Technology Fact Sheet for Adaptation

V. Sloping Agricultural Land Technology [i]

Introduction

The Sloping Agricultural Land Technology (SALT) is agro-forestry model farming system, first initiated by the Mindanao Baptist Rural Life Centre in the southern Philippines to help control soil erosion and increase crop yields.

Technology characteristics

SALT is a system in which dense hedgerows of fast growing perennial nitrogen-fixing tree or shrub species are planted along contour lines thus creating a living barrier that traps sediments and gradually transforms the sloping land to terraced land. The hedgerows markedly reduce soil erosion and contribute to improving and/or maintaining soil fertility by acting as a source of organic matter. SALT has emerged as one of the main approaches used to control soil erosion in mountainous region.

Besides the general SALT design, described as SALT 1, SALT 2 is classified (*Small Agro-Livestock Land Technology*) as a goat-based agroforestry with a land use of 40% for agriculture 20% for forestry and 40% for livestock. As in a conventional SALT project, hedgerows of different nitrogen-fixing trees and shrubs are established on the contour lines. The manure from the animals is utilized as fertilizer both for agricultural crops and the forage crops.

SALT 3 (*Sustainable Agroforest Land Technology*) is a cropping system in which a farmer can incorporate food production, fruit production, and forest trees that can be marketed. The farmer first develops conventional SALT project to produce food for his family and possibly food for livestock. The plants in the hedgerows will be cut and piled around the fruit trees for fertilizer and soil conservation purposes. A small forest of about one hectare will be developed in which trees of different species may be grown for firewood and charcoal for short-range production. Other species that will produce wood and building materials maybe grown for medium and long-range production[1].

Country specific applicability and potential

The challenge for promoting low-cost SLM technology for steep slope agriculture in Bhutan is to adapt it to the prevailing extreme climatic variability, cultural and technology practices. Such technology must be backed up by development of farmer-friendly training and extension materials followed by training of farmers in a phased manner[2].

Extensification as well as intensification of agriculture, to enhance food production, face serious constraints in Bhutan because expansion of arable land is restricted and the nature of the terrain makes enhancing the productivity of cultivated land difficult.
Shifting cultivation is an age-old practice common to several parts of the country. With increases in population, more and more areas are being tapped for this practice. With the narrowing down of the fallow cycle due to paucity of arable lands, such practices do not allow a sufficient period for the natural processes of recuperation to repair the disturbed ecosystem resulting in erosion and fertility decline. LUSS, Ministry of Agriculture, estimated an area of more than 1000 km^2 under shifting cultivation in Bhutan.

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[1] Sommer Haven Ranch International, 1996, Sloping Agricultural Land Technology (SALT – 1) Sustainable Agriculture, Training Pac, available at http://www.sommerhaven.org/prac_app/sus_ag/t_pac_salt1.pdf , accessed on 4 May 2012.
[2] National Action Programme to Combat Land Degradation, 2009, United Nations Development Programme and Global Environment Facility, available at http://www.undp.org.bt/assets/files/publication/NAP_Draft_Full&Final_Oct09.pdf, accessed on 4 May 2012.

SALT holds the potential to increase the productivity and varieties of crops that may be cultivated and replace the traditional farming practices that have become unsustainable due to the increasing population pressure. The SALT is the key to address the problem of land erosion and degradation in the extremely vulnerable regions of the country subjected to over exploitation of resources due to increasing population pressure, unplanned development works and unscientific and unsustainable agricultural practices like shifting cultivation. SALT is meant to address the increasing problem of loss of valuable and scarce arable land in the mountainous country due to shifting cultivation, encroachment into forest, extension of cultivation onto lands of low potential or high natural hazards and non-adoption of adequate soil conservation measures and improper crop rotation. With about 13% of the area of Bhutan categorized as sloping land of slope between 8-30%, SALT is an important tool to exploit the land sustainably and productively.

Status of technology in country

Project for Rainwater harvesting and Sustainable Land Management (SLM) are being implemented in Bhutan for the last decade[3]. The National Action Programme to Combat Land Degradation (2009) also institutionalizes the requirement for undertaking SALT activities. But as the action plan has envisioned, proper capacity building activities and awareness drives must be organized to help in diffusing of the technology to the grassroots.

Benefits to economic / social and environmental development

The SALT technology in a generic manner has the following aspects that may prove economically beneficial to the targeted communities

i) Contour farming: Farming along contours will help check soil erosion and enable moisture retention, thereby enhancing soil productivity

ii) Planting of nitrogen-fixing varieties: As part of the generic design of SALT, nitrogen fixing crops as part of the crop rotation, suitable for prevailing agro-climatic conditions as well as trees are planted. This results in enhanced soil fertility and recovery of depleted soil nutrients in areas subjected to intensive cultivation. In the long run, this helps in enhanced productivity as well as reduction in chemical fertilizer use in the long-run

iii) Planting of crops having different maturity periods: Plantation of seasonal crops, permanent crops like horticulture varieties as well as tree plantations help in diversity of income sources for famers as well as create a cushion against the threats of seasonal natural vagaries that may affect income from one of the sources.

iv) Labour-intensive activities: The activities related to SALT like contour trenching, plantation and tending operations etc. are very labour intensive as well as requiring some specialized expertise. Thus with proper government support, SALT activities can be able to generate significant local employment and stymie seasonal migration.

v) Improved agricultural techniques that incorporate soil amelioration and productivity enhancing measures and at the same time respect the traditional practices of the local populace are the key for ensuring food security and counter the vagaries associated with an increasingly unpredictable climate variability associated with global climate change phenomenon. Proper planning and execution of SALT can thus result in agricultural productivity increasing manifold vis-à-vis the investment required for implementation of such practices[4].

The SALT has been design as such to promote soil and moisture conservation measures, nutrient enhancement in depleted areas and enhance crop productivity, which are expected to have a positive impact on the environment.

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[3] National Soil Services Center, Ministry of Agriculture, 2008, Review of Mainstreaming of Sustainable Land Management in Government Policies and Plans in Bhutan, available at http://www.bt.undp.org/assets/files/publication/Final%20Report%20on%20SLM%20Mainstreaming%20Review.pdf , accessed on 4 May 2012.

[4] Laquihon W.A. and Pagbilao M.V., Sloping Agricultural Land Technology (SALT) in the Philippines, available at http://www.fao.org/ag/AGP/AGPC/doc/Publicat/Gutt-shel/x5556e0y.htm, accessed on 4 May 2012.

Climate change adaptation benefits

The traditional upland subsistence cultivation practices are seen as especially vulnerable to the following adverse impacts of climate change:

- Increasingly extreme variations in climate and weather patterns leading to drought and flash floods
- Incessant rains leading to large scale soil erosion, landslides and washing away of top soil
- Rising incidence of pests and diseases due to unseasonal rains and dry spells

A report of National Environmental Commission in partnership with UNEP (2009) lists the following vulnerabilities faced by agriculture sector, viz:

- Crop yield instability/loss of production and quality
- Increased risk of extinction of already threatened crop species (traditional crop varieties)
- Loss of soil fertility due to top soil erosion and runoff
- Crop yield loss due to unseasonal rains
- Delayed sowing due to shift in season cycle
- Spreading of pests into new areas affecting larger number of more vulnerable crops
- Deterioration of infrastructure of supply of food grains to markets

Thus the major perceived threats from increasing climate variability to ecologically fragile mountainous regions are loss of crop production, affecting the primary means of livelihood of the country, increased loss of soil fertility and increased erosion which is expected to reduce the already restricted availability of arable land, the increasing incompatibility of traditional cropping cycle with shift in the onset of seasons and the spread of pests to hitherto non-affected regions.

SALT, as a technology option is expected to address the issues related to soil and water conservation, enhanced soil fertility and consequent crop productivity and crop diversification. With increasingly erratic rainfall patterns threatening to exacerbate the rate of soil erosion in areas subjected to intensive cultivation, improper contouring and loss of vegetation cover, SALT is a relevant technological tool that can be adapted to the conditions prevailing in Bhutan in multiple dimensions as discussed above.

Financial Requirements and Costs

The cost of implementing SALT will depend on the type of land, especially the slope of land and form of SALT being implemented. The cost will vary from USD 100 to USD 200[5] per hectare. Besides, implementation, appropriate funds are required for the purpose of capacity development and technology diffusion. As part of NAPA (2009), a budget of USD 9,00,000 has been envisaged for rainwater harvesting projects in Bhutan.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment and Technology Action Plans for Climate Change Adaptation – Bhutan. You can access the complete report from the TNA project website http://tech-action.org/**

[5] Assuming USD 1 = INR 50.