Left: Farmyard manure covered by a creeper and tin sheet (left) (Juerg Merz)
Right: Covered farmyard manure in a field (Juerg Merz)

Improved farmyard manure through sunlight, rain and runoff protection

Nepal: घाम, भलपानी र बलेनीबाट बचाई निर्माण गरिएको राम्रो गुणस्तरको गोठेमल

Improving farmyard manure by protecting it from direct sunlight, rainfall, and runoff to reduce volatilisation and leaching

Farmyard manure is the most common form of organic fertiliser applied to crops in the midhills of Nepal. Farmyard manure has a high proportion of organic material which nurtures soil organisms and is essential for maintaining an active soil life. Typically, only about half of the nutrient content of farmyard manure becomes available for crop growth during the first year after it is applied to the soil. The rest of the nutrients are channelled through soil biotic processes and are released in the following years. The high organic matter content and the more active soil life improve or maintain a friable soil structure, increase the cation exchange capacity, the water holding capacity, and the infiltration rate, and reducing the risk of soil pests.

Indigenous methods of preparing and using farmyard manure vary depending on the ecological zone, access to bedding material from crop or forest land and to crop residues and fodder, the availability of labour, and other factors. Traditionally, Nepali farmers take the manure out of their sheds to dry it for 2-3 days and then carry it to the field where it is left in small heaps for a number of days before being spread and incorporated into the soil.

Farmers rate the quality of manure according to which livestock species it comes from. These ratings have been confirmed by nutrient analysis as cattle manure (NPK%: 0.6, 0.13, 0.66) is considered to be better than buffalo manure (0.33, 0.25, 0.10), and horse manure; while pig (0.5, 0.18, 0.42), goat (0.6, 0.13, 0.99), and sheep manure (0.6, 0.13, 0.99) are considered better than cattle manure. Chicken manure (1.46, 0.51, 0.51) is considered the best of all.

It has however been shown that considerable nutrient losses occur if the manure is inappropriately handled or stored. Drying of the manure leads to loss of nutrients through volatilisation, and rainfall and runoff leads to leaching or washing out of nutrients. In addition, the common disposal of urine – the part of the excreta with the highest nutrient concentration – further reduces the level of nutrients in manure.

To reduce nutrient losses farmyard manure needs to be protected from direct sunlight; protected from rainfall or run-on; and protected from runoff. This can be achieved in a variety of ways using a variety of inputs. It is most important to protect the manure during storage and just before it is applied in the field to make the best use of this valuable local resource.

The Sustainable Soil Management Programme (SSMP) implements its projects in several midhills districts of Nepal
(dark green: previous working districts; light green: districts in 2007)

WOCAT database reference: QT NEP9
Location: Nepal midhills
SWC measure: Management
Land use: Annual cropping on rainfed agricultural land
Climate: Humid subtropical
Related approach: Farmer-to-farmer diffusion (QA NEP1); Farmer-led experimentation (QA NEP3); Farmer field school on integrated plant nutrient systems (QA NEP4)
Compiled by: SSMP
Date: January 2007

The Sustainable Soil Management Programme is implemented by Helvetas Nepal and Intercooperation in collaboration with the Government of Nepal and civil society actors. It is financed by the Swiss Agency for Development and Cooperation. The technology was documented using the WOCAT (www.wocat.org) tool.

Classification

Land use problems

Intensifying cultivation practices with either 1) inadequate application of fertilisers leading to a decline in soil fertility and the mining of soil nutrients or 2) application of too much fertiliser causing environmental problems through excessive leaching, and losses of fertiliser in surface runoff and consequent eutrophication or nitrification of streams, ponds or groundwater

Land use

Annual crops: maize-wheat, potato, mustard, different types of vegetables

Climate

Humid subtropical

Degradation

Chemical degradation: soil fertility decline, soil nutrient mining

SWC measures

Management: protect farmyard manure; change application

Technical function/impact

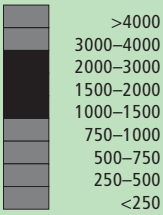
Main:
- increase in soil fertility
- increase in soil productivity
- increase in organic matter

Secondary:
- increased infiltration rate and water holding capacity
- improved soil physical properties (friability, easier soil preparation)

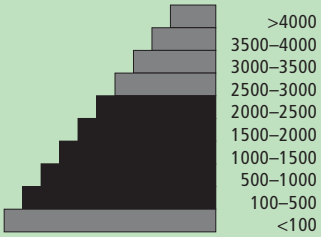
Environment

Natural environment

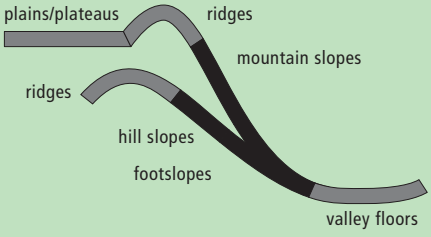
Average annual rainfall (mm)



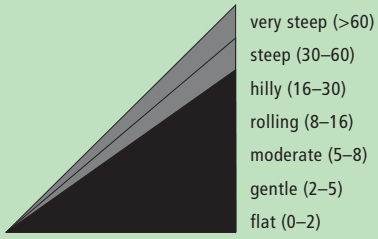
Altitude (masl)



Landform



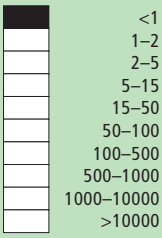
Slope (%)



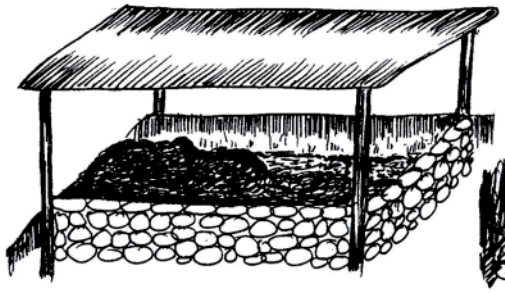
Applied Potential

Human environment

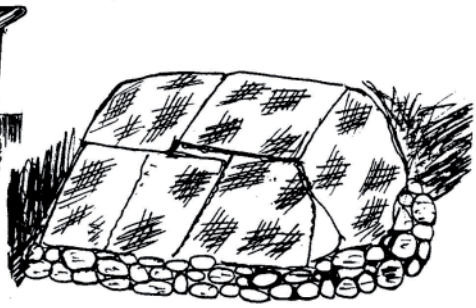
Cultivated land per household (ha)



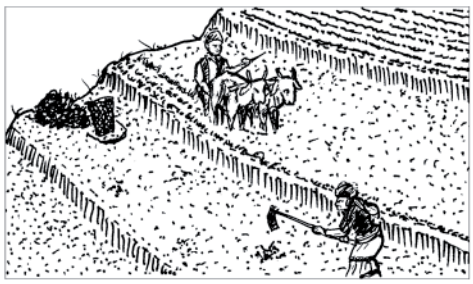
Land use rights: individual, leased (sharecropping between owner and tenant)
Land ownership: individually owned, titled and not titled
Market orientation: subsistence, commercial, and mixed (subsistence/commercial)
Level of technical knowledge required: low
Number of livestock: poor households usually have some goats and one cow or a buffalo, wealthier households often own several cattle, buffaloes and a pair of oxen for ploughing.
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.



Cover made of tin sheet



Cover made of plastic sheets or gunny bags (jute sacks)



Technical drawing

a) Covering the farmyard manure with a roof made of tin sheet or plastic sheets. Cheaper alternatives are:
   - a thatched roof
   - shading with creepers like cucurbits
   - planting broadleaf mustard on the heap
   - applying a covering of crop residues or forest material

b) Farmyard manure is traditionally carried to the fields in doko baskets and left there in unprotected heaps to be incorporated often weeks and sometimes several months later (top and bottom left). It is much better to incorporate it on the day of transport as the longer it is left out on the fields in heaps the greater are the nutrient losses from the heaps (bottom right). Alternatively it can be stored in a corner of the field covered with plastic sheets, crop residues, or in some other way (top right).

Implementation activities, inputs and costs

Establishment activities

1. Cover the farmyard manure heap or pit with any available material (crop residues, forest material, plastic sheet, thatched roof, zinc sheet, etc.)

Duration of establishment: < 1 day

Establishment inputs and costs

Inputs	Cost (US$)[1)]	% met by land user
Depending on materials	0-25	100%
Labour	2	100%
TOTAL	**0-27**	**100%**

[1)] Exchange rate as of January 2007, US$1 = NRs 67

Maintenance/recurrent activities

1. Pour household wastewater onto the heap or pit to keep the farmyard manure moist (but not saturated). This enhances decomposition.

Maintenance/recurrent inputs and costs per ha per year

Inputs	Cost (US$)	% met by land user
Labour	negligible	100%
TOTAL	**negligible**	**100%**

Assessment

Acceptance/adoption

This technology found a very high rate of acceptance despite the extra labour involved. An independent assessment found that 95% of the farmers participating in SSMP's farmyard improvement activities were found to be protecting their farmyard manure from direct sunlight, rainfall and runoff and had changed their way of applying the manure to the field by straight-away incorporating it into the soil. About 70% of non-participant farmers who had come into contact with the technologies had also adopted them. These results are supported in the annual reports from SSMP's collaborating institutions.

Drivers for adoption

- A simple technology allied to and derived from traditional practices
- Compatible with traditional practices
- Moderately fast impact visibility (mainly through better physical conditions of the soil)
- Inexpensive

Constraints to adoption

- Labour requirement is shifting in time, (i.e. more work is needed during the ploughing than during the everyday transport of manure)
- Livestock is required to produce the manure

Benefits/costs according to land users

Large short- and long-term benefits due to need to use less of the costly mineral fertilisers. The only extra 'cost' is the extra labour needed.

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

Impacts of the technology*

Production and socioeconomic benefits	Production and socioeconomic disadvantages
+ + + Reduced expenditure on mineral fertilisers	none
+ + Increased yield	
Socio-cultural benefits	**Socio-cultural disadvantages**
none	none
Ecological benefits	**Ecological disadvantages**
+ + + Improved physical soil characteristics	none
Off-site benefit	**Off-site disadvantages**
+ + Reduction of outside dependence	none
+ + Reduction of nutrient influx into water bodies	

* All changes in technology may have gender and equity implications and potentially affect the members of disadvantaged groups differently. This has not been assessed here but should be considered when recommending technology use.

Concluding statements

Strengths and →how to sustain/improve	**Weaknesses** and →how to overcome
The use of improved farmyard manure reduced the need for mineral fertiliser thereby reducing production costs and outside dependency → Further promotion of the technology will increase this impact	Cost of a permanent roof for the manure heap may hinder adoption of the technology →Promote simple alternatives to high cost roofs such as straw cover, cover with broad leaf mustard, thatch, and waste plastic
A simple technology affordable by poor farmers in remote areas far from a roadhead	
The increased use of organic fertiliser improves the physical characteristics of soil making ploughing easier and increasing water holding capacity of the soil	

Key reference(s): STSS; SSMP (2001) *Farmyard Manure and Compost Management* (in Nepali) Kathmandu: Soil Testing Services Section, Department of Agriculture and Sustainable Soil Management Programme

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