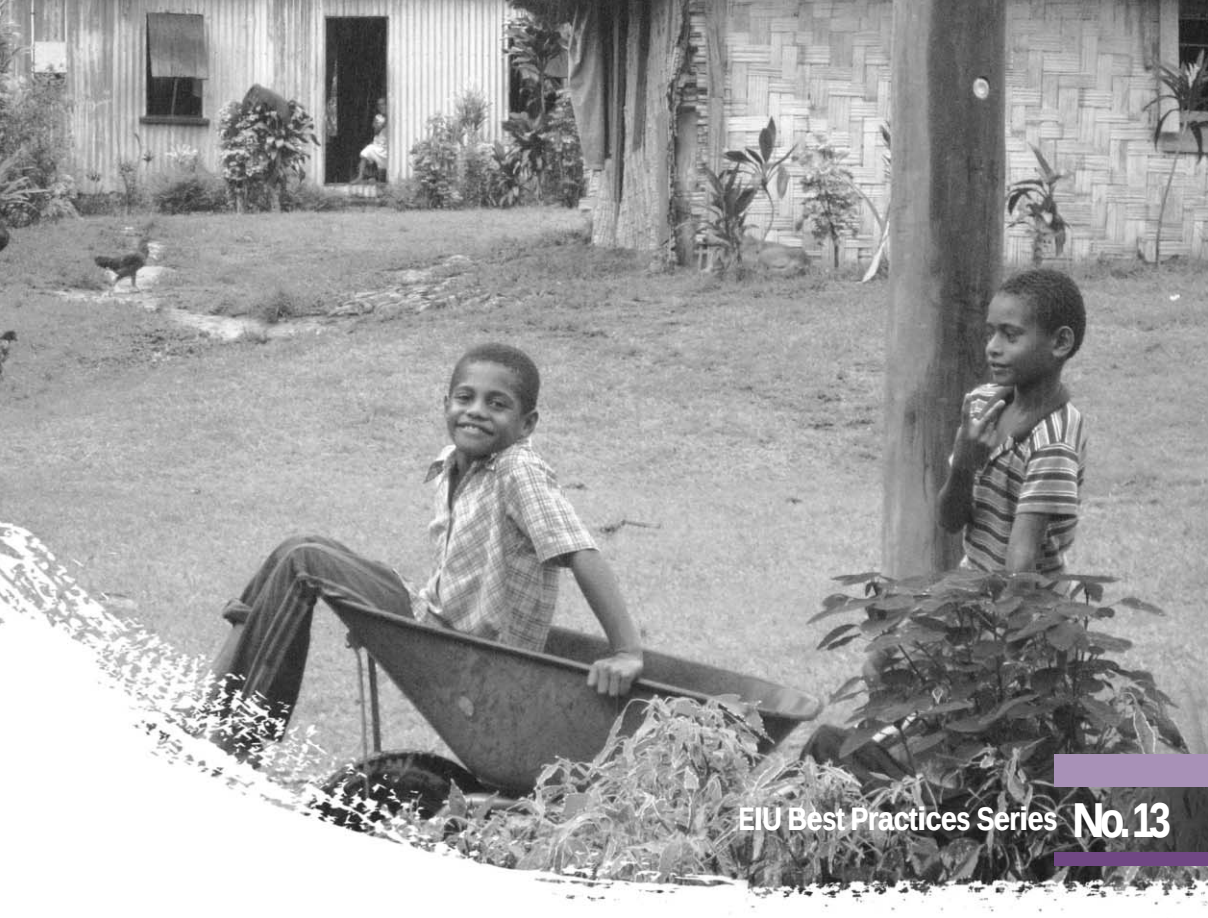

EIU Best Practices Series No. 13

Integrating Organic Waste Management in Fijian Schools

EIU Best Practices 2009

United Nations Educational, Scientific and Cultural Organization

Asia-Pacific Centre of Education for International Understanding under the auspices of UNESCO

Foreword

As a regional centre mandated to promote Education for International Understanding (EIU) towards a Culture of Peace in Asia and the Pacific region, Asia-Pacific Centre of Education for International Understanding (APCEIU) under the auspices of UNESCO has been engaged in various endeavors aimed at fulfilling its mandate since its inception. APCEIU launched the EIU Best Case Studies in 2006 as an Experiential Learning Programme (ELP) in cooperation with the Member States in the region to encourage local initiatives on EIU. In 2009, it was renamed EIU Best Practices.

EIU aims to promote, in particular, "Learning to Live Together", among the four pillars of education set forth in the Delors report, through participatory learning and critical thinking. EIU Best Practices brings and explores various efforts in the region geared to foster "Learning to Live Together".

Asia and the Pacific region, with some of the major flashpoints of the world, have long been plagued by a history of socio-political conflicts often intersected by challenging ethnic, cultural and religious issues. In the era of globalization, ensuring education towards a culture of peace and a sustainable future has become critical more than ever for a common prosperous future of all humanity. Launched against this background, EIU Best Practices is an outreach effort that seeks to encourage and further local initiatives on peace, human rights, intercultural understanding and sustainability in different social and cultural contexts.

This series no. 13 introduces a case from Fiji which aims to raise awareness on solid waste management. It initially introduced best practices of disposing recyclable waste materials in selected secondary schools, but with hopes of elevating composting as an organic waste management option for Fiji and the Pacific Islands. More awareness of composting will empower people to take responsibility in managing their waste. The project is not only focused on teaching and training them on composting methods, but also on changing their behavior and attitude towards waste disposal and gaining insights on how their actions may affect other people.

I hope that through this endeavor, various EIU Best Practices can be shared among educators, scholars and activists who are committed to promoting a Culture of Peace in the region. I expect this project can provide a platform to share and exchange our experiences and perspectives.

I would like to extend my heartfelt appreciation to the National Commissions for UNESCO, in particular, Fiji National Commission, the selection committee and Adi Cakobau Secondary School and Lelean Memorial School for their kind support and cooperation in carrying out this project.

December 2009

LEE Seunghwan
Director

EIU Best Practices is...

APCEIU has been committed to the promotion of a Culture of Peace since its inception, in line with one of the pillars of education "Learning to Live Together." A Culture of Peace has been a key principle at the core of UNESCO's ethical mission. It involves a set of values, attitudes and behaviours that can be taught, developed and improved upon to enhance mutual understanding and conflict resolution. Attaining a Culture of Peace requires transformation of institutional practices, as well as individual values and behaviours in which education plays a crucial role in the process. As a major educational tool aimed at promoting a Culture of Peace, EIU addresses issues related to cultural diversity, globalization and social justice, human rights, peace and sustainable development. It focuses on increasing the capacity of learners to deal with issues of everyday life, to resolve community conflict and to enjoy human, political and civil rights to a greater extent.

APCEIU launched EIU Best Case Studies in 2006 in cooperation with the UNESCO Member States in the region to encourage educators, scholars and activists to implement and share local initiatives on EIU. It is an outreach programme that invites them to share their efforts in promoting education for a culture of peace in different social and cultural contexts. Now renamed as EIU Best Practices in order to further encourage the participation of practitioners in the field, the programme seeks to promote and collect innovative practices based on optimal classroom conditions and activities, school climate, community and social atmosphere, and disseminate them throughout the region.

The programme is conducted through the following steps: 1) Announcement: APCEIU sends announcement letters along with application forms and guidelines to the 47 National Commissions for UNESCO, UNESCO field offices, major National Institutes of Education in the region and MOU partners of APCEIU in the region; 2) Screening and Selection: Submitted applications are reviewed by the Screening Committee, composed of experts, who then select the best practices; 3) Field Visit: APCEIU staff undertake field visits to the programme sites of the selected case to confer the EIU Best Practices awards, conduct field observation and interviews, and provide the selected applicants with the guidelines for the final report; 4) Submission of the Final Reports: Selected applicants submit the final reports to APCEIU based on the guidelines; and 5) Publication and Dissemination: Final reports are published as a monograph series and disseminated throughout the Asia and the Pacific region.

Given the favorable and enthusiastic responses from the region and the support from the National Commissions for UNESCO, APCEIU wishes to expand on the positive momentum built thus far and further its efforts for the coming years.

APCEIU encourages educators, scholars and activists from Asia and the Pacific region to apply and share their experiences and perspectives. The centre expects that through the EIU Best Practices, diverse practices of EIU will be widely shared throughout the whole region, thus contributing towards achieving a Culture of Peace.

Author

Ms. Bulou Daiana Taoba has been working with the University of the South Pacific's Pacific Centre for Environment & Sustainable Development (PACE-SD) for three years. She started as a Research Assistant at the University of the South Pacific Waste-Wise project and currently a programme assistant of the START Oceania Secretariat, a component of the centre that focuses on Global Change.

Between 2008 and 2009, she worked closely with Suva City Council, one of Fiji's biggest municipal organisations, on a pilot program for composting organic waste. As a technical expert, she imparted knowledge of composting organic waste to workers at the Suva City Council. Today, the council is working independently on the project and plans to expand it.

She holds a Certificate in Laboratory Technology and Diploma in Environmental Studies from the Fiji Institute of Technology and is completing her Bachelor of Applied Science in Environmental Studies at the Auckland University of Technology via Fiji Institute of Technology.

Acknowledgements

This research entitled "Integrating Organic Waste Management in Fijian Schools" was made possible with the assistance of the Asia - Pacific Centre of Education for International Understanding (APCEIU) and the Pacific Centre for Environment and Sustainable Development, University of the South Pacific.

I would like to thank the staff of Adi Cakobau Secondary School and Lelean Memorial School, especially to the students who participated in learning about composting.

December 2009
Bulou Daiana Taoba

Contents

Integrating Organic Waste Management in Fijian Schools

1. Introduction

1.1. Background

Waste has become a major problem in the Pacific Island Countries (PICs). Rapid urbanization, changing consumption patterns, limited land areas and vulnerable ecosystems add to the complexity of this issue and impose considerable burden on the environmental (e.g. pollution), economic (e.g. management costs) and social (e.g. public health) aspects of island life. Organic waste is a significant portion of all the waste disposed at landfills.

In recognition of University of South Pacific's (USP) role in capacity building for better environmental practices and the fact that USP is a microcosm of Pacific communities, the Pacific Centre for Environment and Sustainable Development (PACE-SD) and the Institute of Applied Science submitted a project proposal to USP senior management entitled "Greening USP." The crux of the "Greening USP" concept is to make USP adopt environmentally sustainable practices in all of its operations. The long-term goal is the attainment of a "Green USP," to be achieved through a step-by-step and iterative process of improving its environmental practices.

Ultimately, all USP operations should have minimum adverse impact on the environment and human health, through implementation of environmentally informed decisions, efficient use of resources (e.g. water, energy, finance and time) and better management of waste underpinned by a strong corporate commitment. Within the "Greening USP" concept, there are a

number of different initiatives for implementation. One initiative is the USP Waste-Wise project, which is aimed at minimizing solid waste generation through the application of the three components of the solid waste management hierarchy (reduce, reuse and recycle).

1.2. USP Waste-Wise Project

Composting was identified as one of the initial activities to be implemented under the USP Waste-Wise project. The need to introduce composting in USP is driven by the desire to establish appropriate and *do-able* composting methodologies within the context of large organizations such as USP and at the individual level. Current composting methods practiced in the South Pacific region rely on animal (pig, cow) manure to spur the decomposition process. However, the application of these methods in urban settings (which usually have large volumes of green and putrescible wastes), especially areas with space constraints and limited access to animal manure will be problematic. In the composting pilot programs, there are two configurations: one will use *windrows*, and the other will use *rotating tumblers* (Fig. 1).

Figure 1. (a) Windrow-based composting

(b) Rotating tumbler composting

Windrow-based composting involves having an open composting pile, which will be aerated manually by turning the composting pile. On the other hand, the rotating tumbler composting, as the name suggests, involves composting using a rotating container. The latter configuration is aimed at facilitating composting at the household level, especially in urban areas, where space and public health regulations may not favour open composting piles.

1.3. Composting Organic Waste

Composting is a natural process of decomposition of organic materials. It is simply a way to help speed up the natural decomposition process. It produces an exothermic (heat producing) reaction, so the internal heat increases the temperature and creates vapour.

Organic waste + Oxygen (O2) + microorganisms ➞ Carbon Dioxide (CO2) + Water (H2O) + Compost + Heat

The mass of organic waste is lost during decomposition in the form of carbon and water vapour. The composting process depends entirely, to a great extent, on ambient conditions including nutritional balance, humidity, temperature, pH and aeration. Since the Pacific Island Countries have hot and humid weather, composting is an

excellent way of managing biodegradable solid waste.

Composting offers several benefits such as enhanced soil fertility and soil health, therefore helps increase agricultural activity, improve soil biodiversity, reduce ecological risks and overall, a better environment. It is not only about utilizing the wastes but it is also about reducing emissions (leachates and greenhouse gasses - GHGs) at landfills. A gas that is produced from organic waste disposed at landfills is methane, which contributes to climate change, and unfortunately is not managed in any landfill within the PICs.

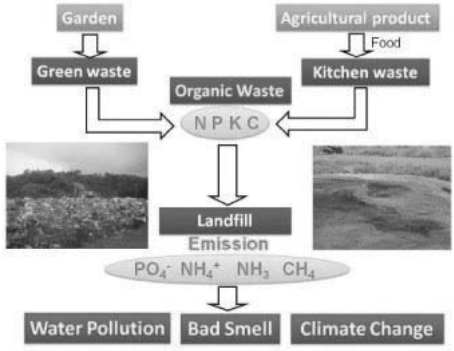

Figure 2. Flow of organic waste (Photo source: K.Yao)

As a result, the University of the South Pacific's PACE has designed a methodology of composting organic waste without the use of animal manure. The compost methodology included certain waste ingredients to be combined with a required amount of organic waste in order to produce high quality compost.

1.4. Goals and Objectives

The project aims to develop composting methods and capacities that are practical and effective at various types of institutions including schools. The specific goals are:

1. To educate students and school staff on solid waste management and practical options to dispose solid waste; and

2. To transfer skills and knowledge about composting to the selected secondary schools as a practical option to dispose waste.

The pilot project is focusing on schools to adopt the composting procedures. The programme will also target non-examinable science students and teachers.

1.5. Methodology

The pilot project involves a participative-learning teaching method, where students learn about the composting process through hands-on experience. The case report involves interviews and discussions with the teachers and students about the project. A questionnaire was also given to the students.

2. Project Implementation in Schools

2.1. Dialogue and presentation with working partners

To begin with, two secondary schools (Adi Cakobau Secondary School and Lelean Memorial School) were selected for the pilot programme of composting organic waste in schools. The schools were selected based on the following criteria:

(1) Both are boarding schools, and therefore have significant levels of organic waste;

(2) Close proximity to the USP which allowed the PACE-SD composting project officer to pay regular visits; and

(3) With the schools' reputation, they can potentially lead other schools and institutions in promoting eco-friendly values.

It also included sending out invitation letters to secondary schools with a brief description of the project. After receiving a positive response from the selected schools, a dialogue was established with them in order to determine the appropriate time for presentations and

implementation of the composting process and to ensure that it suits the school's curriculum.

The school students were assigned to work on the project of composting organic waste since it is related to their studies. These enthusiastic students were non-examinable. It also gives a boost to the programme, since the students can impart the knowledge they learned about composting to the younger students in the following year.

2.2. Segregation of organic waste

The students were taught how to segregate waste by using separate bins to dispose the different types of waste. Students were also given a list and images of the types of waste that are categorised as "good kitchen" waste and "bad kitchen" waste, as well as brown and green waste. The students would be able to identify the different types of solid waste and take the responsibility of disposing it appropriately.

Good kitchen waste includes vegetables, root crops peelings and stems, and potato peelings; while the bad kitchens waste were cooked food or highly acidic organic waste like lemons, which were not suitable for composting. However, the students were advised that it was readily available for the workers to feed the pigs within the schools farm. Brown waste includes twigs, dead leaves and grass, while refers to fresh grass.

There was a small demonstration showing how to mix the waste, allowing students to learn the basic steps in compiling compost and the purpose behind the activity. With this hands-on activity, the students were able to understand the types of solid waste and alternative environmentally sustainable practices such as composting. Then, students placed solid wastes in trash bins which have been labelled according to different categories of organic wastes needed for composting.

2.3. Introduction of rotating tumbler

The use of the tumbler for composting organic waste was introduced to the students during the first phase of the programme. Its use in the schools was appropriate since it takes less space in the school compound and can be placed near the school kitchen. The rotating tumblers is a controlled process for composting using an enclosed vessel ≈200 litres that modified and accelerated the natural process of decomposition in nature.

2.4. Collection of waste materials

An important feature of composting is the ratio of carbon to nitrogen content of compost, known as the C:N ratio. There are various ways to calculate this value based on field calculations. This has been simplified through the use of computer software called "compost calculator," which is used by composting facilities in other countries. This gives people interested in composting an opportunity to roughly estimate the C:N value based on various statistical data available on field feedstock. The compost calculator allows for some flexibility in working with materials found locally in Fiji. The optimum C:N ratio in all composting operations is 30:1, which basically means 30 parts of carbon to each part of nitrogen. The key ingredients for composting collected within the school compound are as follows:

A. Grass clippings
B. Kitchen waste
C. Dried leaves/ twigs/ small branches

Figure 3. Waste are segregated by students

Figure 4. The researcher explaining the composting process to the students

This set of ingredients form the main basis for the composting tumbler method but is not limited to them. Field results have shown that some deviation in feedstock is possible, but the basics are still the same. As long as the main feedstock materials are in the proportions 30:1, then the composting process should produce optimum yield.

2.5. Mixing ingredients for composting

The feedstock was calculated and determined by the facilitator to start a pile, and ingredients have been stocked by the students. All raw ingredients were combined equally in the tumbler and mixed thoroughly by hand; the main reason behind this is to ensure that all components are combined together equally so as to avoid clumping. Once the material has been mixed thoroughly, the tumbler was closed to allow composting to occur in damp conditions and also retain inner moisture without drying out the compost material. Furthermore, the tumbler was rotated frequently to ensure that the ingredients were mixed comprehensively.

Figure 5. Students collecting grass clippings

Figure 6. Preparing the ingredients for compost

2.6. Monitoring the tumbler

There were several important factors that were emphasized to the students, which were essential to the composting method as given below:

- Materials will compost best if it is between 1/2 to 1 1/2 inches in size. Soft, succulent tissues need not to be chopped in very small pieces because they decompose rapidly. The harder tissues need to be cut into smaller pieces. It is advisable to cut all kitchen waste and the brown large leaves only to ensure good results.

- The carbon to nitrogen ratio of 30:1 should be considered when mixing the composting ingredients.

- Materials such as soil, ashes, manure from carnivorous (meat-eating) animals, highly acidic fruits and vegetables, chillies, onions, lemons, lime, and peppers, cooked meat and food, oils, bones or raw meat/fish or animal products, should not be added into the tumbler.

- Take note of the moisture content of the compost. Do a squeeze

test to determine the moisture level of the compost. Your hands must always feel wet when squeezing the compost. However, having more than two drops of water coming out of the compost material indicate that there is too much moisture. Excessive moisture or dryness of the organic material will slow the decomposition of the materials. If it is too wet, the materials should be spread out to dry. If it is too dry, add more moisture.

• Heat is vital in composting and is supplied by the respiration of the micro-organisms① as they break down the organic material. It is suitable to place unused kitchen waste materials in bins, while the tumbler is to be closed at all times in order to keep the moisture. Note: As the compost matures, the tumbler can be opened for a while to allow ventilation.

• The compost tumbler needs to be rotated to prevent the compost pile from becoming too hot. Micro-organisms will be killed by too much heat, and these results in a slow composting process. By turning the tumbler, it will not overheat, and it will be aerated, both of which are necessary to keep the most active decomposers functioning. The pile should be turned so that the material on the outside is moved to the centre. This will allow all of the compost material to reach optimum temperatures. It is important that after every turn that the tumbler is closed to retain the heat loss from turning the piles. If the pile is turned frequently, the composting period will take four weeks.

• The pile should reach high temperatures within 24 to 48 hours. The temperature will be affected if the pile is too wet, too dry or there is not enough green waste. This can be adjusted accordingly by spreading the material if it is too wet; if too dry, adding moisture; or putting more green waste.

① Micro-organisms is an organism that is usually too small to be seen by the naked human eye

• Note that during composting process, if there is a strong unpleasant odour, it indicates that the C/N ratio is less than 30:1. The strong odour indicates that the nitrogen is lost in the air, and as a countermeasure, more brown waste should be added.

• Good indicators of decomposition are: a pleasant odour; heat produced is visible when turning the pile or when uncovering the windrow; growth of fungi on the decomposing material; reduction in volume; change of colour of the compost materials to dark brown; and a decline in temperature.

• The complete compost material is filtered before packing (the unstrained compost particles is then placed onto the next compost pile).

3. Impact and Evaluation

The programme being implemented in the schools shows there are available resources within the school compound that could be used to produce compost, as opposed to using animal manure that entails added costs for the school. As a result, the school has not just improved environmental quality but also resource efficiency and productivity.

The hands-on activities also allowed the students to gain the skills of composting, understand the waste flow and its impact on the environment if disposed improperly. The students would be able to take such practices to their households and could play an important role in changing their families' attitudes and behaviour towards waste disposal.

The programme was suitable for implementation in secondary schools since the students understood chemistry and the physical

component of composting. The students have the potential to learn the skills; however, the timeline for the project was not suited to the school curriculum. The project was implemented towards the end of the year as the students prepared for their final academic examinations. The programme will be continued the following year, since there are more composting activities to be carried out.

4. Conclusion

This programme is suitable for secondary schools but the timeline should be suitable to the school's curriculum. The other alternative is for the school staff and workers to be trained on such activities, so that it becomes part of the school programme. Furthermore, students involved in the project should be part of the student body so they can make recommendations on waste disposal at their schools. This is the first programme of composting in schools that make use of the tumbler, which modifies and accelerates the composting process. It is recommended that these composting methodologies be documented in manuals, so that students and teachers can fully understand it.

References

SCC-USP Compost Pilot Project Final Technical Report. (2009).
Rambault, S. (2006, January) Waste-Wise USP Report.

Appendix

Evaluation Sheet

Identification/Details

Date : _____

School : _____

Form : _____

Gender : _____

Do you live on the school campus? _____Yes _____No

A. Waste disposal and current practices

1. What kind of waste do you dispose of at school?

	Waste Type	Waste Disposal Method				
		Rubbish Bin	Recycle Bin	Throw on the ground	Mulch	Other
	Food rubbish					
	Plastic soft drink bottles					
	Plastic (bags, btls, containers)					
	Aluminium cans					
	Tin cans					
	Recyclable glass bottles					
	Paper					
	Dry cell batteries					
	Other					

2. Do you know where the different waste types from Lelean Memorial School would eventually end up?

	Waste Type	Final Disposal Destination			
		Limi Dump	Naboro Landfill	USP Compound	Don't know or specify if other
	Green / garden waste				
	Kitchin organic waste				
	Paper				
	Plastic soft drink bottles				
	Aluminium cans				
	Tin cans and other metals such as copper				

3. Can you list some companies that collect waste for recycling?

_____

_____

_____

_____

4. Do you make an effort to reduce, reuse and recycle (RRR) the waste you generate in school?
(E.g. taking plastic bottles and aluminium cans to recycle bins, putting organic waste into gardens). If yes, please explain.

_____

_____

_____

B. Attitudes and concerns on waste management

1. What do you think about the current waste management in your school?

   _____Inadequate

   _____Adequate

   _____More than adequate

2. If inadequate what do you think should be done to make it adequate?

   _____

   _____

3. How important is to recycle, reuse and reduce waste at your school?

   _____Not that important

   _____A little important

   _____Important

   _____Very important

   _____Needs to be addressed immediately

4. How important is it that Lelean Memorial School compost its organic waste?

   _____Not that important

   _____A little important

   _____Important

   _____Very important

   _____Needs to be addressed immediately

5. Do you understand the term “composting”?

_____Yes _____No

6. Do you practice composting at home or in school?

_____Yes _____No

7. Are you willing to separate waste according to these four categories?

_____Paper

_____Plastic bottles or aluminium cans

_____Organic

_____General waste

_____Yes _____No

Information Instruction Sheet for Students in the Kitchen

Field Visit

On behalf of APCEIU, Ms. Johanna Encabo, Junior Programme Specialist of the Research and Development Team, undertook a field visit to Suva, Fiji from 14-20 September 2009 to carry out the following missions: 1) to confer the EIU Best Practices Award on the Author, 2) to provide the guidelines on finalizing the report: and 3) to interview teachers and students involved in this case, and discuss how to continue and enhance further activities related to EIU.

▲ Conferring the award on the researcher

▲ Meeting the students of Adi Cakobau Secondary School

▲ Meeting with Mr. Isireli Senibulu, Secretary-General, Fiji National Commission for UNESCO

▲ The researcher explains and demonstrates the composting procedure

▲ The researcher and students at the composting site