SUSTAINABLE AGRICULTURAL LANDUSE AS A MODERN, EVOLVING TECHNOLOGY

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ABSTRACT

Modern science is revolutionizing the concept of soul resources, creating a much richer vision of soil as a living, dynamic system that drives crop production and mediates the effect of farming on the environment. Sustainable agriculture is a management goal that relies on a modern, evolving, and highly adaptable management technology. It has real and measurable environmental benefits and will become more popular as environmental constraints grow.

A study carried out in Ogun State among some farmers show that about 85% of the farmers reported either moderate or severe land degradation on their farms. Agricultural science therefore will have to adapt itself to long-term, whole-farm methods of analysis to support the development and adoption of sustainable agriculture.

INTRODUCTION

Agricultural land, including its water resources, is an essential input to farming. This is especially true in the poorest countries, where agricultural production is crucial to development, the livelihoods of the majority depend on it. And yet agricultural landuse in these countries often results in degradation of natural fertility and reduced productivity.

FAO (1983) estimated that 0.3 to 0.5% (4 to 7 million ha) of the world's crop land is being taken out of production each year and that the rate of degradation is accelerating. It further stated that if these projections are near target, the amount of land lost of crop production may approach the amount of new lands that can be brought into production.

Small farmers living in the tropics comprise a large sector of the world population. They operate in relatively stable subsistence agricultural systems using traditional technologies designed to achieve sustained crop production at very low yields and with minimum land degradation. However, there is a growing awareness that sustainability of subsistence agriculture is steadily deteriorating as a result of rapid growing population and over exploitation of the land. Given the various limitations affecting tropical agriculture, few soil management and conservation options remain.

Otzen (1993) note[illegible]t as long as agricultural resources are availab[illegible] abundance as a gift of nature and as virtually free goods, their utility value will continue to be undervalued both as an intrinsic and as an economic quantity. There is then a danger that their complex productive force will be exploited in a variety of ways. This undervaluation changes only when the users of agricultural resources become more acutely aware than formerly of their scarcity, fragility and degradability.

While scarcity influences the economic value-component as an expression of the steadily declining land-man ratio, fragility and degradability make for growing awareness of the intrinsic value-component as resource use increases. These two value-components should therefore no longer be considered in isolation. If attention is now focused on the biological regenerability of agricultural resources as well as their purely economic productivity, resource use as a whole must come to be valued more highly (Otzen. 1993). If land is to be valued more highly, however, it must be used more economically and more carefully than at present.

In order to maintain sustainability, however, significant improvements to crop production must come from improved soil management practices focusing on soil and water conservation, improved crop management, and the use of farm machinery and equipment designed to reduce soil erosion and maintain soil productivity.

Sustainability is intimately connected with the issue of justice, rights, and obligation. Moral and ethical constraints to a policy prescription must always be recognized and acknowledged. Intergenerational equity considerations are more easily met for individuals and communities who have believe that, while they have a right to consume existing resources, they also have an obligation to act as stewards for future generations.

Soil tillage is perhaps as old as settled agriculture, yet its impact on soil degradation, soil resilence, ecological stability, environmental quality, and agricultural sustainability are more important than ever before (Lal, 1993). The importance of soil tillage is likely to increase with increasing demographic pressure, global shortage of prime agricultural land, and need to produce basic human necessities from progressively declining per capita land availablility.

Soil erosion occurs alm all over Nigeria. As a matter of fact, it is one of the n st striking features on the land surface. This paper i intended to look into some crucial challenges that face the engineers, agriculturist and policy makers particularly as it affect achieving sustainable use c soil resources.

METHODOLOGY

Data for this study were collected overn seven a month period (October 1994 to May 1995) from six local governments in Ogun State, south-western Nigeria. The area comprises Abeokuta, Ijebu-Ode, Ijebu-North, Ijebu-East, Obafemi-Owode and Odeda local governments. Generally the climatic conditions of this area falls under hot and dry harmattan season (November to March) and the warm and wet rainy season (April to October). The rainy season is longer and bimodal in nature, with an early rains around late February/early March which normally spread to the month of October with a little dry speel in August.

The impacts of some agricultural settlements of the Agricultural Development Programme (ADP) and Ogun Oshun River Basin Development Authority have greatly enhanced agricultural production in the area. The soil group is generally deep with distinct profiles, higher natural fertility and high water retention capacity during the dry season. The soil and climatic conditions combine to produce an ever-green tropical forests that dominate the study area.

The primary data were obtained from the responses of farmers to the questionnaire. Such data include responses of the farmers to equipment used during farming operations, farm practices adopted, topography and physical properties of the soil in the area under study. The population for this study are the peasant farmers residing in these local governments and some farms from Ogun Oshun River Basin Development Authority.

The sampling procedures used were a combination of purposive and systematic sampling. the first sampling comprising 10 farmers participating in the Adaptive Research Programme from Ogun Oshun River Basin Development Authority. 25 non-participating farmers from each local government, that is, 10 from each local government headquarters and 15 from the villages around.

The administration of the questionnaire involved reading and explaining the questions fully to each of the farmers sampled. The reason for this is the ilitracy of majority of the farmers. Only information that was fully completed in the questionnaire were analyzed. A total of 200 questionnaires were sent out and 177 were returned from which 155 were returned with complete information.

RESULTS AND DISCUSSION

Table 1 shows the distribution of various equipment used during farming operations. It is observed that cutlasses and hoes still remain the major tools used by the farmers representing about 76% of the total respondents. This might have been the reason for low productivity of the farmers since they still use antiquated tools compared to the introduction of improved technology used in advanced countries. The table also shows that a sizeable number of farmers (21%) have access to the use of tractors for farm preparation. The majority of these farmers however are either state government farmers who are closed to the tractor hiring stations.

As in many small scale tropical farming areas. the hoe is used for tillage. harvesting or with the axe for bush clearing and matchetes are used for weeding. The most that can be prepared by hand per adult in any given season is about 0.5ha.

Table 2 shows the distribution of erosion occurences in the different local government areas. Most farmers (about 85%) indicated that there are erosion problems on their farms in all the different local governments. However, farmers in Abeokuta, Ijebu-North and Ijebu-East local governments particularly reported occurences of severe erosion. This erosion problems may be as a result of the impermeable substratum near the soil surface in some of these areas which leads to poor drainage of the soil.

Land degradation and the depletion of soil resources have important economic implications for low income countries. Environmental damage results in loss of current income and increased risk, and particularly affects the poor. Degradation of land resources also threatens prospects for economic growth and future human welfare.

The distribution of respondents farmland according to their existing cropping pattern with respect to erosion extent is shown in Figure 1. The figure shows that most farmers in Ogun State adopt intensive cultivation/arable land or fragmentation resulting from the land tenure system. this practice accounted for about 37% of the farmers.

Combinations of various farm practices represent the cropping pattern of about 29% of Ogun State farmers. However shifting cultivation, crop rotation and bush burning are being practiced by 22%, 11% and 1.3% respectively by the farmers of the state.

Generally, the erosion extent is common in all the different practices. In crop rotation, shifting cultivation and bush burning. the erosion extent represent about 10%, 18% and 1.3% respectively. But intensive cultivation/multiple farming and combination of different practices, account up to about 30% and 26% out of 36% and 29% respectively of the farmers undertaking these practices reported of soil degradation due to erosion.

Whole most mulching techniques in humid tropics are transferable to small farmers using hand tools, there are constraints in transferring other techniques of mechanized farming. There is an urgent need for research to develop no-tillage equipment to meet the needs of tropical agriculture which is predominantly of concern to the small farmers.

The need for technology study and transfer

The results indicated above show that sustained productivity in agriculture, especially in the tropics can be achieved only if the present generation, as it were signs a generation contract under which it agrees to refrain from totally exhausting non-renewable reserves and to design equipment that can stabilize the regenerability of the renewable resources - soil fertility, water balance and genetic potential.

Benites and Ofori (1993) noted that extension services need to pay more attention to those tillage practices developed by the farmers themselves which have been proved effective in soil and water conservation. However, with the increasing average age of farmers as a result of the outflow of youth to the urban areas, tillage practices as well as tillage equipment will need to be adjusted to these labour constraints, although this can only be achieved within the financial resources of the farmer. Furthermore, it has been found that some of the improved implements introduced to farmers for effective tillage have not been widely adopted, and it is necessary to ascertain the reason for this.

Recently, Chambers et al (1989) observed that development experts have gained an appreciation for indigenous farmer's knowledge and local innovations, and a new generation of projects in seeking to develop and promote techniques that combine the knowledge of farmers and scientists. These indigenous techniques are either not practiced widely enough to significantly impact land degradation, or they are in adequate, from technical or economic perspective to significantly slow degradation. It is clear that both, organizational and technological innovations have been insufficient in the face of population growth particularly in Nigeria and in many other developing nations.

The challenge before the engineers and development planners is to find out why indigenous techniques are not practiced more extensively, and then look into what should be done to expand their adoption. Peasant group dynamics facilitate the innovation adoption, and diffusion of techniques. Many of the most innovative and successful soil conservation in Nigeria have either develop techniques with small peasant groups or promoted through them. The findings observed in

this study suggest that goovernment and external aid encouragement of peasant groups would have an indirect and positive impact on the environment.

CONCLUSIONS

The demand for land and energy to produce food and agricultural raw materials is on the increase throughout the world, particularly in Nigeria as in many other developing nations. Thus, fervent attention must be given to preservation of natural resources of water, soil and vegetation cover, with a view to arrest desertification, deforestation, Salinization, soil degradation and soil erosion. The study carried out among the farmers in Ogun State shows that most farmers (up to 85%) are affected by soil degradation which coupled with inadequate farm equipment available to them have resulted in low agricultural production.

Small farm developmer needs to receive special attention if agricultural proc on technological packages, especially tillage syster , are to be effectively adopted. Any system introduce d must fit into the small farmer's production pattern an d cropping system and show clear benefits expecte' by farmer at acceptable cost.

There is a need to encourage aggressive research into tillage system which will include detailed study of soils, climatic factors, especially rainfall characteristics, management of crop residues and equipment development, specifically for small farmers. The parallel development of appropriate agricultural machinery and equipment would enable farmers to effectively apply recommended technological package suitable to the particular soils, crop to be cultivated and socio-economic conditions.

There are needs for government and foreign assistance on provision of adequate funds for the following:

1. Development of the existing agricultural research centres (including establishment of more sub-centres) to intensify efforts on improvement of tillage system which involves detailed studies of soils, climatic factors rainfall characteristics, selective use of suitably modified machines and implements to increase effective and efficient food production at affordable costs.

2. Periodical maintenance, repairs and fabrication of different types of machines, implements, and tools for various categories of farmers (peasant/small, medium and large scale) for reliable vast expansion of food production and to reduce the drudgery involved in manual agricultural works.

3. Intensification of extension services through the Ministry of Agriculture, Parastatals (such as Agricultural Development Authority, etc) on educating the farmers on the advantages involved in using suitable machines. implements and tools for minimising costs and increasing area of food production.

Table 1: Equipment used in farming operations.

Types of equipment	Absolute frequency	Relative frequency
i. Cutlasses and hoes	117	75.48
ii. Shovels and spades	0	0.00
iii. Land leveller	0	0.00
iv. Scrappers	0	0.00
v. Terracers	0	0.00
vi. Graders	0	0.00
vii. Ploughs and tractors	0	0.00
viii. Combination of (i) and (ii)	2	1.29
ix. Combination of (i, ii and iii)	1	0.65
x. Combination of (i) and (vii)	33	21.28
xi. Combination of (ii) and (vii)	1	0.65
xii. Combination of (i, iii and vii)	1	0.65
Total	155	100.00

Table 2 : Extent of Erosion on Farmlands

	Absolute frequency						Total	Relative frequency						Total
Land size Affected	AB LG	I.N LG	I.E LG	O.D LG	O.O LG	I.O LG		A.B LG	I.N LG	I.E LG	O.D LG	O.O LG	I.O LG	
All the farmland	2	2	1	0	0	0	5	1.29	1.29	0.65	0.00	0.00	0.00	3.23
Some of the farmland	23	21	22	19	20	22	127	14.84	13.55	14.19	12.25	12.90	14.19	81.92
None of the farmland	0	2	2	11	5	3	23	0.00	1.29	1.29	7.10	3.23	1.94	14.85
Total	25	25	25	30	25	25	155	16.13	16.13	16.13	19.35	16.13	16.13	100.00

A.B LG = Abeokuta Local Government

I.N LG = Ijebu North Local Government

I.E LG = Ijebu East Local Government

O.D LG = Odeda Local Government

O.O LG = Obafemi Owode Local Government

I.O LG = Ijebu-Ode Local Government

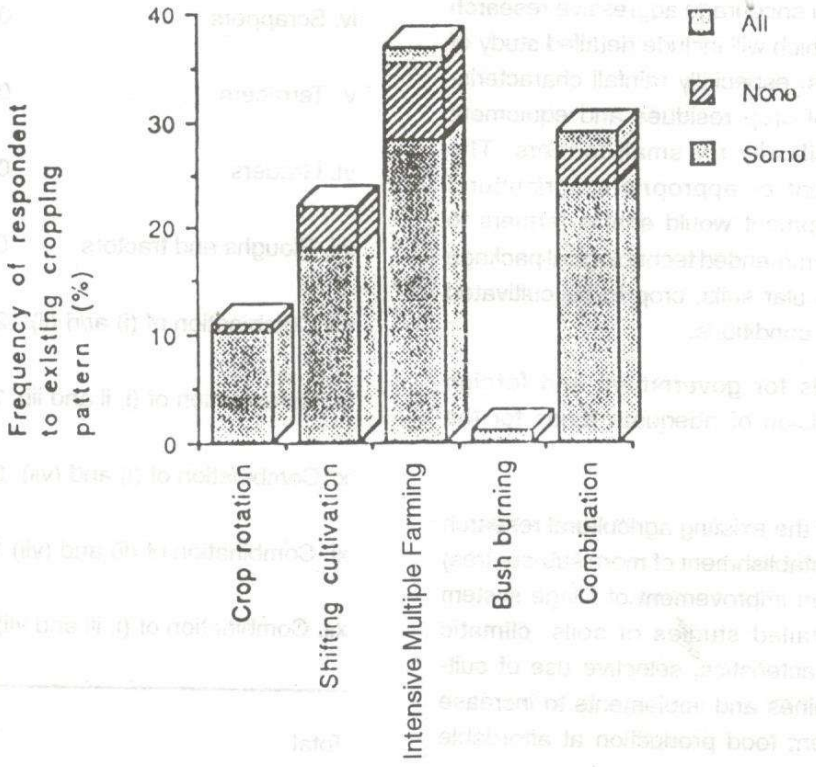


Figure 1: Distribution of respondent existing cropping pattern/extent of erosion

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