SEMI-ARID FOOD GRAIN RESEARCH AND DEVELOPMENT
RECHERCHE ET DEVELOPPEMENT DES CULTURES VIVRIERES DANS LES ZONES SEMI-ARIDES

Linkages of Agroforestry Practices to Enhance the Development of Sustainable Agriculture

A summary of OAU/STRC-SAFGRAD activities in Agroforestry and soil conservation

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Introduction

Within the Convention to Combat desertification which was adopted in June 1994, and its operationalization in December 1996, African countries agreed on the control of desertification and/or alleviation of the effect of drought as a mean to combat poverty. In this respect, it was proposed the creations of seven networks, among which the network on agroforestry and soil conservation.

Today, because of high population growth in Africa, many economists predicted that SSA will not be able to feed its population unless agricultural growth has tripled. By large, in many african communities, farming systems include the presence of cereal, leguminous crops, medicinal and fruit and other economic trees (which are deliberately protected in fields), and livestock. The importance of wood in the system cannot be overstated as more than 90% of the families uses the wood for cooking and building, leading to deforestation and the destruction of the environment. Today, more than ever, there is need for the integration of Agroforestry systems into this traditional farming enterprises inorder to meet the high demand for food and the protection of the environment.

This paper summarizes SAFGRAD activities in the field of agroforestry and soil conservation and discusses the possible linkage between those activities and the agroforestry and soil conservation within the Convention to combat desertification. No attempt was made to provide a thorough literature review on the discussed subject matter.

1 Technology generation

Past activities of FSR research under SAFGRAD has focused on the generation of various integrated farming systems suitable to different agroecological zones in West and Central Africa. These productions systems included livestock, cereal, legumes and and beneficial crop trees. As a results, several set of technologies in the area of

agroforestry and soil and water conservation were developed or tested in collaboration with National Systems of Ghana, Benin, Cameroon, and Burkina Faso.

1.1 The Alley cropping: Case in Ghana

Under a high rainfall area in south eastern sector of Northern Ghana (Bimlilla District), rapid population increase and a subsistence agriculture of consisting of intercropping maize, sorghum and groundnut; and planting cassava and pigeon pea in the periphery of the farms have significantly contributed to reducing soil fertility. The need to explore improved farming practices were evident for sustainability. Alley cropping consist of the cultivation of fast growing leguminous trees in row 4-5 m apart and food crops are cultivated within. Alley cropping provided many well documented economic and environmental benefits to agriculture producers.

In Ghana particularly, it was shown that the average yields achieved under alley cropping with pigeon pea for maize (2341 kg/ha) and for groundnut (816 kg/ha) were 188 % and 54 % higher than those obtained under farmer practices (Table 1). The leguminous trees are periodically pruned, thus providing mulch and green manure as well as fodder. The increase in soil organic matter may be the basis for the improved physical characteristics, and therefore, reducing the need for the long fallow periods. However, one of the constraints to alley cropping is the lack of incentives in terms of land ownership to manage soil resources more intensively. A clear and conducive land tenure policy to make long term investment in soil management attractive is needed.

SAFGRAD contribution to alley cropping activities also took place, Benin and recently in Cape Verde where there is an increase yield of cereal grown within Leucaena and cajanus cajan were intercropped with maize (OAU/STRC-SAFGRAD reports 1988, 2001).

Table 1. The effect of Alley-cropping with pigeonpea on the grain yields (kg/ha) of maize, sorghum and groundnut in Northern Ghana.

	Farmer practice			Alley cropping			CV %		LSD .05	
Crops	1990	1991	Mean	1990	1991	Mean	1991	1991	1990	1991
Maize	608	1019	814	812	870	2341	23	25	880	989
Sorghum	503	752	628	258	971	615	21	22	267	NS
Groundnut	461	600	531	422	1210	816	26	29	341	588

Source: SAFGRAD technical report 19990/92

1.2 Feed garden

Small ruminant production is an activity highly practiced in Southern Ghana because sheep and goats serve as a source of protein in the diet of most Ghanaians, and also serve as a ready source of income to the farm family. They are owned mainly by subsistent households and generally managed by women and children. The major constraints faced by these women in the animal fattening activities is the low productivity due to high mortality, poor management and inadequate nutrition Coupled with a complete lack of high quality feed locally grown. As a result, farmers rely on byproducts of cassava (peels and leaves) for feeding the animal. SAFGRAD in collaboration with Animal Research Institute (ARI) has been transferring this practices of feed garden to farmers in southern Ghana in order improve the nutritional status of village sheep and goats during the dry season through utilization of fodder trees and shrubs produced in the feed garden to supplement crop residues and agro-industrial by-products. Feed garden are concentrated units of leguminous (herbaceous and shrubs) species primarily managed and reserved for dry season feed supplementation of livestock. This practices developed by ILRI showed significant livestock gain in supplemented animal on stylo fodder banks.

Community feed gardens, about 0.4 ha each have been established at Minya and Sota. At the Minya feed garden, *Gliricidia sepium* and *Leucaena leucocephala* have been planted while the one at Sota has been planted with *Gliricidia sepium*. At Baabi, backyard feed gardens have been established with *Gliricidia sepium*.

Initial results suggest that: i) the integration of agriculture and livestock is not limited only to the production of cash leguminous crop such as cowpea and groundnut; ii) as proposed, the practices has good potential for adoption in the region.

1.3 Mixed cropping

It involves the planting of trees planted at regular or irregular patterns for the value of their fruit, soil conservation strategies fodder, fuel wood and cash. The good example is the association of Acacia albida/cereal system in Northern Cameroon. The traditional acacia albida system in the sudano-Sahelians zones provide fodder for animals during the dry season and animals urines and manure fertilizes the soil (Fig. 1).

1.4. Soil and water conservation

Activities and soil and water conservation are interrelated, making it difficult to separate the two.

Tied ridging:

Research activities in tied ridging were undertaken especially in Burkina Faso, at Kamsi, Kamsaoghin, and Yalka (Taye et. al 1997), in Cameroon and Ghana. The work was undertaken in order to mitigate the effects of low and irregular rainfall particularly during the growth and reproductive phases when soil moisture beside soil fertility is critical to crop yield. Tied ridging is a labour intensive activity, but is effective in improved water use and preventing soil erosion. Based on studies conducted in Burkina Faso in the sudanian zone, tied ridging combined with 5t/ha of mulch improves grain and stover yield of maize and sorghum. Compared to traditional farming yield increase of sorghum and maize varied from 100 to 250 %. In the sudano-sahelian zone, the use of tied ridging plus 100 kg NPK and 50kg urea per ha increased sorghum and millet yield by 50 to 200%. It was however concluded that several factors affect the performance of tied ridges such as: nature of the soil, position on the toposequence, date of ridging after planting and distances between ridges.

Most recently, in Burkina Faso, (SAFGRAD report 2001), activities on soil water retention technologies were tested in Tiano, Thiougou and at Pobe in collaboration with INERA. The objective was to verify on farmer fields, technology packages for cereal/legume production system including the use of tied ridging practice as well as documenting the socio-economic factors to its adoption by farmers.

Improved fallows

Use of fallow improves soil fertility in a very poor environment such as SSA where farmers lacks the mean to purchase fertilizers. While, traditionally farmers practice fallowing or abandon their fields because of striga infestation pursuing to low soil fertility, there is seldom the use of agroforestry trees such as Sesbania sesban, Acacia angustissima for the fallow although these species have shown promise for the generation of fuel wood production and the increase in the yield of subsequent cereals (ICRAF 1997). Such promising technologies should be disseminated.

2. Technology transfer

SAFGRAD has recently refocused its strategy and defined its niches of intervention among which technology transfer and commercialization plays a key role.

SAFGRAD activities in technology transfer in general and specifically in sustainable agricultural development concentrates its efforts on technologies on the shelf ready or in need for a fine tuning to adapt to the particular needs of the end users before dissemination. Several technologies on soil fertility management, soil water conservation and agroforestry practices are being tested in more than 10 participating countries in West and Central Africa. Such activities have a high potential of positively impacting the livelihood of millions of small scale farmers. Activities will also focus on the socio-economic aspects, the cost of the proposed technologies in real situation (on-farm), the ability of the technology package to address the issue raised by the farmers in order to improve the chances of the technologies being adopted.

3. Networking and capacity building

SAFGRAD gained substantial amount of experience in networking ranging from commodity networks (maize, sorghum, millet, and cowpea) and farming systems. These networks gathered more than 500 researchers working on diverses aspects of crop improvement of crop production and productivity. SAFGRAD contributed to the development of NARS capacity through infrastructure and capacity building, program development and implementation as well as resource mobilization. Also, this included the facilitation of the exchange of scientific information through workshop and publication of books. Today, SAFGRAD on-going new program activities address some of these issues. Those activities are cross cutting and provide services to scientists involved in various thematic research including agroforestry.

4. Linking agroforestry and soil conservation to sustainable Agricultural farming systems

Several technologies options exist in the area of agroforestry and soil conservation. They are not limited to the activities already undertaken by SAFGRAD in some of our new programs. SAFGRAD would like to embark in a development of a database on semi-arid agriculture. Such database can be a very useful source of proven technologies for all partners involved on technology development, transfer and commercialization, including sustainable agricultural and agroforestry.

SAFGRAD capacity to work with NARS can be used as a catalyst for the set up of pilot activities in the verification and transfer of agroforestry technologies. In this framework, agroforestry technologies can be packaged in a sustainable manner to address the overall issues of responding to food security problem in West and Central Africa. In this new set up, SAFGRAD is a key partner in the widely transfer of research results to the end users. Our experience is that agroforestry technology can bring significantly benefits to farmers.

Fig 1. Monitoring *Acacia albida* growth in a farming system research plots in Cameroon.

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