions earthworm industry. China is a big agricultural country, green agriculture has become the direction of development today, organic fertilizer market prospects, as the base material of vermicompost, can be compounded into a variety of long-term, quick-acting fertilizer. This is a great potential of the industry, the Government should strongly support. Earthworm industrial chain, sanitation resources industry is like a large ocean-going ship formation, in the field of high-tech industries, become a new bright spot in economic growth, set a new high in the national economy is not false words. Conclusion Traditional waste disposal methods have the drawbacks of one kind or another. The use of earthworms to deal with urban waste that is to solve the shortcomings of these treatments, but also can use organic waste into useful substances to be used to achieve the energy of garbage. Of course, the use of earthworms to deal with urban waste in our country is still a new thing, there are many questions to be further study, and constantly improve the earthworms to deal with garbage in other cities in the construction of a virtuous cycle of ecological system. We believe that the current situation, the most prominent is to solve the

*large-scale disposal of earthworms required for supporting the garbage process. In the garbage pre-treatment stage, need to have a certain garbage dumping sites and means of transport. In order to reduce labor intensity and improve work efficiency, but also need some machinery, equipment and tools. We hope that the relevant departments work closely together in the use of earthworms to deal with the theory and practice of urban waste for further and agricultural*

*A Reporter verification(FROM INTERNET)*

*WeChat friends @ blue pencil: Taobao bought some red earthworms to support, was pleasantly surprised to find that it can not only use the "reduction" and "harmless", but also "harm for the treasure" to help flowers Zhang better .*

*"I like to plant flowers, a few days ago at a gathering of friends, I heard that red earthworms can get rid of garbage, but also can help plant growth, I feel very interesting, home through Taobao bought two pounds of red earthworms, "Blue pencil in a circle of friends yesterday, said," not a few days, I was pleasantly surprised to find that the germination rate than the previous did not put. "... Earthworms to be much higher when the original, earthworm eat garbage will produce tasteless, harmless and efficient multi-functional bio-fertilizer can be used for flower cultivation and fruit and vegetable production. Earthworm breeding speed quickly, with the earthworm's own weight Increase, their ability to digest garbage treatment will increase.*

*In this regard, some users have thumbs-up.*

*Users, I am headstrong, said: "Earthworms are omnivorous animals, which in addition to glass, plastic, metal and rubber do not eat, and the rest such as humus, animal waste, soil bacteria and decomposition products of these substances are eating garbage is a good choice .*

*"If we reduce the amount of household waste we throw away every day, especially the amount of garbage that can be rotten and smelly, like animal offal, vegetable leaves and melons, Residential and urban environment will be more beautiful. "*

*Netizen @ Xiao Jie said: "Too much cattle! Treatment of garbage with red earthworm quite environmentally friendly, very novel, I have to give it a try."*

*(Reporter Eiao Miao)*

*so,through some persons lab and my lab,I know that*

*earthworms to treat kitchen waste, this method is the most environmentally friendly.Earthworms not only inhibit the propagation of harmful bacteria such as Escherichia coli, increase the number of beneficial bacteria, but also increase the soil nitrogen and potassium content, is conducive to plant growth. "These elements are what we should add to the soil, so that people absorb the vegetables after eating.In addition to eating food waste, earthworms to create" by-products "such as excrement and shedding of the epidermis, lawn is an excellent fertilizer, Was collected in the hotel facilities scattered in the garden of the peacock.In addition, these earthworms are also conducive to improving climate change. Garbage dumped organic waste will release carbon dioxide and methane and other greenhouse gases, the atmosphere to absorb heat to produce "greenhouse effect", global warming.*

*"The methane gas is particularly bad because it absorbs about 20 times more heat than carbon dioxide," says environmental scientist Roger Jacques. Earthworms can devour trash and convert it into solid organic matter, thereby preventing greenhouse gases.*

*"There is no doubt that the organic waste at the refuse dump will produce a lot of methane, which will aggravate global climate change," Murphy said. "But earthworms may be able to save the world."*

*I suggest that every restaurant and family kitchen waste are destroyed with earthworms, such as: Nelson Hill Hotel is located in Cape Town, South Africa, is one of the oldest and most famous hotel. Every day, the hotel gatekeepers wear traditional colonial colonial helmets to meet celebrities from all walks of life. These distinguished guests enjoy delicacies in luxurious surroundings and never expect to have a special "staff" in the corner of the hotel where they can not see.*

*Nelson Hill Hotel in the presidential suite near the room with a "earthworm farm." Every day the hotel to thousands of kilograms of leftovers and kitchen food waste sent here, by the earthworms devouring treatment. Here the earthworm is the most common red earthworms, up to 15 cm long, was kept in the specially designed crates. "Unbelievable, earthworms can reduce 70% of the rubbish, and eliminate the garbage," Murphy told the Reuters news agency, who was wearing thousands of earthworms that "I collected earthworms". "Murphy explained that earthworms not only inhibit the proliferation of harmful bacteria such as E. coli, increase the*

*number of beneficial bacteria, but also increase the soil nitrogen and potassium content, is conducive to plant growth. "These elements are what we should add to the soil, so that people eat vegetables after absorption," she said.*

*Nelson Hill Hotel through the "earthworm farm" has been disposed of 20% of the hotel organic waste. They hope that in the next 9 months, with the earthworm breeding and expansion of the farm, the hotel all organic waste are disposed of in this way. In the right conditions, within one year two earthworms can multiply 1 million.*

*The "earthworm farm" at Nelson Hill is the first of its kind in South Africa, and Murphy wants to introduce it to other hotels and schools. She says the "earthworm project" has great potential. "If we value ... everyone does not "The disposal of organic waste, which is thrown into a dumpster, but through places such as earthworm farms, can have a dramatic impact on climate change."*

*Experts believe that the earthworm project is conducive to encouraging people to find other ways to deal with garbage, so that South Africa by 2022 to stop the garbage station to refuse the target.*