

# **Converting Dead leaves to fertilisers in the most efficient way**

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## Abstract

Hwa Chong is home to many plants and trees. According to the gardeners, Hwa Chong has a total of 50 different species of trees. Hence, there are many dead leaves that fall onto the ground. The gardeners are painstakingly picking them up, which is extremely tiring for them especially since they are quite old. The leaves end up being incinerated and are not put to good use. Money is also being wasted on fertilisers, with one bag costing \$120. This project aims to put the leaves to good use, save time and effort of the gardeners, but also to reduce money spent by the school. This project is about creating a compost in school, and adding food scraps to speed up the decomposition of leaves. The leaves should decompose to form nutrients so it can be used as fertilisers. Composts have been created and the amount of food scraps used in each compost was varied. All the leaves decomposed within a month due to the addition of food scraps. However, when it was tested out on a plant, it died within a few days. Additionally, the canteen vendors do not have leftover food scraps and hence it is impossible to use food scraps to compost leaves in Hwa Chong. One recommendation is that composting can still be carried out, just without food scraps.

## 1. Introduction

The main problem is that there are many dead leaves that drop in Hwa Chong everyday. These dead leaves are being wasted as they are being swept by the gardeners and end up being incinerated then dumped into the landfills.



Figure 1.1: Dead leaves in Hwa Chong are everywhere!

Figure 1.2: The fertilisers we use in Hwa Chong.

Sweeping leaves is the current solution to the vast amount of leaves dropping, which is however, not the best solution as many resources are being wasted. Firstly, leaves are being wasted. Secondly, sweeping leaves up is a very exhausting task and could pose a problem for older workers. This has been confirmed as the gardeners have said that sweeping the leaves up is actually a very tiring task. On top of the fact that leaves are not being put to good use and the gardeners spending a lot of energy picking up these leaves, money is being wasted on fertilisers, which cost \$120 per bag. According to the gardeners, 2 bags of fertilisers are needed per month. To put that into perspective, we can use this sum of money per month to buy 16 textbooks, assuming each textbook costs \$15. By saving this sum of money, 16 students can benefit from this money being saved by getting textbooks for free. This money can be saved by not purchasing fertilisers and instead getting the fertilisers ourselves. The aim of this project is to save money, relieve the workload of gardeners, and also put these leaves to good use by making them into compost. Composting is basically a method of decomposing organic waste. Composting is essentially putting organic wastes together and allowing it to decompose. Organic wastes include food scraps, dead leaves, dead flowers and wooden stuff. There are two main methods to doing this. Anaerobic composting and aerobic composting. Aerobic composting is composting in the presence of air while anaerobic composting is composting in the absence of air. Nparks use aerobic composting. They drill small holes in the side of a bin so as to allow air to circulate freely within the compost heap. They also add garden soil to introduce microorganisms to the compost. On top of that, they add an equal amount of "greens" and "browns" to the compost. "Greens" include leaves, egg shells and kitchen wastes. "Browns" include dry leaves and twigs, thick vegetable stems, cardboard and wooden shavings. Additionally, they expose it to sunlight. However, these methods are quite slow. When left alone, a compost takes 6-12 months to fully decompose which varies due to the environment. This is because dead leaves do not have enough nitrogen to speed the composting

process. The main idea of this project, which is using food scraps, solves this problem as food scraps, especially vegetable food scraps, contain large amounts of nitrogen.

## **2. Solution Design**

As mentioned, the plan was to add food scraps to the compost in Hwa Chong to increase the nitrogen content in our compost. The nitrogen in our compost will not only speed up the decomposition process, but also provide nutrients to our fertiliser. Nitrogen is the most important component in fertilisers as it is a main component of chlorophyll, therefore allowing the plants to make food. Collecting food scraps from the canteen vendors and burying them in the soil together with the dead leaves so they can decompose and form fertilisers was the initial idea of this project. The compost will then be frequently watered so that it remains moist and quickens the process of decomposition.

### **2.1: Our own compost**

The original idea was to bury the food scraps and dead leaves in school. However, due to COVID-19 complications, this was impossible. Hence, composts were done. At least 10 leaves, along with some soil and food scraps were added to each compost. The amount of food scraps used as well as the size of the container used to store the compost were varied so as to simulate the conditions of composting in school.



Figures 2.1.1 and 2.1.2 shows our first compost, consisting of garlic cloves, onions and chilli padi.



Figures 2.1.3 and 2.1.4 shows our second compost, consisting of 8 prawn shells.



Figures 2.1.5 and 2.1.6 shows our 3rd compost, which consists of tomato skins, onion peels and eggshells.



Figures 2.1.7 and 2.1.8 shows our 4th compost, which consists of egg shells, potato peels and carrot peels.

All the photos recorded were before and after 2 weeks. In such a short amount of time, the majority of the leaves decomposed. The composts which contained the most amount of food scraps decomposed the fastest, whereas the size of the compost did not really matter. Within a month, all the dead leaves decomposed due to the increased nitrogen from the food scraps which sped up the decomposition process. Although the process was fairly smooth sailing, there were some problems. Firstly, the compost had some odour. To this, charcoal from the lab can be used to remove the stench.

Secondly, there were mosquitoes and flies around the compost. Lemongrass scraps to drive away these insects can be used as not only does it serve as an insect repellent, but it also acts as food scraps which will aid the decomposition process. However, there was one outstanding problem. The chemical composition of our compost to see whether it was effective as fertilisers could not be carried out due to COVID-19 complications.

## **2.2: The field test**

There was no waste to test the compost in Hwa Chong, once again due to the COVID-19 situation. However, a test was conducted on a plant at home. A compost was added to the soil of the plant to see whether the fertiliser produced was really able to provide the plant with nutrients. The plant died within a few days even though it was healthy before we put the fertiliser in.



Figure 2.2.1: The plant died and the leaves withered in a few days.

Although it is foolish to pinpoint an error due to the many probabilities, it is safe to say that the compost did play a part in its death as the plant was healthy prior to the placement of the compost into the plant's soil. Any further experiments were not conducted as the group did not want to incur anymore deaths.

### **3. Results and Discussion**

As can be seen from the findings, the concept of the composting system used in this project itself had succeeded, in a sense that it has achieved the desired result of decomposition. From the experiments conducted, the composts had taken a significantly shorter amount of time (from 8 months to 1) to decompose. This proves the feasibility of using vegetable scraps to aid decomposition.

However, there has been a lack of sufficient lab work to confirm the components of the fertilizer. A field test has been conducted in an attempt to test out our product, but with the end result of the death of our plant. It is not possible to pinpoint the exact cause of death of the plant because the experiment has not been conducted repeatedly hence the cause of the death of the plant cannot be confirmed. However, it should have been caused by some complications within the fertiliser itself.

Furthermore, the lack of food scraps was a major issue in this system, as, (mentioned above) food scraps are a major factor contributing to the decomposition of dead leaves. The nitrogen found in vegetable scraps are crucial to the quick decomposition to the plant. The lack of it is a big issue. The reason behind using the food scraps from the canteen was to make good use of the resources we have at hand.

However, a possible replacement of food scraps may be grass clippings, which are also high in nitrogen. They are technically no different from vegetable scraps. It is also a way to put the discarded clippings to good use, instead of throwing them away.

The biggest problem in our project is the lack of data collected through extensive testing and collecting of information through lab work. It is therefore not possible to very certainly confirm the effectiveness of our project and findings. However, considering the numerous unresolved issues faced along the way, the conclusion drawn is that the composting of dead leaves using food scraps in order to generate fertiliser for the plants in the school is not feasible, with room for further work and development.

#### **4. Conclusion and Further Work**

Based on the results above, this project has proven that the use of dead leaves and vegetable scraps to make fertilisers for plants is not feasible. Through the field test, it can be concluded that the use of food scraps as a source of nitrogen in composts is not an effective way to reduce the amount of time taken for the composting process, as the

plant withered. However, this takes into assumption that the withering of the healthy plant is mainly due to the addition of the created compost into its soil, which cannot be confirmed as the COVID-19 situation prevented any use of the science labs in school.

Limitations of the project include the lack of a constant supply of food scraps as the canteen vendors did not have a significant amount of leftover or unused food. Furthermore, there was no suitable location to place the compost as either the gardeners or the canteen vendors would have to travel long distances to drop their bags of dead leaves or food scraps respectively.

Even though this project did not prove to be successful, it is possible to make use of dead leaves in many other ways. A leaf mold can be made with the composting of shredded dead leaves and the addition of water on a weekly basis to ensure that the leaves remain damp, though the composting process would take longer.



*Figure 4.1 A leaf mold*

## **5. References**

Nparks, (Last updated Apr 2020), Composting - Caring for plants, Singapore  
<https://www.nparks.gov.sg/gardening/gardening-resources/caring-for-plants/composting>

Todayonline, (13 Nov 2014), 'Autumn' in Singapore at East Coast Park  
<https://www.todayonline.com/singapore/autumn-singapore-east-coast-park>

J.R. Heckman and D. Kluchinski, (April 1996), Chemical Composition of Municipal Leaf

Waste and Hand-Collected Urban Leaf Litter

<https://sustainable-farming.rutgers.edu/wp-content/uploads/2014/09/JEQ-2006-Chem-Comp-of-Leaves.pdf>

Green as it gets, (May 2019), Why do plants need nitrogen?

<https://www.greenasitgets.com/why-do-plants-need-nitrogen/>

Jane, C. (2019, June 05). Leaf Mold: An Invaluable Resource Your Plants Will Thank You For! Retrieved August 10, 2020, from

<http://www.artfulveganliving.com/veganic-gardening/permaculture/leaf-mold/>

Min Wang, Qingsong Zheng, Qirong Shen, and Shiwei Guo, Apr 2013, The Critical Role Of Potassium <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3645691/>

Kare Fog, (Jan 2008), The Effect Of Added Nitrogen On the rate of decomposition of organic matter

[https://www.researchgate.net/publication/230033660\\_The\\_effect\\_of\\_added\\_nitrogen\\_on\\_the\\_rate\\_of\\_decomposition\\_of\\_organic\\_matter](https://www.researchgate.net/publication/230033660_The_effect_of_added_nitrogen_on_the_rate_of_decomposition_of_organic_matter)

Amy Jeanroy, (Dec 2019), How to Make your own compost

<https://www.thespruce.com/how-to-make-compost-p2-1761841>

Jamie McIntosh, (Feb 2019), How to Turn Dead Leaves Into Healthy Flowerbeds

[www.thespruce.com/use-dead-leaves-in-garden-1316001](http://www.thespruce.com/use-dead-leaves-in-garden-1316001)

Anne Quito, (September 2, 2019), An ingenious Filipino artist creates mosaics with dead leaves and garlic peels

<https://qz.com/quartz/1698682/filipino-artist-pando-maglipon-creates-art-from-dead-leaves/>

Frechka, V. (2018). FALLEN LEAVES AS RENEWABLE SOURCE FOR PAPER PRODUCTION. Retrieved August 10, 2020, from

<http://media.icys2018.com/2018/04/UkraineFrechkaValentyn126180.pdf>

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