DAK LAK AGRICULTURE
EXTENSION CENTER

RURAL DEVELOPMENT DAK LAK

PROCESSING COMPOST PRODUCTION FROM COFFEE SHELLS

Buon Ma Thuot, 5/2008

gtz

GFA Consulting Group

Contents

1. Introduction

Central Highland is a large potential area for agricultural development with various crops, the soil here is regarded as paradise for such industrial crops as coffee, rubber and others. However, due to the natural factors, the slope terrain is highly partitioned and the improper land use of the local people has degraded the soil productivity, firstly the organic content, the fertility and then later the soil texture.

The practical production confirms the important role of organic fertilizers in maintenance of soil fertility, improving crop productivity, contributing to sustainable agriculture. At present, the animal's manure is however getting scarce, not sufficient to meet the demand of agricultural production in Central Highland; meanwhile the coffee shells, as a valuable organic resource, is very much available and cheap which can be used to produce compost as either a partly or entire substitute for animal's manure, but it's not yet well considered in farming production, some households even discard this valuable resource.

Realizing the potential of coffee shells in sustainable agriculture in Dak Lak, since early 2005 the project on Rural Development Dak Lak has cooperated with the province's Agricultural Extension Center, Extension Station in two target districts of Lăk and Ea H'leo to implement trials on compost production from coffee shells.

This manual is prepared on the basis of the aggregation of results and experiences made in these trials over the past years as a reference material for farmers and extension workers in producing coffee shells into compost at farm level.

2. Benefits of using coffee shells for compost production

Considering the existing coffee area in Dak Lak particularly and Central Highland in general, every year thousands of coffee shells are produced from husking process, if this amount is processed as compost, it will bring lots of benefits for each farm households and the entire society.

Economic benefits

It requires only man-day, coffee shells and some money to buy micro biological ferment, manure (if not available in farm), urea, phosphate, lime, and sugar for producing good compost which cost only 30% of price of the similar fertilizer in the market. Therefore farmers can save a quite remarkable amount of money for other purposes. Moreover, compost application can help to stabilize the crop yield, reducing the amount of chemical fertilizers to be applied. This is a potential for cutting down production costs.

Environmental benefits

Application of compost produced from coffee shells for rice, maize, coffee, pepper, etc. will result in the following environmental benefits:

- No pollution of eco-system, no negative impact on health of human being, plants and animals
- Improvement of soil texture, softness and fertility
- Stabilizing the micro biological system in the soil environment
- Disintegration, transformation of other organic matters in soil as nutrients for crops.
- Reducing the use of chemical fertilizers, therefore minimizing the amount of chemicals washed away in ground water or sublimated in the air, polluting the environment.

3. Processing guidance

Materials

Key materials for compost production are around 1.000 kg coffee shells discarded from the husking process to produce 3.000 kg of coffee bean.

- Manure: 200 kg
- Phosphate 50 kg

- Urea: 10 kg
- Lime powder: 15 kg
- Sugar: 2 kg
- Micro-biological ferment: 2 kg

Materials

***Note**: there are various types of ferments:*

- *Ferment with key element as a microorganism which can disintegrates cellulose, protein, deodorizes bad odours*
- *Ferment with key element as Trchoderma fungus, Streptomyces bacterium*

Labour

- It requires 5 man-day split into 2 turns to complete this processing:
  - 1st turn: 3 man-day to make the pile
  - 2nd turn: 40 days after the 1st turn, 2 man-day to mix the pile up

Instruments

The following instruments need to be prepared for this task:

Tools

- Hoe: 02
- Shovel: 02
- Rake: 02
- 500 liter water tank: 01
- Watering can; 01
- Pump: 01
- Water pipe: long enough to feed water from water source to work place
- Plastic canvas: to cover the pile

Activation of micro-biological ferment

Around 4 - 5 hours prior to processing, pump 500 liters of water into the tank and prepare other materials:

- Micro-biological ferment: 02 kg
- Sugar: 02 kg
- Urea: 200 gram or 0,2 kg

Then, dissolve ferment, sugar, and urea in the above mentioned water tank and stir up. Stir up again in at least 4 times in order to totally activate the ferment so that the coffee shells can be disintegrated quickly in the pile.

Dissolve sugar, ferment and urea in water

Processing

Mixing up dry materials

- Lay coffee shells on the ground at 40 cm thickness
- Scatter manure over the coffee shell layer
- The remaining urea amount (9,8kg) is put over the mixture of coffee shells and manure
- continue to add phosphate and lime powder

After putting all materials together, mix them up .

Mixing up dry materials

Blending dry materials

Watering and mingling

Watering and mingling

When the dry materials are blended together, water and mix up again at the same time to make sure the whole mixture is completely wetted. Only watering without mingling can wet the top layer of the mixture, the other unwetted areas will not be disintegrated during piling up and covering. The water amount that can wet 70 – 80% of the

mixture is enough, if too much water is applied, urea, phosphate and lime might be washed away quite a lot.

Adding activated ferment and piling up

Adding activated ferment

When the entire mixture is totally wetted, leave it there in 15 – 20 minutes so that water and fertilizers can be absorbed evenly in all elements of the materials. Then lightly water it again to make sure all elements are soaked, and add the activated ferment and make the pile up. Do it as follows:

- Clear and clean a site for making a pile
- Cover the ground by a 10 cm layer of rice straw or wet coffee shells
- pile up to make a bed at 20-25 cm thick, 2-2.5 m wide, and the length depends.
- Stir up the activated ferment liquid and sprinkle it over the bed by a watering can.
- Continue to add the wet materials and activated ferment until the pile is finished.

Piling up and covering

- The completed pile should be min. 1,2 m high, and 2 - 2,5 m wide so that it can hold heat for the disintegration.

- Put over the pile a 10 cm - 20 cm layer of rice straw and coffee shells, lightly water the pile, and finally cover the whole thing by plastic canvas to keep moisture and temperature of the pile.

Note: *Plastic canvas should be choked by heavy things to avoid being gone with the wind.*

Checking the pile

Around 15 days after piling up, make a check, use hoe to make a hole in the heart of the pile and realize many ferment fungi on the surface of the materials and temperature of the pile might go up to 80°C to disintegrate the materials and eliminate germs. It the moisture content of the pile is inadequate (dried), water the pile and cover it again.

Checking after piling up

2nd mixing up the pile

25 - 30 days after the 1st check, or 40 – 45 days after piling up, remove all covering and evenly mix the pile up while watering.

When finished, gather and wedge the pile to make it at 1 m high and cover it by plastic canvas as before.

2nd missing up the pile and make it into smaller piles

Final check

Final check

110 - 120 days after piling up, 70 - 80 days after 2nd check, open it again and check if the materials are rotten and soft then it's ready for use.

***Note**: Regularly check the moisture of the pile, if it's getting dry more water should be applied. Sometimes, the pile surface is wet but it might be very dry inside, therefore it should be watered to help microorganisms work well.*

Volume of produced compost

Given the above amount of materials, about 1.300 - 1.400 kg of compost at 20-25% moisture will be produced from this process.

4. Use of compost

- Mix 100 kg of compost with 1.000 kg or 1 m^3 of top soil to make soil mixture for nursery.
- Use 2.000kg compost as basal application for 1ha of short-rotation crops to improve soil fertility and productivity.

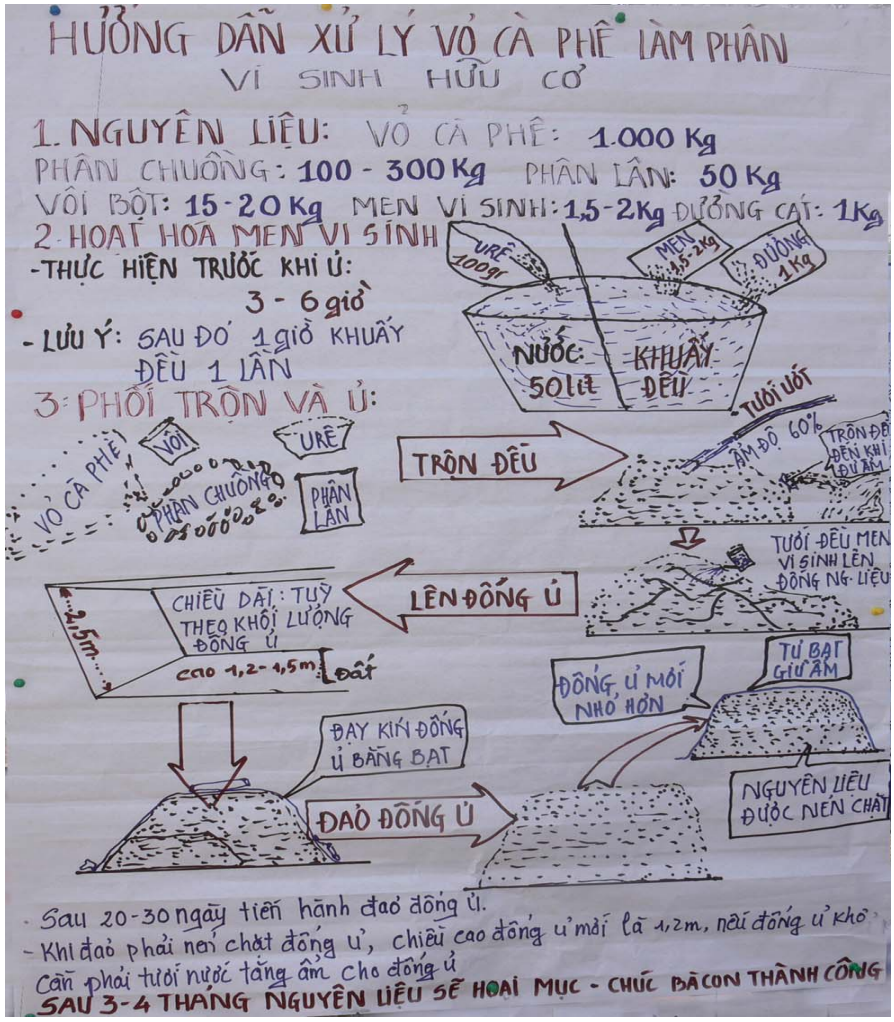
- For wet rice, scatter evenly 2.000 - 3.000 kg compost on the surface of the field, later plough for rice planting.
- Apply 2 - 3 kg compost for each coffee hole before planting
    - How to apply: after making a hole, mix compost with manure and top soil, put them in the hole and cover with a thin soil layer. 20 days later plant coffee seedling in the hole

- Annually, apply 4 – 5 kg compost for each coffee tree to improve soil fertility, coffee productivity.
    - How to apply:
        - Compost is scattered evenly under the canopy
        - Otherwise make ditches at 15cm deep, 25cm wide, with length depends, put compost there and cover with soil

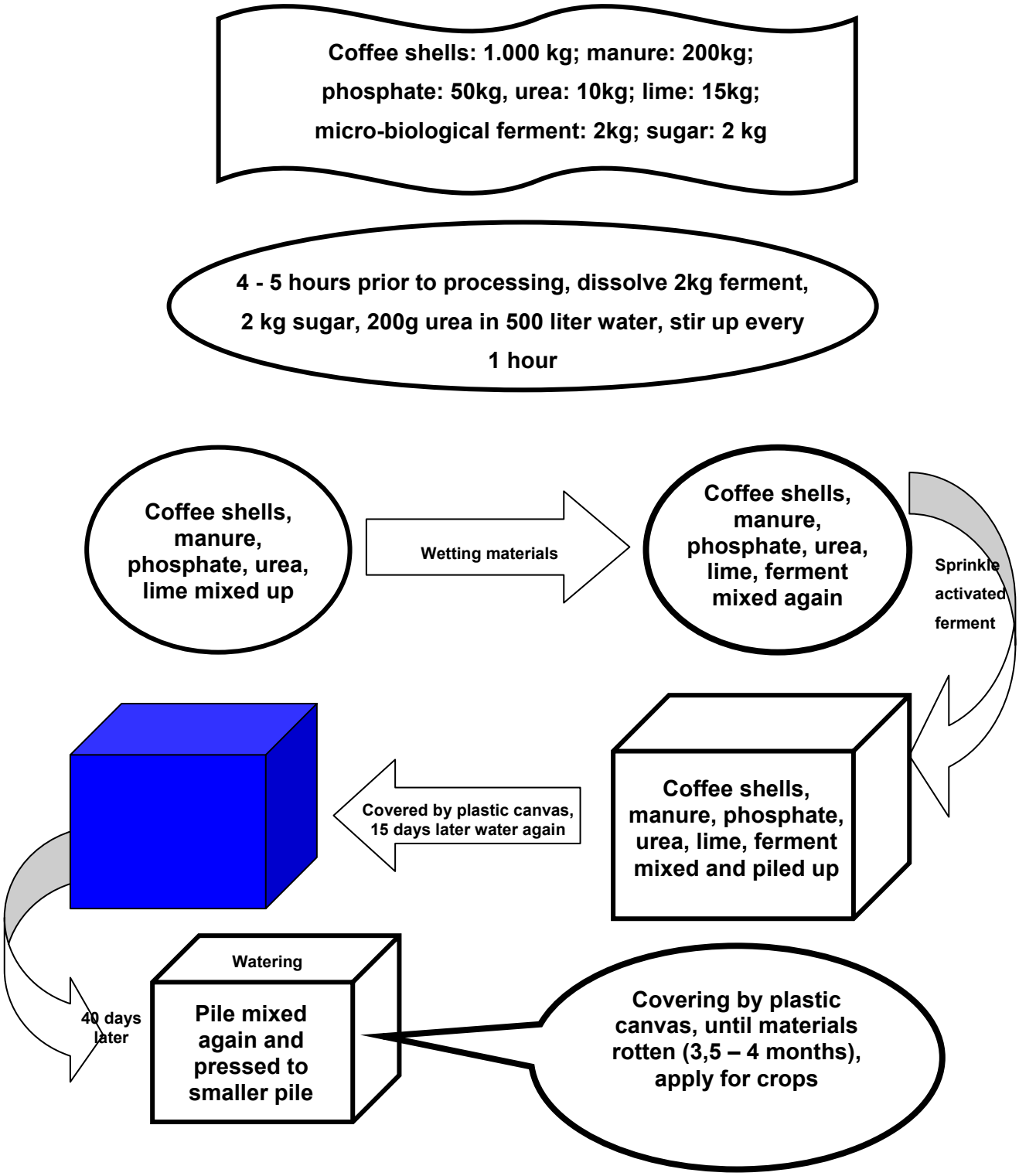
- Apply 4 - 5 kg compost for pepper to reduce disease occurrence, improve productivity.
    - How to apply:

- Evenly scatter compost around pepper pole and slightly turn soil up to cover compost.
- Otherwise, make ditches at 10cm deep, 20cm wide, 100cm long between two pepper poles to apply compost and cover with soil

***Note**: Making ditches with caution, so as to not damage the root system of pepper, which will influence the pepper's growth and yield.*



5. Summarized process of compost production from coffee shells



ANNEX

ASSESSMENT BY EXTENSIONISTS ON COMPOST PRODUCTION TRIALS

Buôn Ma Thuột, 24th May, 2008

1. Basic facts

Number of trials: 40

Piloting duration: 4 years from 2005 to 2008

Place: Lăk and Ea H'leo districts

Consultancy: Lăk and Ea H'leo AES

2. Materials

Materials required for compost production from 1.000kg of coffee shells.

- Coffee shells: 1.000kg.
- Phosphate: 50kg.
- Urea: 5 -10 kg.
- Manure: 200-300kg.
- Lime powder: 15 - 20kg.
- Micro-biological ferment: 2kg.

3. Production process

- Ferment activation.
- Mixing materials.
- Watering materials (moisture 60%).
- Sprinkling activated ferment on material pile.
- Making the pile up.
- Covering the pile.
- Disintegration (about 3-4 months)

4. Trial outcome

Based on the material elements used for compost production and the estimated produced compost volume, the economic benefit of the trial is calculated (as in below table). However, the value of 1.000kg of coffee shells is not included in the production cost of the product.

The result shows that if farmers invest VND 1.208.000 in compost production they will get VND 3.220.000 from the compost product. Therefore, they can save VND 2.012.000 if they have to buy the similar fertilizer in the market. Moreover, this compost can help to improve the soil quality in their coffee farms, and stabilize productivity.

During the course of processing, the high temperature inside the pile eliminated germs in coffee shells, therefore disease dissemination will be avoided when applying compost. Otherwise, application of untreated coffee shells might increase the risk of disease communication and nutrient competition between coffee trees and microorganism, which leads to the sort-term mal-nutrition of coffee trees. Therefore, it is required to apply the rotten compost to facilitate the nutrient absorption of coffee tree.

No.	Material	Unit	Quantity	Amount (VND)
1	Coffee shell	Kg	1.000	-
2	Phosphate	Kg	50	320.000
3	Urea	Kg	10	98.000
4	Manure	Kg	200	300.000
5	Lime powder	Kg	20	40.000
6	Micro-biological ferment	Kg	2	200.000
7	Man-day	day	5	250.000
I	**Total cost TC)**			**1.208.000**
1	Compost product	Kg	1.400	
II	**Total revenue (TR)**			**3.220.000**
III	**Balance = TR - TC**			**2.012.000**

Note: *Prices of materials and labour in 5/2008*

5. Result of compost use

Frequent use of compost for rice, maize, coffee, pepper, etc.:

- Improves growth, development of crops
- Produces good yields over years
- Improve soil texture, softness and fertility
- Microorganisms in compost help to disintegrate, transform other organic matter in soil into nutrients.
- Increases the proportion of mineral fertilizer application for crops

6. Conclusion

- Farmers assess that compost production will increase the value of coffee shells.
- Applicable processing techniques
- Cost-effective approach
- Compost to improve crop growth and soil quality

7. Recommendation

- Dissemination of the model to other areas, especially remote areas with large coffee land
- Introduction of the model to EM farmers
- Elaboration of technical manual on compost production from coffee shells
- Organization of mass trainings for farmers

THIS “TECHNICAL MANUAL ON COMPOST PRODUCTION” IS ELABORATED WITH USE OF MANY PHOTOS AND DOCUMENTS BY OTHER COLLEAGUES