Technical Note on Local Adaptations to Soil Erosion and Low Soil Moisture in the Semiarid Tharaka District, Kenya

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Abstract

This study explored the local adaptations to soil erosion and low soil water status in the semi arid Tharaka area in Kenya. Personal interviews and non-participant observations were used to solicit information from 137 small-scale farmers. A workshop was held in each of the three village clusters at the beginning and at the end of each rainy (crop) season involving the researchers, farmers, local opinion leaders and agricultural extension agents. The study found out that farmers had developed ingenious indigenous soil and water conservation practices in response to soil erosion and low soil moisture. The main indigenous methods used were intercropping, trash lines, stone bunds, minimum tillage, grass strips, ''fanya juu'' terraces and their combinations. The farmers' decision to adapt a particular technique was influenced by the technique's ability to control runoff, associated crop yield increment, farming system, availability of the raw material, and the labour requirement.

Key words: Soil erosion, soil moisture, soil and water conservation, indigenous knowledge, Tharaka

Introduction

Indigenous soil and water conservation (ISWC) is based upon local knowledge (Critchley *et al.*, 1994). The latter involves a fundamental understanding of the process of ecological change, slope dynamics and biological regeneration (Zurick, 1990). The contribution of indigenous knowledge is rarely acknowledged by the advocates of conventional modern methods of soil and water conservation (SWC) (Wamalwa, 1991). Colonial agricultural officers perceived African farmers' interaction with land as being predatory through thoughtless mismanagement. The farmers' activities were therefore seen as the cause of soil erosion in arid and semi-arid areas (Mutiso, 1991; Gachimbi, 1996). At independence, Kenya embraced modern (foreign) technology almost uncritically. Colossal sums of donor money was set aside for SWC programmes that involved sophisticated engineering designs, equipment and machinery (Thomas, 1997). Despite the imposition of such grand programmes, soil erosion continues to ravage many parts of Kenya e.g. Marakwet district (Adams *et al.*, 1996). Recent works by Tiffen *et al.* (1994), Okoba *et al.* (1998) and Wakindiki *et al.* (1998) have gathered evidence in the semi arid parts of Kenya that there is great potential in ISWC.

Such traditional soil management techniques are highly diverse and dynamic (Edwards, 1993) e.g. pit cultivation in Matengo highlands in Tanzania (Temu and Bisanda, 1996), water harvesting in the Red Sea hills of Northern Sudan (El-Sammani and Dabloub, 1996) and hedges and ridges in west Cameroon (Tchawa, 1996). In Kwa-Zulu -Natal, South Africa the rural dwellers have valuable indigenous knowledge concerning SWC (Pile, 1996). Nevertheless, conservation authorities neglect this

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knowledge and therefore soils are severely eroded in this region. Such indigenous knowledge is deemed less technical, not scientifically testable and is therefore undocumented (Wickramasinghe, 1997).

Marginalisation of minority groups in SWC programmes contribute to the continuing land degradation problems (Chambers, 1983; Shiva, 1990 and Moser, 1993). Wickramasinghe (1997) observed that the minority groups especially women are not consulted in either planning, executing programmes or offering solutions although SWC is part of their day to day activities. The role of the actual land users is increasingly being recognised world-over (IFAD, 1992 and Quiroz, 1996). Many SWC experts now concede that it is highly cost effective to learn from farmers since such knowledge is not readily available with scientists (Edwards, 1993; Farrington and Martin, 1998). The objective of this study was to explore the local adaptations to soil erosion and low soil water status in the semi arid Tharaka district of Kenya.

Methodology

The study was conducted among farming households located in Tharaka district. The district is in eastern province of Kenya and lies to the south east of Mt. Kenya. The entire district lies within a typical semi-arid environment. The mean annual rainfall is about 926 mm and the mean annual potential evapotranspiration is 1280 mm. It is a moderate to low settlement area. Human population in the region is increasing and soil productivity is fast declining due to soil erosion. Soils in Tharaka are used for production of crops such as maize, millet, green-grams, cowpeas, pigeon peas, and cotton. Rainfall has a bi-modal pattern. The long rains fall between March and May while the short rains occur between October and December. The long dry season (June – September) is very dry with less than 25 mm of rainfall per month (Republic of Kenya, 1977).

Selection of respondents

From a list of 48 villages that the local District agricultural office provided, 23 villages were randomly selected. Names of households in the selected villages were then obtained and used to construct sampling frames for each of the villages. In each village there were at least 35 households. Six households were randomly selected from each village (one of the villages provided 5 households). Each of the 137 selected households provided one respondent (male or female practising farmer) who was interviewed. Three of the selected households in each village provided female respondents while the rest provided males. In total, 69 male and 68 female small-scale farmers were selected.

Data collection and analysis

Face to face interviews were conducted with the selected farmers. Information was solicited through the use of structured interview schedules. Each schedule contained open-ended questions about ISWC. Farmers were interviewed either in their farms or homes. Direct observations were made concerning ISWC practices in the farms cultivated by the respondents. In cases where interviews were conducted at home, the researcher requested to be taken to the farm(s) where observations on ISWC practices were made. Observations were also made and recorded from other farms that the researcher came across. Workshop discussions between the researchers, farmers, local opinion leaders and the agricultural extension agents helped to determine the farmers' criteria in adapting a particular method of SWC. Descriptive statistics and contingency tables (Steel and Torrie, 1981) were used to analyse the data.

Results and Discussion

Local adaptations to soil erosion

All the interviewed farmers were aware of rill erosion or its severe form of gully erosion but oblivious of interrill erosion. Therefore, the ISWC techniques were aimed at controlling or retarding overland flow. It was observed that farmers were mostly using more than one technique in a single plot. This strategy was meant to spread the risks of crop failure and maximise the utilisation of labour. Figure 1 and Table 1 show the ISWC techniques that the

***This technique was applied in farms with surface stones**

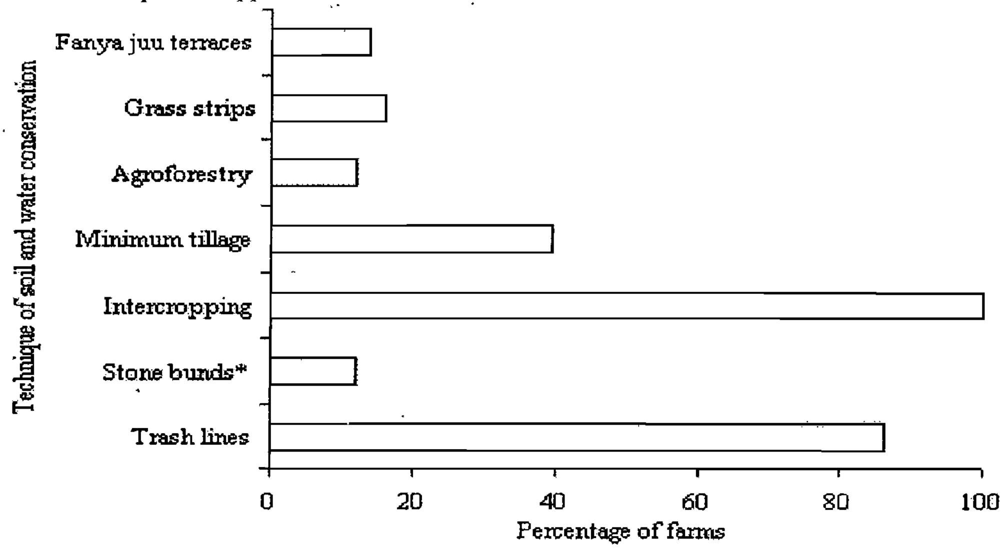

Figure 1: Percentage of total farms applying a given ISWC technique

Table 1: Indigenous soil and water conservation techniques used in Tharaka District and their farmer perceived advantages and disadvantages

Technique	Description	Advantages/Benefits	Disadvantages
Trash lines	Cereal and/ or legume stover placed in strips across the slope. Measures about 30 cm to 50 cm wide and 35 cm to 70 cm high. May be modified to incorporate logs from felled trees.	Traps sediment in runoff. Reduces the velocity of overland flow. Guides in labour allocation during farm operations e.g Planting and weeding Increases soil fertility upon decomposition. Has low labour and cost requirement.	Provide habitat for rodents, snakes, grubs and other pests. Does not form a permanent barrier to runoff Prone to damage by termites and livestock
Stone bunds	Barriers of stone laid across the slope Dimensions vary considerably. May eventually develop into bench terraces over time.	Traps sediment in runoff. Reduces the velocity of overland flow Guides in labour allocation during planting, weeding etc Makes more land available for growing crops. Minimise obstruction during weeding and tillage operations	Provide habitat for rodents, snakes, gubs and other pests. Has high initial labour demand.
Intercropping	Several crops are grown in one plot at the same time Usually cereals and legumes are intercropped	A crop diversification strategy against low moisture Soil fertility is maintained for a longer time Provide raw material for trash lines No extra labour	Make operations such as cultivation, and harvesting difficult
Minimum tillage	No tillage is done prior to planting Previous seasons crop is left standing or sometimes cleared by hand.	Saves on labour Soil loss is greatly reduced	Provide habitat for rodents, snakes, grubs and other pests Runoff increases with time especially if crop cover is poor
Agroforestry[1]	Beneficial trees are grown together with annual crops. Fruit trees are mostly grown.	Provide shade, fruits and micro environment for some crops e.g. Yams.	Too much shade lead to poor crop stand below the tree. The Trees also provide hiding places for pests such as weaverbird
Grass strips[2*]	Vegetative barrier to runoff. May lead to terrace Development over time	Traps sediment in runoff. Guides in weeding and labour allocation	May seperd as weed
Fanya juu teracces[3*]	Back-slope bench teraace made by digging and throwing the soil up-slope	Reduces the slope and velocity of overland flow. Grass, if used to stabilise the banks, provide feed for livestock	Requires skill, it is costly in construction and maintenance. The grass attract livestock to the cropped area.

[1]This technique has greatly been modified by the modern practice of agroforestry. Its purpose has been expanded to include trees for fodder and soil fertility improvement. The traditional tree species have been replaced with the quick maturing trees such as *Leucaena leucocephala*. [2]Traditionally, vegetative strips arose from the seeds of cereal/legume within the trash lines No direct seeding of grasses was done. Today, this technique has been modified into direct seeding of perennial grasses and the purpose expanded to include provision of fodder. The need to stabilise embankments in the *Fanya juu* systems and the need for fodder in zero grazing was seen to be closely associated with this technique [3]This technique has been the standard for soil and water conservation in steep land since the colonial era. It was initially meant for high potential areas but has been extended to arid and semi arid areas often without any modification. *These two techniques have often been promoted together by the agricultural extension agents and some non-governmental organisations operating in Tharaka area

farmers use in Tharaka district. Intercropping was applied in all the farms while 86% of them applied trash lines. Stone lines were applied in all the farms where surface stones occurred. The farmers' evaluation criteria of the ISWC techniques are shown in table 2. Trash lines was the most favoured technique.

This reason explained why farmers were not carrying out any SWC in the relatively flat areas where the risk of water erosion was low. Moreover, no attempt was made to conserve the residual soil moisture during fallow in the dry months. Table 2 shows the perceived benefits and ranking of the ISWC techniques. The

Table 2: Farmers evaluation and ranking of the ISWC techniques

Technique	Benefit	Ranking
Trash lines	Traps sediment in runoff	1
	Crops planted adjacent to trash lines yield better	2
	Keeps the soil moist long after the rains	3
	Guides in labour allocation during farm operations	4
	Increases soil fertility upon decomposition	5
	Requires little labour and are simple to make	6
Stone bunds	Traps sediment in runoff	1
	Makes more land available for growing crops	2
	Forms a flat bench terrace with time	3
	Guides in labour allocation during farm operations	4
	Less obstruction during weeding and tillage operations	5
	It is not attacked by any pests/makes a permanent barrier	6
Intercropping	Ensures that there is no total crop failure in case of low rainfall	1
	Maximum utilization of land	2
	Soil fertility is maintained for a longer time than in monocsrop	3
	Some pests attack the crops when planted in a pure stand	4
	Provide raw materials for trash lines	5
	No extra labour is required	6
Agroforestry	Provide fruits	1
	Provide firewood	2
	Provide shade	3
	Provide microenvironment for some crops e.g. yams	4
	Provide building poles	5
	Give fodder during dry spells	6
Grass strips	Traps sediment in runoff	1
	Guides in labour allocations e.g. Weeding and harvesting	2
	Volunteer seedlings provide some crop during drought	3
Minimum Tillage	Saves on labour	1
	Reduce soil loss	2

Local adaptations to low soil moisture

Soil water was conserved as a by-product of the farmers' effort to prevent soil loss by water.

farmers associated trash lines and stone bunds with soil water conservation. The importance of ISWC techniques depends on their ability to reduce runoff. All farmers agreed that inter-cropping and minimum tillage are traditional farming practices, but they were not aware that these methods actually conserved soil water. Other criteria that the farmers use to evaluate ISWC include diversification against low rainfall, optimization of land utilisation and labour.

Conclusions

This study revealed that farmers in Tharaka are aware of soil erosion and its consequence as demonstrated by the practice of ISWC. Farmers perceive soil erosion to be a bigger threat to crop yields than soil moisture. It is recommended that sustainable SWC programmes should incorporate ISWC.

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