Left: Plastering a biodynamic compost heap with a paste made from a mixture of soil and cow dung. (Samden L Sherpa)
Right: A biodynamic compost heap prepared by alternately layering dry and green biomass. (Samden L Sherpa)

Biodynamic composting

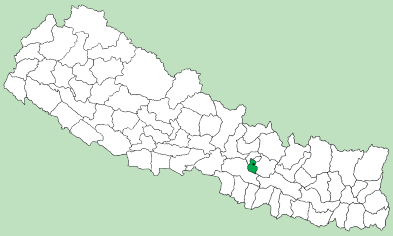
Nepal: जैवीक मल बनाउने तरिका

A faster and more effective way to produce high quality compost in large quantities by surface composting using dry and green farm biomass piled in a heap.

Biodynamic denotes a method of organic farming that emphasizes a holistic understanding of the interrelationships between soil, plants, and animals in a self-sustaining system. It excludes the use of artificial chemicals and stresses the importance of integrating farm animals, the cultivation of crops, and caring for the land. Fermented herbal and mineral preparations are used as compost additives and field sprays.

Biodynamic composting is an inexpensive means of producing a large amount of compost within a relatively short time compared to other methods. It is ideal for farmers who require large amounts of compost, such as for orchards; or when several households get together to produce and share compost. This type of composting also helps to store soil carbon, assists irrigation practices that keep fields alternatively moist and dry, works to decrease the number of soil pests, and reduces methane emission. This practice not only enhances agricultural production as an on-site benefit to the land users but also contributes to the off-site benefits enjoyed by downstream land users, since it helps to reduce sedimentation and increases water availability.

The biodynamic compost is prepared as a surface heap rather than in a traditional pit. The heap is built on a flat, dry site away from shade trees and other elements that would promote water logging. The farmer marks out a rectangular plot of land according to his needs and places a set of logs or PVC pipes lengthwise in the middle of the rectangle to facilitate air circulation and help aerate the pile. Alternating layers of dry and green biomass are added on top. Rock phosphate and crushed slaked lime are added to the middle layers to enhance decomposition and to supplement the mineral content. Once the layering is complete, the pile is sealed using a paste made from soil and cow dung. Over the ensuing two months, the pile is watered weekly (through holes made in the plaster layer which are then resealed) and is monitored; any cracks that appear in the external plaster are sealed. At the end of this time, the compost is tested to check if it is ready by taking samples from a few different locations in the heap. When a crushed sample smells like forest soil, it indicates that the degradation is 80% complete and that the compost is ready to use.



WOCAT database reference: QT NEP 35
Location: ICIMOD Knowledge Park at Godavari, Lalitpur District, Nepal.
Technology area: Demonstration plot
Conservation measure(s): Management
Land use type: Annual cropping
Stage of intervention: Prevention of land degradation
Origin: Experiment/demonstration/research
Climate: Sub-humid/temperate
Related approach: Not described
Other related technology: Improved compost preparation (QT NEP 7), Better quality farmyard manure through improved decomposition(QT NEP 8), Improved farmyard manure through sunlight, rain and runoff protection (QT NEP 9), Black plastic covered farmyard manure (QT NEP 16)
Compiled by: Samden L. Sherpa, ICMOD
Date: May 2011, updated March 2013

The technology was documented using the WOCAT (www.wocat.org) tool.

ICIMOD WOCAT

Classification

Land use problems

Crop productivity is limited by poor soil fertility, intense cropping, and a scarcity of irrigation water. Farmers in the hills notice a marked decrease in the health of their crops and degraded soil conditions when chemical fertilizers are overused. Biodynamic composting is a low input response to this problem.

Land use

Annual crop (rainfed)

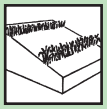
Climate

Sub-humid/ temperate

Degradation

Chemical deterioration: decreased fertility

Conservation measures



Management: Improved compost quality

Stage of intervention

- Prevention
- Mitigation/reduction
- Rehabilitation

Origin

- Land users' initiative:
- Research: demonstration
- Externally introduced:
- Other (specify)

Level of technical knowledge

- Low
- Medium: land users and technicians
- High

Technical function/impact

Main:
- Increases soil fertility and productivity
- Increases the organic matter content of the soil
- Improves the physical condition of the soil

Secondary:
- Improves the physical properties of the soil
- Increases infiltration rate
- Improves water retention capacity of the soil

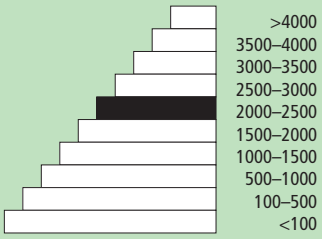
Environment

Natural environment

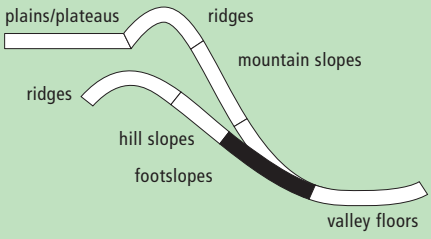
Average annual rainfall (mm)

- >4000
- 3000–4000
- 2000–3000
- 1500–2000
- 1000–1500
- 750–1000
- 500–750
- 250–500
- <250

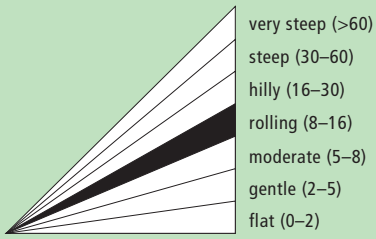
Altitude (masl)



Landform



Slope (%)



Soil depth (cm)

- 0–20
- 20–50
- 50–80
- 80–120
- >20

Growing season(s): not relevant
Soil texture: medium loam
Soil fertility: medium
Topsoil organic matter: high (>3%)
Soil drainage/infiltration: poor
Soil erodibility: medium

Soil water storage capacity: medium
Ground water table: <5 m
Availability of surface water: good
Water quality: good for drinking and agricultural use
Biodiversity: high (695 species of flora and 230 species of fauna have been documented within the Park's 30 ha area)

Human environment

Crop land per household (ha)

- <0.5
- 0.5–1
- 1–2
- 2–5
- 5–15
- 15–50
- 50–100
- 100–500
- 500–1000
- 1000–10000
- >10000

Land user: for demonstration and experiment
Population density: >10 persons per km^2
Land ownership: government
Land/water use rights: community/individual
Relative level of wealth: neighbouring communities are poor
Importance of off-farm income: >50% of all households around the demonstration site have off-farm income
Access to services and infrastructure: labour available; road access used to transport crops

Market orientation: mixed subsistence and commercial in the vicinity of the demonstration site
Mechanization: manual and animal traction
Number of livestock: in the vicinity of the demonstration site poor households may have a few goats whereas wealthier farmers often own several cattle
Purpose of forest/woodland use: fodder, fuelwood
Types of other land: scrubland
Level of technical knowledge required: simple to low

A biodynamic composting heap	Top	
6th layer Green biomass+water+cow dung slurry The heap is sealed with a paste made of cow dung and soil.	Thickness (approx.) 22 cm	**Comment:** Add green biomass then seal the heap by plastering over the top and sides using a paste made from soil and cow dung (3:1 ratio) to make it air tight. The final heap should be approximately 1.2 m high.
5th layer Dry biomass+water+cow dung slurry	15 cm	Add dry biomass, moisten with water and cow dung slurry.
4th layer Green biomass+water+slacked lime	15 cm	Add green biomass; moistened with water and cover with a layer of crushed slaked lime (approx. 30 kg).
3rd layer Dry biomass+water+rock phosphate	15 cm	Add dry biomass, moisten with water and then sprinkle with crushed bone meal or crushed rock phosphate (approx. 30 kg).
2nd layer Green biomass+water+cow dung slurry	15 cm	Add green biomass; moisten with water and cow dung slurry.
1st layer Dry biomass+water+cow dung slurry Logs or PVC pipes for aeration	22 cm	Demarcate a rectangular plot area which measures approx. 5 m X 2 m and place logs or PVC pipes at the middle of the rectangle. Make a first layer of thoroughly drenched dry biomass and apply cow dung slurry in the form thick paste to cover this layer completely.
Bottom – ground level		

Technical drawing
Layering of the different materials in a biodynamic compost heap

Implementation activities, inputs and costs

Establishment activities

The composting takes place above ground and the heap is energized by additives which not only enhance the nutrient content of the compost but also make the decomposition process faster. The additives required include cow dung, crushed lime, rock phosphate (or bone meal), and dry and green farm matter. The compost heap is assembled in less than one day and the compost is ready to use within two months (under weather and temperature conditions similar to those at the ICIMOD Knowledge Park).

Note: If rock phosphate is not available, crushed stone dust can be substituted.

Establishment inputs and costs per unit (average)

Inputs	Cost (USD)	% met by land user
Materials		
- Cow dung (300 kg)	30	
- Lime and rock phosphate (25 kg each)	20	
Labour (Biomass/soil collection, heap preparation)	80	
Equipment		
Shovel, chopping machine, bucket, bamboo, rope	20	
TOTAL	**150**	**0%**

Maintenance/recurrent activities

The compost heap is punctured weekly in order to add water; after watering, the punctures are resealed using cow dung.

Maintenance/recurrent inputs and costs per unit per year

Inputs	Cost (USD)	% met by land user
Labour	25	
Manure	10	
TOTAL	**35**	**0%**

Remarks:

- All costs and amounts are rough estimates by the technicians and authors. Exchange rate USD 1 = NPR 71 in May 2011.
- This was a demonstration project conducted by ICIMOD.

Impacts of the technology

Production and socioeconomic benefits

+ + + Increased crop yields
+ + + Increased farm income
+ + + Reduced expenses for purchasing chemical fertilizers

Production and socioeconomic disadvantages

none

Socio-cultural benefits

+ + + Improved knowledge on biodynamic composting
+ + + Improved knowledge on soil conservation and soil fertility

Socio-cultural disadvantages

none

Ecological benefits

+ + + Increased organic matter and nutrients in the soil; it is used for intercropping
+ + + Better compost encourages farmers to diversify crops to include mixed farming and biodiversity is enhanced
+ + + Decreased use of chemical fertilizers

Ecological disadvantages

none

Off-site benefit

+ + + Environmentally friendly: keeps village cleaner by recycling waste matter and produces large amounts of compost

Off-site disadvantages

none

Comments: Biodynamic composting is an advanced farming system that is gaining popularity because it improves the quality of crops and the health of the soil. The use of biodynamic compost improves soil fertility; increases agricultural production, and contributes to improved livelihoods.

Benefits/costs according to the land user

The land user enjoys both short and long-term benefits; in the short term there is a reduced need for costly chemical/mineral fertilizers and in the long term the health of the soil improves. Locally available dry and green biomass can be used for making biodynamic compost. The only extra costs arise from the need for lime, rock phosphate, and labour.

Benefits compared with costs	short-term	long-term
Establishment	positive	positive
Maintenance/recurrent	positive	positive

Acceptance/adoption:
The biodynamic composting technique found a high rate of acceptance with orchard and vegetable farmers. ICIMOD provided farmers from the Godavari and Bishankhunarayan Village Development Committee areas with training on biodynamic composting. The farmers who need a large amount of compost, such as those who have orchards, have adopted the technique and are now producing the compost themselves.

Drivers for adoption:
- The technology is simple and inexpensive; it can be implemented using local materials.
- The biodynamic method is faster and produces more compost than traditional methods.
- The conditions promote complete decomposition and help to reduce the incidence of soil pests.

Constraints
- There is some initial investment cost in terms of the labour needed to collect biomass/soil and to construct the heap.
- This composting method is limited to farmers who keep livestock because fresh cow dung is needed.

Concluding statements

Strengths and →how to sustain/improve	**Weaknesses** and →how to overcome
The main advantage of this method is that the composting process is completed within 60 days, whereas the traditional method requires more than 120 days. The biodynamic compost itself is very fine and decomposition takes place uniformly from top to bottom in the heap. → Share experiences with a wider audience and provide training to replicate the technology.	Large amounts of biomass are not always available. → Rice and wheat straw can also be used if forest biomass is not easily available.
The quality of biodynamic compost is better than that of traditionally prepared compost. The nutrient content of N, P, K, and organic matter, and the C/N ratio, are higher. → as above	Rock phosphate is not always available → crushed stone dust can be substituted.
This method is suitable for producing large amounts of compost. → as above	
Promotes organic production of desired crops and avoids the need for chemical fertilizers → as above	

Key reference(s): Diver, S (1999) *Biodynamic farming and compost preparation.* Pethuparai, India: BDAI Secretariat, Ichor Estate
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