Left: Farmyard manure covered with a black plastic sheet. The sheet provides a favourable environment for the growth of microbes so that the manure decomposes faster compared to the traditional practice (K.M. Sthapit)
Right: Women carrying farmyard manure to the fields (K.M. Sthapit)

Black plastic covered farmyard manure

Nepal: कालो प्लास्टिकले छोपेको मल

Improving farmyard manure (FYM) by covering it with black plastic sheeting to provide a favourable environment for microbial activities, and to conserve available nutrients and moisture

Applying compost or farmyard manure (FYM) is an excellent way of maintaining and building soil fertility. Considerable nutrient losses often occur through the inappropriate handling or storage of compost and FYM. Drying out causes losses through volatilisation and rainfall whilst runoff causes leaching and the washing out of nutrients. To reduce nutrient losses, farmyard manure needs to be protected from direct sunlight, rainfall, run-on, and runoff.

A number of improved composting methods have been tested and demonstrated with farmers in the Jhikhu Khola watershed. The Sustainable Soil Management Project (SSMP) has recommended black plastic-covered farmyard manure as one of the most promising methods. Farmyard manure is covered with a piece of black plastic to prevent nutrients from leaching out, to decrease evaporation losses, and to provide a more favourable environment for the growth of microbes due to the increased temperature and moisture content. This method is especially suitable for areas with low temperatures.

In this method, raw organic materials that are used for animal bedding – crop residues, leaves, grass, weeds and other organic materials – are piled up or put into a pit in layers together with animal urine and dung. The pile is then completely covered with black plastic sheeting. This method is based on the passive aeration approach, the plastic sheet is removed from the heap each day to add more bedding materials. It is then covered again immediately. Maintenance is easy although care is needed to avoid damaging the sheet. The black plastic should be handled carefully while taking it off and returning it to the pile as the composting material may contain sharp-edged plant stems.

The method was found to be easy to apply and took little time and labour. In the Jhikhu Khola area, women are mainly responsible for preparing manure and carrying it to the fields. This technology reduces their burden as a smaller amount of black plastic FYM is needed to meet soil nutrient requirements compared to traditional FYM, which is normally applied in a poorly decomposed form and in large quantities.

The method was tested in the middle mountains of Nepal in the Jhikhu Khola watershed, located at 800-2200 masl and with 1200-1600 mm annual rainfall, about 70-80% in the monsoon months (June to September). The temperature ranges from 3-40^{0}C in the lower parts of the watershed and about 3^{0}C less at the higher elevations.

WOCAT database reference: QT NEP16
Location: Panchkhal, Patalekhet, Hokse, Baluwa, Sathighar, and Kabhre VDCs and Dhulikhel municipality of the Jhikhu Khola watershed, Kabhrepalanchok district, Nepal
Technology area: ~ 1-10 km^2
SWC measure: Management
Land use: Annual cropping
Climate: Humid subtropical
Related approach: Not described
Compiled by: Madhav Dhakal, ICIMOD
Date: November 2006

The technology was documented using the WOCAT (www.wocat.org) tool.
ICIMOD
Swiss Agency for Development and Cooperation SDC
WOCAT

Classification

Land use problems

Crop production is limited as a result of soil fertility deterioration, high cropping intensity, and a scarcity of irrigation water. Application of increasing amounts of agrochemicals is further deteriorating soil health.

Land use

Annual crops: rainfed and irrigated

Climate

Humid subtropical

Degradation

Chemical deterioration: fertility decline and reduced organic matter content

SWC measures

Management: from traditional to improved

Technical function/impact

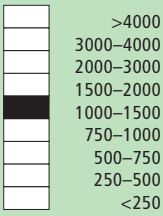
Main: - nutrient conservation
- accelerated decomposition

Secondary: - none

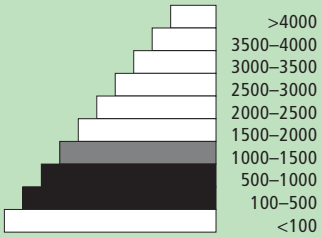
Environment

Natural environment

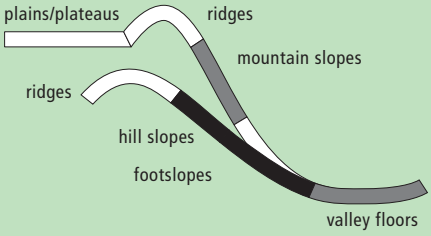
Average annual rainfall (mm)



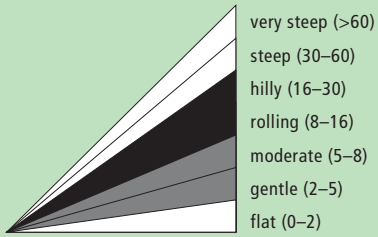
Altitude (masl)



Landform

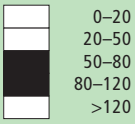


Slope (%)



Applied (large extent) Applied (medium extent)

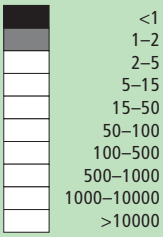
Soil depth (cm)



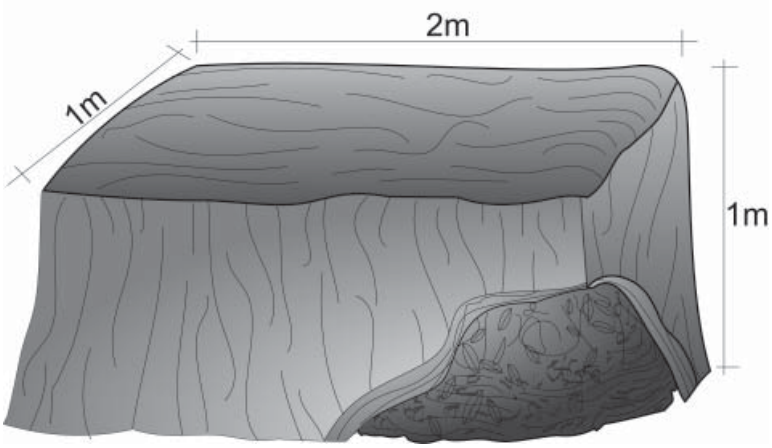
Growing season: 150 days (June to October) and 120 (November to February)
Soil fertility: very low to medium (variable)
Soil texture: fine to medium
Surface stoniness: with or without loose stones
Topsoil organic matter: low to medium
Soil drainage: poor to good
Soil erodibility: medium to high

Human environment

Cropland per household (ha)



Land use rights: individual
Land ownership: individually owned/titled
Market orientation: mostly subsistence (self-supply), some mixed subsistence and commercial (commercial is only growing vegetables)
Level of technical knowledge required: field staff/extension worker: low, land user: low
Number of livestock: 3.9 tropical livestock units (TLU) per household
Importance of off-farm income: in most farm households, off-farm income plays at least a minor and increasingly a major role. Occasional opportunities for off-farm income present themselves in the form of daily labour wages. Some households' members receive regular salaries, whilst an increasing number of Nepalis are working in India, the Middle East, Malaysia, and elsewhere and sending remittance incomes home.



Technical drawing
Black plastic covered farmyard manure

Implementation activities, inputs and costs

Establishment activities

The establishment activities are done using manual labour.

1. Bedding material (e.g. crop residues, leaves, grass, weeds) along with animal urine and dung, are piled near the cattle-shed
2. Each day farmers add bedding material to the piled heap or into the pit and replace the black plastic cover.

Establishment inputs and costs per unit technology (2006)

Inputs	Cost (US$)[1)]	% met by land user
Materials		
- Black plastic sheet (5 kg)	17.6	0%
TOTAL	**17.6**	**0%**

[1)] Exchange rate US$1 = NRs 73 in 2006

Maintenance/recurrent activities

Moisture and temperature is checked regularly

Maintenance/recurrent inputs and costs per ha per season (2006)

Inputs	Cost (US$)[1)]	% met by land user
Labour (4 person days)	8.4	100%
TOTAL	**8.4**	**100%**

Remarks: The only establishment cost is the cost of the sheet. In this case study, a 5 kg black plastic sheet costing about $17.6 was used. This sheet was thick (800 microns thick) and is expected to last for 4-5 years. Less durable and smaller sheets cost less. Each day a farmer needs about 30 minutes to add bedding materials, equivalent to 4 person days per month for 2 months. The labour is mainly done by women and girls.

Assessment

Acceptance/adoption

About 50 households accepted the technology and tested it to make nutrient-rich farmyard manure. Spontaneous adoption of the technology was not seen as the sheeting was not locally available and also due to the lack of dissemination and awareness raising activities.

Drivers for adoption

- The technology is easy to handle and is durable, producing good quality FYM that is fine and well decomposed. This technology reduces women's (and men's) workload in preparing FYM and conserves nutrients.

Constraints for adoption

- Good quality black plastic sheets are not available locally and are relatively costly. This limits adoption, especially by poorer households.

Benefits/costs according to land users

The investment costs are paid back within the first year leading to positive results due to higher production due to more nutrient-rich compost.

Benefits compared with costs	short-term	long-term
establishment	positive	positive
maintenance/recurrent	positive	positive

Impacts of the technology

Production and socioeconomic benefits

+ + Increased crop yields: farmers indicated that after applying the improved FYM (black plastic covered) crop yields increased compared to application of traditionally prepared FYM

+ + Increased farm incomes from higher crop yield

Production and socioeconomic disadvantages

none

Socio-cultural benefits

+ + Improved knowledge on nutrient status of improved and traditional FYM

Socio-cultural disadvantages

none

Ecological benefits

+ + Increased soil fertility compared to traditional FYM; improved FYM is richer in nutrient content (N, P, K, organic matter, C/N ratio)

Ecological disadvantages

none

Off-site benefit

+ + Kept village cleaner

Off-site disadvantages

none

Concluding statements

Strengths and ➔how to sustain/improve	**Weaknesses** and ➔how to overcome
FYM decomposes within 45-50 days compared to about 180 days with the traditional method; the improved FYM is very fine and with equal decomposition from top to bottom of the heap ➔Share experiences with a wider audience and test the technology in different ecological zones	Unavailability of large enough sheets to cover huge heaps ➔ Make two or more smaller heaps; or cover big heaps with two or more sheets
The quality of FYM is better than traditionally made FYM; nutrient content (N, P, K, organic matter, C-N ratio) is higher ➔ As above	Plastic sheet gets damaged if not handled carefully and is easily damaged by rats ➔ Handle sheets carefully and protect from rats using locally available rat repellent plants like *Artemisia indica* (titepati)
This method is very appropriate for high and middle mountain areas; black plastic is easy to handle, light, and durable ➔ As above	Poorer rural people are put off by the cost and unavailability of the sheets; they have to bear the extra cost of bringing sheet from afar ➔ Make the sheets available in the local market and arrange for the cost to be subsidised by agriculture departments and non-government organisations.
More production observed (especially for vegetables) with black plastic FYM compared to traditional FYM ➔ Carry out comparative production studies on more crops	
Less workload for women during FYM preparation and transportation ➔ Promote and implement the technology more	
The technology will promote organic production of desired crops as avoids the need for chemical fertilisers ➔ As above	

Key reference(s): ICIMOD (2007) *Good Practices in Watershed Management, Lessons Learned in the Mid Hills of Nepal.* Kathmandu: ICIMOD

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