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INTEGRATED AGRICULTURAL RESEARCH

PROCEEDINGS OF THE SACCAR/WINROCK
WORKSHOP, HELD IN LILONGWE, MALAWI,
26 NOVEMBER – 1 DECEMBER 1989

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Integrated agricultural research



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**Proceedings of the SACCAR/WINROCK Workshop
held in Lilongwe, Malawi,
26 November - 1 December 1989**

Editors

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INTEGRATED AGRICULTURAL RESEARCH AND DEVELOPMENT IN SADCC MEMBER STATES

L.P. Singogo and J.A. Kategile

Introduction

Concern has been raised on land degradation in sub-Saharan Africa which is indicated by declining soil fertility and texture and changes in soil acidity. Soil erosion on account of water and wind erosion is prevalent in this region and monocropping, deforestation, overstocking, and lack of soil and water conservation measures have been identified as the causative factors. The problem is urgent but complex as there are no simple solutions to it. A solution would call for multi-disciplinary research and development approach but this cannot be organized easily by the existing institutional structures as they are compartmentalized to provide solutions to individual commodities. Realizing this a study was undertaken in Southern African Development Coordination Conference (SADCC) member states to discuss the concept of integrated approach and seek the views of leaders and scientists in this region. This was done in preparation for a workshop on the topic where specific objectives were to:-

- discuss the merits of the workshop;
- seek the views of the leaders and scientists on integrated approach;
- discuss and agree on the participation in the workshop; and
- make an inventory of ongoing research and development on related fields of integrated approach and sustainability.

Methodology

This study sought information and views of leaders and scientists in crop, livestock, and forestry research in SADCC countries. Seven countries out of nine were visited and are included in the report. Information from the leaders of research and individual scientists was sought through interviews. To guide the interviews a set of questions formed a general guideline but there was no formal questionnaire. Discussions were held with individuals and groups and notes were taken during the discussions. This paper condenses and analyses Singogo's report.

Human population

The increase in human population in the SADCC countries ranges from 2.1 to 3.4% per annum and this raises the demand for food and other amenities (housing, clothing, fuel/wood, and health etc.). Population movement due to urbanization and civil commotion cannot be ignored in this region. The human population movements create localized demand situations and availability of labour. In all SADCC member states urbanization is on the increase at 6 to 8% annually, being highest in Botswana.

According to the information obtained during the interviews, the rural areas are facing the problem of labour shortages due to looking after cattle in the cattle posts. The situation has forced a number of cattle owners to move their livestock into villages resulting in overstocking and overgrazing in these villages. Urbanization has also increased the demand for firewood resulting in wide scale deforestation in the areas surrounding the urban centres. The availability of transport for ferrying firewood and charcoal has further accelerated the rate and extent of forest depletion. The impact of urban centres on deforestation is recognised as a factor in the region.

Zambia is the most urbanized country in sub-Saharan Africa and this high concentration of people in urban centres has implications on the demand for fuelwood and therefore deforestation. In Mozambique, the civil disturbances have forced wide scale movements of the human population into safe areas near the cities and towns, placing a heavy demand on available resources.

Further, the movement of people in Mozambique has been accompanied by their livestock into the Southern part of the country resulting in overstocking and overgrazing. Unfortunately, this part of the country has marginal climatic conditions with an annual rainfall of about 400 mm and therefore it is ecologically fragile area.

Changing but collapsing agricultural systems and concerns

Agricultural production systems in Africa have been changing with time. During the period of colonization shifting agricultural systems had been developed to sustainable levels. In the systems, portions of land were allowed to rest for a number of years in order to build up soil organic matter and nutrients. The introduction of large scale farming reduced the land available for the traditional systems of production.

The increase in human population densities also reduced the land available for shifting cultivation for household needs, putting a constraint on the system. Moreover, the colonial governments policies were clearly against shifting cultivation. These factors contributed to the collapse of shifting cultivation. Parallel to this were the introduction of cash crops into the traditional systems e.g., cotton, tobacco, and coffee and the encouragement of food crop production technologies, especially for cereal crops of maize and sorghums. These technologies were introduced as monocrops virtually on a continuous basis.

The negative effects of monocropping on soil condition and fertility are well known. Declines in maize yields with time were reported in Zambia and Tanzania. In Zambia concern was raised on commercial farmers who have failed to maintain soil fertility of the cultivated land. The introduction of the flue cured tobacco in Tanzania did not take into consideration the impact of the crop on deforestation. It is estimated that the curing of tobacco from one acre of tobacco requires the extraction of wood from six acres of woodland. There is, therefore a lot of concern on deforestation caused by tobacco production.

The single technological packages for crop production are monolithic without any considerations on long term soil and water management and possibilities of integrating the crop with livestock and trees. Due to these weaknesses, soils which are continuously monocropped have nutrient imbalances, are of poor soil structure, and have increasing acidity. Further, soil erosion is common in cultivated areas. The declines in yield of cereals inspite of the application of inorganic fertilizers at the recommended rates is a symptom of land degradation.

As human population densities increase more land is cleared for arable cropping. The expansion encroaches on forested areas, grazing land, and marginal fragile areas. In Zimbabwe, the majority of the communal areas are in ecozones IV and V which are fragile and easily degradable, but the population pressure forces farmers to open up more land. This trend can also be seen in other SADCC countries. Livestock numbers in the region are increasing at about 1 to 2% per annum but this is significant as grazing areas are being encroached by arable farming and the carrying capacity is in general declining when stocking rates are increasing.

Capital livestock numbers tend to be high in the marginal semi-arid areas which are fragile. This is mainly due to tsetse infestation in the forest areas and also due to allocating good arable land to crop production. Lesotho is a good example which has set aside the foothills and mountain zones for grazing. These areas are prone to soil erosion.

Overgrazing, deforestation, and lack of soil conservation practices have resulted in severe soil erosion and degradation. A similar situation exists in the highveld of Swaziland. Botswana is in the semi-arid to arid ecozone and livestock is the most important subsector of the agricultural industry. Although intermittent droughts kill scores of head of cattle, the long term trend of livestock numbers is on the increase. This is of concern to policy makers as high numbers are associated with overstocking and overgrazing.

The problem of overstocking is also facing other SADCC member states. Conventional range management technologies have not fitted in the small scale and communal areas due to land tenure problems and socioeconomic factors. For example, fencing of some of the Swazi Nation Land (SNL) by farmers has not improved the fenced rangeland but have instead deteriorated the land even further. It is suggested that overstocking has been the cause of the failures. In Lesotho, scientists and officials who were interviewed expressed the need to involve communities in issues of utilization of communal resources such as rangelands and forestry products. It is apparent that technical solutions have to fit into existing socioeconomic environments.

Table 1, shows a summary of the concerns which were raised by the respondents to the discussions. Across the countries there was a general agreement on the following areas:-

- fuel and wood are in short supply;
- arable cropping is encroaching forested areas;
- rangelands are overstocked;
- serious shortages of feed in dry season; and
- soil erosion is a serious problem.

The shortages of poles for building was common but not universally indicated and availability of other materials such as bricks reduced the demand for poles. The majority of those interviewed did not respond to the issue of watershed. It is felt that this was a reflection of the internal weakness of the unstructured interviews.

Table 1: Identified concerns on sustainable Agriculture in some SADC member states and priorities for integrated research

Concerns priorities	Botswana	Lesotho	Swaziland	Mozambique	Tanzania	Zimbabwe	Zambia
Fuelwood	Urban	Rural and Urban	Rural and Urban	Urban	Rural and Urban	Rural	Rural and Urban
Building materials	Settlements	-	Rural	-	-	Rural	Rural
Arable cropping encroaching forests	-	-	Expanding	Expanding	Expanding	Expanding	Expanding
Stocking rates	Overstocked	Overstocked	Overstocked	Localized overstocked	Overstocked	Overstocked	Localized
Dry season feed	Very scarce	Very scarce	Very scarce	Scarce	Very scarce	Very scarce	Scarce
Soil erosion	Very serious	Very serious	Very serious	Serious	Very serious	Very serious	Serious
Water harvesting	Needed	Watershed	-	-	-	-	-
Integrated approach priorities	Soil conservation and dry season feed	Integrated community approach	Integrated institutional approach	Training in integrated research	Integrated research approach	Integrated institutional linkages	Soil improvement
Agroforestry technology	For feed and conservation	For fuelwood, conservation and feed	Department of research program	Fuelwood and poles	Fuelwood and feed	Incorporation of MPTs in crop/livestock systems	Soil improvement

Ongoing National Agricultural Research System (NARS) research activities in alleviating concerns on sustainable agriculture

Institutional

The research and training institutions in the SADCC countries are based on compartments of disciplines. The ongoing research programs are developed along institutional structures. However, these institutions are generally capable of responding to policy demands for solutions to single commodities. Research programs on sorghum is a typical example of policy led research activities. Food shortages in the semi-arid areas led the governments to emphasize the growing of drought tolerant sorghums in the semi-arid areas and researchers were asked to develop appropriate technologies.

The same institutions (research and training) have been less successful in organizing sustainable multidisciplinary farming systems research teams. The institutions are vertically integrated on the basis of disciplines and institutions. Although at great odds some of the African governments have attempted to institutionalize multidisciplinary approach.

In Zimbabwe, a subcommittee on Agroforestry comprises of Department of Research and Specialist Services (DRSS), Department of Agriculture and Technical Services (AGRITEX), Natural Resources, Water Resources Management, University of Zimbabwe, and Forestry Commission. The subcommittee on Agroforestry also includes soil and water conservation and is under the Research Council. The committee forms the basic frame work from which most of the activities on integrated research are coordinated.

In 1983, the government of Tanzania in collaboration with Rodell Institute, initiated a national research program on resource efficiency farming systems at Mlingano in Tanga. The program is concerned with integrated research in crops, trees, and livestock. Alley cropping, intercropping trees with food crops, mulching, composting, and fodder production are among the activities undertaken at the research station.

ICRAF has a regional collaborative research program linking Malawi, Tanzania, Zimbabwe, and Zambia. The in-country program and activities are based in NARS' research stations. It is, however, still an open question as to whether the programs have been internalized or otherwise and their continuation after ICRAF's involvement.

Research activities

The nonexistence of mandated institutions to carry out multidisciplinary research on sustainable integrated agriculture has not killed initiatives by individual scientists and institutions on carrying out research in the related fields. The authors view the following aspects as most relevant:-

- afforestation (fuelwood, soil and water conservation);
- soil conservation (soil and water conservation);
- land management (soil and water conservation and fertility);
- controlled grazing (soil and water conservation and livestock feeds); and
- agroforestry (fuelwood, soil and water conservation, food production, and livestock feed).

The following is a list of research and development institutions and activities which were identified during the visits. It is appreciated that the list is not exhaustive.

Land and water management

- **LESOTHO** Soil and Water Conservation and Agroforestry Program (SWACAP) - financed by IFAD
Agricultural Planning Conservation Unit of the Ministry of Agriculture.
Lesotho Work Camp
Integrated program - FAO supported
- **BOTSWANA** National Tillage (Research and Extension)
- **TANZANIA** Hifadhi Ardhi Dodoma (HADO) - SIDA funded
- **MOZAMBIQUE** Edward Mondlane University
National Institute of Agricultural Research (INIA) in Manica Province
- **ZIMBABWE** GTZ financed program on Coordinated Agriculture in Rural Development Program in Masvingo
- **SWAZILAND** Research Division of Ministry of Agriculture and Cooperatives
Faculty of Agriculture

Controlled grazing

- **BOTSWANA** Animal Production Research Unit (APRU) - Range Management
APRU Browse utilization
Communal Areas Management Associations
- **LESOTHO** Matelile Rural Development Program
Agricultural Planning Conservation Unit
- **SWAZILAND** N.G.Os
Local authorities
Department of Agricultural Extension/FAO
- **MOZAMBIQUE** Institute of Animal Production (IPA)
- **TANZANIA** Commission of Research and Training at Mpwapwa, West Kilimanjaro, and Kongwa
Hifadhi Ardhi Dodoma (HADO)
- **ZIMBABWE** Department of Research and Specialist Services at Matopos and Makoholi

Afforestation

- **BOTSWANA** Forest Association of Botswana
- **LESOTHO** Division of Forestry
- **SWAZILAND** Forestry Section of Land Use Planning Division
- **MOZAMBIQUE** Forest Department
- **TANZANIA** Tanzania Forestry Research Institute
National Tree Planting Day
- **ZIMBABWE** Forestry Commission
- **ZAMBIA** Forest Department - FAO supported project in Ndola

Agroforestry

- **ZAMBIA** Lusume Services (NGO) in Southern Province
Soil Productivity Research
Agric Extension/ICRAF in Eastern and Lusaka Provinces
- **ZIMBABWE** Department of Research and Specialist Services
University of Zimbabwe - Crop Science
Department of Zambezi Valley
- **TANZANIA** Faculty of Forestry - Sokoine University of Agriculture
(SUA) Morogoro
Commission of Research and Training (CRT) at Mpwapwa
CRT/ICRAF at Tumbi, Tabora
Farming Systems Research Committees (Zonal)
- **MOZAMBIQUE** Animal Production Institute (IPA)
- **SWAZILAND** Veld and Pasture Management Section of Agricultural
Research Division.

Integrated research on crops, trees, and livestock

Commission of Research and Training at Mlingano, Tanga, in Tanzania is the only research program integrating alley cropping (intercropping trees with food crops), multipurpose trees of *Leuceana* and *Sesbania* providing organic matter for the soil and fodder for livestock and composting and use of compost manure for crop production.

Issues to be discussed at the workshop

The intention of this aspect was to obtain information on NARS aspirations on the concept of integrated agricultural research approach. The question was open ended and therefore the responses varied from conceived priority elements within the whole integrated approach to conceived problems in planning and implementing integrated projects (Table 1). However, an integration of the ideas summarises the strategy for planning and implementing research and development in integrated agriculture.

It is logical to place training on the topic as a prerequisite to planning and implementation as the majority of the scientists are trained in accordance to discipline and commodities. Training is needed to instil additional perspectives and also to equip the scientists with the necessary research methodologies for multidisciplinary work. There are also institutional problems which have been discussed earlier.

There are essentially two examples within the region viz, integrated research program based in one institution, and components of the integrated research being investigated by different institutions which are linked by a lead institution. It is not fair at this stage to point out their attributes and weaknesses.

Some countries indicated clearly that soil erosion is the most important element in integrated research approach. One could interpret this to imply that if this element is included in the ongoing research program this will go a long way in solving the existing problems of unsustainable agriculture. The shortages of animal feeds in the dry season is faced by all countries and is closely linked with overstocking. It is apparent that NARS scientists have accepted that destocking cannot be implemented but the alternative solution is to increase feed supplies for dry seasons feeding.

Another priority was the need to involve the communities in research and development. This agrees with the philosophy of farming systems approach of involving the target groups but additionally, it is realized that grazing and forestry resources are communally utilized resources and hence the need for involving the communities.

An expert on population would be disappointed to see that the increase in human population was not pin-pointed as a priority area as it is the underlying factor. This aspect was not included as it is a speciality on its own merit.

Conclusion

In all the countries visited, researchers, extension staff, and NGO personnel expressed their concern on the ongoing unabated processes resulting in the degradation of the land resource base. All pointed out that the present usages of land i.e., cropping, grazing, and fuel extraction contribute to leaving the land bare and thus prone to soil erosion. The movements of human populations into urban and other types of settlement centres have created markets for fuelwood resulting in deforestation around these areas and beyond.

A number of research activities are being carried out by the SADD countries on some elements of integrated agriculture but these are on a small scale with relatively little impact. Site located development activities on soil and water conservation are carried out by NGOs mainly but the coverage is patchy. Suggested solutions to these problems include:-

- institutional structure aspects;
- training in integrated agriculture;
- community approach to research and development;
- soil and water conservation;
- afforestation;
- animal feed production; and
- integrated approach in research and development.