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Potential for Biotechnology Developments and Application

in Kenya

and possible Networking of National, Regional and

International Centres

Report on a Visit to Kenya

(19 November to 1 December 1989)

by

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REPORT ON VISIT TO KENYA - 19 NOVEMBER - 1 DECEMBER 1989

BY

DR. S. VARADARAJAN

INTRODUCTION

UNIDO has been taking interest in the promotion of new and emerging areas of technology and is assisting in building national capabilities in such areas and in improving international cooperation through networking of institutions in different countries, training in advanced technologies and in establishing Regional and National Centres. Among these areas is Biotechnology which has considerable potential for application in several sectors such as agriculture, animal husbandry, human health, food processing, renewable energy, waste utilisation, environment, ecology and industry.

The present visit was initiated by UNIDO, Vienna to have consultations with the Government of Kenya and prepare a Report on developing policy and programme for Biotechnology in Kenya and on possible networking with other African countries. This initiative was taken in response to a communication from Professor Karega Mutahi, Permanent Secretary, Ministry of Reclamation and Development of Arid, Semi-Arid Areas and Wastelands of the Government of Kenya and based on suggestions made by Dr. J. Bunders of the Free University, Amsterdam, Netherlands to Professor Mutahi (Annexure-I). Although the request from Professor Mutahi related to agricultural and animal husbandry in Arid and Semi-Arid Lands (ASAL), in the initial discussions at the start of the present visit Professor Mutahi agreed that it is appropriate to study the basic infrastructure for biotechnology developments in Kenya and the opportunities for application more widely since this is necessary for contributions to ASAL.

VISIT PROGRAMME

The programme arranged initially covered discussions with Ministry of Reclamation and Development of Arid and Semi-Arid Areas and Wastelands, Ministry of Agriculture, Ministry of Scientific Research and Technology and the headquarters of the Kenya Agricultural Research Institute. At the request of Dr. Varadarajan, visits were kindly arranged to Egerton University about 200 Km from Nairobi which concentrates on agriculture and to the College of Agriculture and Veterinary Sciences of the University of Nairobi. Visits were also made to the International Centre for Insect Physiology and Ecology and the African Academy of Sciences. Details of the programme are given in Annexure-II. Within the time available, it was not

possible to arrange visits to Research Institute or stations or discussions with Kenya Medical Research Institute Kenya Industrial Research Development Institute, Kenya Coffee Foundation, Kenya Tea Authority or to Coastal Marine Fisheries Institutions. Discussions with Faculty of the University of Nairobi, Egerton University and of the International Centre for Insect Physiology and Ecology provided useful additional information to the valuable discussions with officials of Ministries and the Kenya Agricultural Research Institute (KARI). A visit to the African Academy of Sciences was also very useful.

BACKGROUND

i) Demography

Kenya has a population of about 24 million and the rate of growth of population is 3.7 percent annually. The population is expected to rise to 36 million by the year 2000. The birth rate is 5.2 percent and on average, a woman gives birth to 7 to 8 children. The birth rate has remained the same for over 25 years. The death rate has declined from 2.2 to 1.1 per cent in this period. The rate of growth of population is among the highest in the world. About 40 percent of women are in the child bearing age groups. The urban population constitutes 22 per cent of total population and is growing at the rate of 9 per cent yearly. Nairobi has 57 per cent of the total urban population and is by far the single city with a very large population of 5.3 million. No other city in Kenya has a population of even one tenth of Nairobi. Infant mortality is declining but still high at 72 per 1000 live births. Life expectancy at birth has steadily improved and is 60 for females compared to 56 for males. The ratio of females per 100 males is 100 and these are good indicators of the position of women.

The Development Plan 1989-1993 envisages the gradual decline of population growth rates through increase in education at all levels. It also aims at development of a large number of smaller urban growth centres in order to slow down the high rate of increase in the large city urban population. Simultaneously employment opportunities in rural areas and in particular ASAL areas through improvement of agriculture, grasslands and forestry and investment in industry in these areas are sought to be increased.

ii) Agriculture

Agriculture is the mainstay of Kenya's economy. Priority is for food production to ensure self sufficiency and food security through strategic reserves to meet shortages in drought periods. Agriculture provides raw materials for local industries and processing for export, especially of cash crops such as coffee and tea. Production details are given in Table-I.

Table - I

Demand and Production in 1988 and estimates for 1993
(in Thousands of Tonnes)

	<u>1988</u>		<u>1993</u>	
	<u>Production</u>	<u>Demand</u>	<u>Production</u>	<u>Demand</u>
Maize	2540	2250	3090	2670
Wheat	231	440	255	535
Sorghum & Millets	181	175	210	213
Rice	28	69	41	84
Beans	309	300	394	366
Potatoes	821	760	1048	925
Sugar	426	399	525	523
Beef	172	183	181	223
Milk	1534	2060	1693	2500

While there is clearly good growth in production at the rate of about 4.0 to 4.5 per cent, demand is increasing at a slightly higher rate. The gap is increasing in the case of wheat, rice, beef and milk.

The output in other crops will also grow at about the same rate. Details are given in Table-2.

Table-2

Output in Thousands of Tonnes

	<u>1988</u>	<u>1993</u>
Tea	160	204
Coffee	123	150
Sisal	44	51
Pyrethrum	6.7	7.8
Cotton	45	67
Tobacco	6	8
Horticulture	44	70

Production of maize, beans and milk utilises approximately two thirds of the land area devoted to agricultural production. It is not intended to increase this area and proportion and it is necessary to increase productivity steadily to ensure food self sufficiency. The balance of one third area is reserved for production of higher value added commodities such as tea and coffee which are the major sources of export earnings. It is also recognised investments in ASAL will be higher than in irrigated areas but it is necessary to effect improvements in the lives of relatively poorer people living in ASAL areas. Milk and meat production are sought to be increased through a strategy of stall feeding and moving towards zero grazing in order to avoid denudation of land.

Kenya covers an area of 582,646 sq.km. of which 571,416 sq.km is dry land and 11,230 sq.km is open waters. About four fifth of the land (473,000 sq.km) is arid or semi arid. Only 18 per cent (104,844 sq.km) constitutes the medium and high potential areas which supports two thirds of the country's population. While most of the arable land is utilised for agriculture, 36,300 sq.km. have been set aside for wildlife conservation and only 2080 km are left to natural and exotic plantation forests. The forests include 62 sq.km of costal mangroves, 1700 km of indigeneous forests, 122 km of exotic plantations and 124 sq.km of private ownership.

About 75 per cent of the total land area is arid and semi arid with vegetation comprising woodland, bushes, shrubs and grasslands. One third of the total population and slightly over one-half of livestock population is located in these areas as also four fifths of all wild life. The preservation of the environment in such areas and providing improved livelihood for the people of these areas through better livestock management and productivity are major concerns of development. These have to be realised by expansion of fodder crops and substantial increase in animal feed for stall feeding. Maize, the present major ingredient of animal feeds is also needed for human consumption and has to be replaced by alternative sources such as sorghum, cassave, millets and by products from processing of sugar, pineapple, oilseeds and cereals.

Intensive high yield livestock meat, dairy and poultry farming will need animal breeding, disease control through vaccines, chemical dips, artificial insemination, in vitro fertilisation and embryo transfer. Feed materials of high nutritional value with low toxic ingredients have to be developed and monitored.

Similarly, higher productivity of cereals, beans, oilseeds, sugar and cash crops requires new high yielding variety seeds and plants development, rapid multiplication and distribution of certified planting materials. Fertiliser inputs are about 55 kg per hectare of arable land and total fertiliser usage is expected to rise from 250,000 tonnes annually at present to 400,000 tonnes by 1993. The high foreign exchange costs in imports of these and local costs in transportation are constraints in increased usage. Control of agricultural pests and weeds in intensive farming is also a major challenge.

iii) FISHERIES.

Fish production has increased at the rate of 14 percent annually increasing to 138,400 tonnes in 1988 from 48,218 tonnes in 1980. Of these Lake Victoria accounts for 120,259 tonnes and other lakes 8,813 tonnes. Inland fish farming resulted in 1,116 tonnes. There is a decline in fish in lakes other than Victoria. Marine fish and shell fish accounted for

7,795 and 418 tonnes respectively representing only a tiny fraction of the potential marine resources. There are clearly many opportunities for increasing fish production through modern scientific systems. Ocean fish meal and by products of fish processing have considerable potential for use in animal and poultry feeds.

iv) Energy

Kenya's energy requirements are increasing at the rate of 4.4 per cent per annum. The total energy demand at present is 32.43 million tonnes of Oil Equivalent (TOE) and of these 30.30 M TOE or 93.5 per cent is met by wood, fuel. Hydro electric power and Coal form small proportions (1.0 per cent) and the balance (5.5) per cent is from petroleum fuels. These proportions are expected to continue and wood fuel requirements will therefore increase. The total supply from renewable resources currently is about 19 million tonnes of which 28 per cent comes from gazetted forests, 47 per cent from agro-forestry and 25 per cent from range lands. The demand is 24.5 million tonnes.

Hence, the gap is 5.5 million tonnes and is met by depletion of standing forests at the rate of 1 per cent per annum. Thus the standing stock of 1004 million tonnes in 1980, declined to 932 million tonnes in 1990 and will decline further to 800 million tonnes by year 2000. The consequences of widespread deforestation and denudation of grasslands are extremely serious.

v) Forestry

Forests and rangelands are major contributors to Kenyan economy providing not only fodder and fuel but also sustaining wild life, which in turn generates foreign exchange income from tourism. They also form the basis of supply of timber for construction and pulp for paper mills. Wood is also needed for plywood panels, fibre board and particle board mills. Forests thus make significant contribution to industrial development and employment. Demand is growing at a high rate and in spite of the schemes for social and commercial forestry, supplies, as at present envisaged will be inadequate. Details are given in Table-3.

Table-3
Industrial Wood Supply and Demand (Thousand cubic meters/year)

<u>Year</u>	<u>Sawlog/Panels</u>			<u>Pulpwood</u>		
	<u>Supply</u>	<u>Demand</u>	<u>Difference</u>	<u>Supply</u>	<u>Demand</u>	<u>Difference</u>
1990	1895	866	1029	577	672	- 95
1995	2073	1279	804	577	582	- 25
2000	2108	1725	383	746	740	6
2005	2100	2404	-304	620	940	-320

Rapid reforestation to augment supplies, has been recommended by Kenya Forestry Research Institute (KEFRI) and several measures are envisaged by Government to increase supply without depletion.

vi) INDUSTRY

Industry in Kenya is based largely on agriculture, animal husbandary, forestry and to a smaller extent on minerals and import substitution. Details are given in Table-4.

Table-4

Output of Industry in K & Million

	<u>1990</u>	<u>1993</u>
Food Processing	2800	3352
Beverages & Tobacco	362	440
Textile	359	429
Leather	67	81
Paper and Wood	156	190
Plastics & pharmaceuticals	148	180
Basic Chemicals	128	155
Cement and Glass	9	11
Iron and Steel	421	511
Electrical & Transport	266	324
	----	----
	4675	5672
	----	----

A growth rate of 6.7 per cent per annum for industry and commerce sector is envisaged through several incentives for investment and for export. Among core industries, chemical and bio technological industries to provide fertilisers, pesticides, pharmaceutical industries for the production of medicinal drugs and vaccines and agro industries based on local raw materials such as oilseeds, coffee, tea, milk, pyrethrum, sugar, grains, hides, skins and agro wastes and by products are specially listed in the Development Plan.

vii) Education

Education has been of primary importance and currently one fifth of Government Budget is devoted to Education. There are 5 million in primary schools and 522,000 in secondary schools. Enrolment in the four Universities is over 17,000 and 3 National Polytechnics and 16 Institutes of Technology provide training for over 11,000 students. It is noteworthy that in primary and secondary schools, ratio of boys to girls is 107:100 and 144:100 respectively. Women constitute 30 per cent of the total student population of Universities. The Ministry of Education exercises administrative and budgetary control over the Universities of Nairobi, Moi and Egerton and the Jomo

Kenyatta University College of Agriculture and Technology. The Ministry of Educational Training and Applied Technology is in charge of Institutes of Technology and National Polytechnics. These Ministries do not appear to provide any funds for research in the Universities and Institutions.

There is an increasing demand for University education. Student intake rate is being doubled in the period 1988 to 1993 and undergraduates and postgraduates population in 1993 will be 52,300 and 3,400 respectively. There are currently 12,000 Kenyan students pursuing University courses abroad. Of these 7,200 are in North America and 2,900 in India. Only 10 per cent of these students overseas receive Government Scholarships.

The standards of University Education are good. The Faculty, largely from Kenya, are excellent. Most have received extensive training in North America and Europe and have carried out research in noted Universities and Research Institutions abroad. They continue to maintain active contacts through periodical exchange visits and have excellent knowledge and awareness of contemporary advances in Science and Technology.

The graduates in Science, Engineering, Technology, Agriculture, Veterinary Sciences and Medicine find ready employment generally in Government organisations and Universities. A small number are also employed in private industry as well as by private plantations and medical institutions. There is clearly enough talent and trained manpower for undertaking research, development and extension work in most areas. This is particularly true in agriculture, forestry, plant breeding, entomology, veterinary sciences, medicine, surgery and dentistry. There are also very good departments in basic sciences such as mathematics, physics, chemistry, botany, zoology, microbiology and nutrition. There is increasing interest in environmental sciences and ecology. Knowledge and rich experience from many years of work are available in areas such as plant, animal and human communicable diseases and their prevention and control.

viii) Health Services

The steady investments in health services during 25 years has resulted in marked improvement of health status of the people. There is increased expectancy of life at birth, better nutritional status and a satisfactory ratio of women to men. The Immunisation Programme is being intensified to reduce incidence of measles, polio, whooping cough and tetanus and the aim is to cover 80 per cent of new born babies by 1993. Sanitation and water supply have to be improved. Environmental pollution and food contamination levels have to be reduced.

Malaria, bilharzia and sleeping sickness are widespread and are causes for concern. Malaria accounts for 20 per cent of out-patient morbidity cases. There is indication of the increase in chloroquin resistant strains. Hookworm and tape

worm are also major causes of illness - impeding growth and development of children. Sexually transmitted diseases such as gonorrhoea and syphilis are major causes of morbidity. Others which pose serious problems to mothers are chancroid and chlamydia infections. There is also spread of AIDS.

The contribution of Government for the health sector is 50 per cent of the total cost and it has been growing at the rate of 7 per cent. Private sector and NGO contribution is about 42 per cent. During the period 1989-93, while expanding the total health services substantially, Government contribution will be reduced to 45 per cent through levy of charges as well by improvement in the management of health services for achieving higher efficiency. Private hospitals are likely to increase as they are stated to be efficient and are preferred. A health insurance scheme is being introduced through a National Health Insurance Corporation. A Health Management Information System is being instituted to provide detailed district wise Survey and information as part of the drive for efficient management. Primary Health care with emphasis on immunisation, nutrition, health education, sanitation, drinking water supply and community participation is being promoted. Preventive health care at all levels and schemes of maternal and child health are being expanded to ensure immunisation of 80 per cent of all new born babies by 1993.

A Food and Nutrition Planning Unit has been established for data collection and analysis of nutritional status and for information exchange in the Eastern and Southern African Region and with the rest of the World. Since iodine deficiency has been noted, 70 per cent of salt (75,000 tonnes per annum) is now iodised and it is proposed to extend it to 100 per cent by 1993. Anaemia is prevalent, especially among children, pregnant and lactating mothers from iron deficiency, caused through malarial infection, chronic haemorrhage from hookworm and schistosomiasis. Preventive health care is recognised as the most cost effective system for reducing anaemia. Blindness from Vitamin A deficiency is a major disability in Kenya and it is hoped to eliminate such incidence of blindness by year 2000.

The objectives of health and nutrition will require large amounts of vaccines and new drugs especially to cure drug resistant infections. Sanitation and hygiene will need waste disposal by biological methods. Likewise, the treatment and recycling of water to provide safe drinking water supplies will again call for a role for bio treatment. Production of drugs, vitamins, iodine and vaccines will improve availability and reduce dependence on imports.

A large proportion of people in Kenya depend on traditional medicine. There is however much skepticism on its efficacy. There is renewed interest world over in such systems. It is proposed to encourage formation of professional associations and gather information on traditional diagnostic,

therapeutic and rehabilitative control technologies as part of the programme of medical research.

ix) Balance of Payments

Kenya's agricultural and industrial sectors are heavily dependent on imported inputs such as fuel, fertiliser and machinery. Foreign exchange is generated from exports of coffee and tea and the increases in petroleum prices affect balance of payments. There is a negative balance of the order of 75 million Kenyan Shillings in the past five years. The value of Kenyan Shilling has depreciated by 46 per cent during the period 1984-87. There is therefore urgent need to increase exports, obtain higher productivity, quality and volume in coffee and tea to remain internationally competitive. Food security also demands increases in agricultural production to meet rising demands. Exports of value added speciality crops such as products from medicinal plants, spices, perfumery essential oils will be of interest. Simultaneously reduction in imports through increased local production of essential products, preferably with low capital investment will also provide for better balance of payments situation. External debt servicing has emerged as a critical issue requiring special attention.

x) Self Help Movement

Harambee, Kenya's unique self-help movement operating since independence supplements official development programmes through voluntary contributions in money, materials and social services for community welfare and development. Professional services contributed without costs are particularly important. The education and training of participants and local community leaders in the application of modern scientific biological methods will be highly rewarding in making programmes of development highly efficient and economic.

Scientific Research in Kenya

Kenya has promoted and developed major scientific agencies and institutions related to its economy and social needs and these have been nurtured further since independence. These are particularly noteworthy in the areas of agriculture, land and water resources usage, animal husbandary, forestry, wild life, environment, plantation crops and control of pests in plants and communicable diseases of animals and human population. There is a vast store of scientific knowledge accumulated by painstaking observations and systematic sustained study of all natural living resources of the country. Kenyan Scientists have gathered special perceptions of the influence of land, water and climate on plants, animals, insects and micro-organisms of all types and of the interactions among various living species. The comprehensions of the spread of pests and parasites and their control by biological methods are particularly rich. Kenyan scientific leadership in these

sectors in the world and in the Region has been widely recognised and applauded. Kenya's role in international cooperation and specially in the Developing Countries and the Third World as well as in the Commonwealth is much appreciated, resulting in the establishment of several International, Regional Scientific Organisations and Institutions in Nairobi. Scientists of Kenya have been active participants in research in Kenya based institutions as well as in many renowned centres in developed countries and have gathered high reputation for their contributions in research in traditional basic and applied biology. It is also remarkable to find many scientists from other countries working in Universities and Research Institutions in Kenya. Through Government and private initiatives, a large number from Kenya have received education and research training abroad. A critical mass of talent and rich experience in human resources in all major disciplines of biology is thus available with the potential to make scientific advances of economic and social relevance to the country and to the region and indeed to the whole developing world. There are however, constraints for truly achieving this potential and if these are minimised and positive support is provided, the results could be highly significant for rapid development.

A brief outline of the existing organisations and their programmes is given below. It must be acknowledged that within the time available, only limited information could be gathered on these and there are bound to be many omissions and defects in the true appreciation of the total scientific capabilities and systems. Nevertheless a description of these institutional mechanisms is relevant for evolving policies and measures related to future development of biotechnology in Kenya and in the Region. The National Research institutions include Universities and Post Graduate Colleges, Kenya Agricultural Research Institute (KARI), Kenya Forestry Research Institute (KEFRI), Kenya Industrial Research Development Institute (KIRDI), Kenya Medical Research Institute (KEMRI), Kenya Tea Development Authority (KTDA), National Council of Science and Technology (NCST) and the Coffee Research Foundation. The International Organisations include International Centre for Insect Physiology and Ecology (ICIPE), the International Centre for Research in Agro Forestry (ICRAF) of the Consultative group of International Agricultural Research Centre (CGIARC), Africal Academy of Sciences, the United Nations Environmental Programme (UNEP) and HABITAT of United Nations.

The largest among these is KARI, established as a semi autonomous research council under the Science & Technology Act, 1979. It has responsibility for agricultural research and dissemination of research findings, in addition to cooperation with Universities and other research organisations inside and outside Kenya. It was placed until recently in the Ministry of Agriculture. The Research functions and laboratories hitherto under Ministry of Livestock Development, have now been merged with KARI, which itself has now been transferred to the Ministry of Scientific Research and Technology. Director, KARI

is the Chief Executive. KARI has a Board of Management for policy matters and has members from different Ministries related to Agriculture and Livestock. KARI has several National Research Centres and Regional Stations for subjects such as Maize, Pasture, Plant Breeding for wheat and cereals, Horticulture, Potato, Land, Water and Plant Resources Management, Agricultural Engineering, Dry land Farming, Natural Fibres, Pyrethrum, Sugar, Animal Productivity, Veterinary Systems, Soil Survey, Entomology, Arid Lands and Ecology. The total staff of KARI is 6000 of which 600 are scientists and 214 are Technical officers. About 1000 are Technical Assistants and Technicians. The balance 4300 are administrative and support staff. Apart from research, it provides services for pest monitoring and control, soil analysis and scientific information. Under KARI, the National Veterinary Research Centre produces rinderpest vaccine and supplies to several countries. KARI has linkages with international centres in Kenya and abroad, the Tea and Coffee Research Foundations and with Private Company Research. KARI conducts conferences, workshops and training courses and publishes a Journal.

With the transfer of KARI to the Ministry of Scientific Research and Technology, liaison with the Ministries of Agriculture, Livestock Development, Environment and Natural Resources, Health, Water Development, Commerce and Industry, Tourism and Wildlife, Energy and Regional Development, Transport and Communications, Reclamation and Development of Arid and Semi Arid Areas and Wastelands is maintained through the Board of Management and by appointment of Research Liaison officers in these Ministries. The Director KARI is a Member of the National Council for Science and Technology. It administers 17 National Centres, 5 Regional centres and 11 sub centres. There are specialist National Level Committees as well as Research Committees for each Centre. There are also National Programme Coordinators.

The budget allocation for KARI has not been changed after its transfer. Some resources are also obtained from International Organisations. KARI recruits Science graduates and they also carry out research for higher degrees of Universities. They tend to remain for the whole of their career in the National Centres and some are seconded to Ministries from time to time. There does not appear to be much new recruitment at higher levels. The total resources are somewhat limited and not large enough to add new laboratories and modern instrumentation and replace old ones regularly in a significant manner.

The programmes related to biotechnology are being pursued by KARI. These include the following:

Vaccine Development for Anthrax, Rinderpest

Artificial Insemination of Cattle and In Vitro fertilisation, Embryo Transfer

Tissue Culture Propagation of plants such as pyrethrum, horticultural crops.

Tissue Culture for Ornamental Flowers for Export

Potato, Cassava, Sweet Potato, Micro tuber propagation and for virus free material

Tissue Culture for Fruits (Peaches, Plums, Pears, Grape, Citrus varieties)

Induced Somatic Resistance against coffee rust disease through callus secondary stage

Tissue Culture for high quality tea

Micro propagation of selected sugarcane varieties

Incorporation of streak virus resistance genotypes in Maize to restore resistance now decreasing

The Ministry of Agriculture continues to be responsible for some agricultural research. The projects include soil science, fertiliser and pesticide residue monitoring, crop protection from pests and Information Bank. Some institutions under the Ministry are Plant Quarantine Research station and National Seed Quality Control Service. Other important Research institutions include Kenya Trypanosomiasis Research Institute (KETRI) and the Research Institutes of Coffee Research Foundation and Tea Research Authority. The last two are supported by Industry.

Kenya Forestry Research Institute (KEFRI) is the major organisation with research interests in preservation of forests, introduction of quick growing trees, control of diseases in wild life. Agro forestry is a major interest for ensuring availability of timber, fuelwood and raw material for paper.

The College of Agriculture and Veterinary Sciences, Kabete Campus of the University of Nairobi is a major institution with several Departments of Science, carrying out important research, in addition to teaching. These include Departments of Botany, Zoology, Biochemistry, Mathematics, Physics, Chemistry, Medicine and Meteorology. There are several research projects related to Biotechnology already in progress in a modest way. The basic facilities are largely for teaching. There is no separate research grant provided to the University. Financial support for establishing facilities and conducting research appears to be from research project grants provided by international agencies or under bilateral agreements. Small amounts are available from KARI and Ministries of Government and from Industry. The Vice Chancellor has constituted a Committee of the Faculty for examining future interests in Biotechnology and it has recommended that a Biotechnology

Centre should be established in the campus with adequate facilities for research and development in modern biology and with participation of faculty of different departments. The Report has been circulated to Government. A list of some projects now in progress is given below:

Tissue Culture for flowers

Sugarcane Embryogenesis

Animal Embryo Transfer

Animal Virus Molecular Biology

Hormonal control of fertility in Sheep

Effect of Sleeping Sickness, Trypanosomiasis on reduction of spermatogenesis

Neurophysiological response in reproduction in crocodile and fish

Drought Monitoring

Drug resistance in Schistosomiasis

Natural Pesticides from Neem and other tropical plants

Monoclonal Antibodies in Trypanosoma and Tsetse fly infections

The Faculty maintains high standards in teaching and research and has excellent linkages with Kenyan Research Councils and with International Research Centres in the Region. Faculty have worked abroad. There are also many visiting Scientists. The instrument facilities however are not modern or adequate to meet the needs of modern molecular biology, immunology and genetic engineering. These have to be augmented.

Egerton University at Nakuru Njoro 230 km north west of Nairobi was constituted in 1987 from a College which developed from 1955 in the area of Agriculture. The University has expanded rapidly and the academic staff number 310. It is planned to increase the staff to 500 and students population to 5000 by 1991. The University has departments in humanities and sciences including physical and biological sciences and provides undergraduate and post graduate courses and research facilities. Being a relatively new University, with large expansion, the facilities are modern. There is emphasis on research with a Deputy Vice Chancellor in charge of programmes of research and extension. There is a good computer centre. There are departments of Agricultural Engineering and Agricultural Economics. Research projects have to be funded largely by external grants from International Agencies and National Ministries and Research Councils. Here again the

extent of support is still modest. The location of the University offers opportunities for research in grass lands, horticulture, fisheries. Some of the research projects now in progress in subjects related to Biotechnology are mentioned below:

Potato and other vegetable micro tuber propogation in operation with Cornell University

Sorghum varietal improvement

Oilseeds research (Sunflower, Sesame, cottonseed)

Millet's improvement by chloroplast studies

Fisheries development in Lakes

The University is recruiting new staff. Support for research is being provided from organisation such as US AID, IDRC, Canada, UNDP, Rockefeller Foundation and the Government of Kenya. The University has 1000 acres of land for research and a further 3000 acres of Commercial farms as well as animals for meat and dairy production. There is clear interest in development and application of biotechnology.

The International Centre of Insect Physiology and Ecology (ICIPE) is now in a new large campus, with new buildings and facilities for advanced biological research. It has excellent core staff recruited internationally and it is being developed under the dynamic leadership of Professor Thomas R. Odhiambo. It is receiving large support from a number of UN agencies, Foundations, Aid Programmes of several countries in Western Europe and North America, Development Banks and Finance Bodies and from Industry and Government in Kenya. Its core research programmes include crop pests, livestock ticks, medical vectors and tsetse and their control. There are research support units for Chemistry and Biochemistry, Cell Biology, Sensory Physiology and Biomathematics as well as for international cooperation network and social science interface for integrated pest control. The Centre is clearly emerging as an international centre in modern biology related to pest control in tropical countries and particularly in the African Region. There are scientists already carrying out research in molecular and cell biology and genetic engineering.

The Centre is unique in combining excellent knowledge of developmental biology of insects and their inter-action with plants, crops and micro organisms with modern biology at molecular cellular level. These studies are related to ecology. There is excellent potential for development of biotechnology with emphasis on control of diseases of plants and animas. The Centre is well equipped to organise workshops with international faculty and to conduct major conferences. The Governing Council has Members from the African Region as well as from countries outside Africa. Studies are in progress

on plant resistance, biological control, plant varietal improvement, interventions in insect development stages, effects of inter cropping, natural enemies of animal disease insects and overall ecology. There are high quality publications and rigorous reviews of research projects. There are field stations in Kenya, Phillipines, Somalia and Zambia.

The African Academy of Sciences, of which Professor Odhiambo is President, is located in ICIPE Campus and is evolving as an institution for international cooperation and development of science in Africa. It is evolving major Information Banks with Computer facilities and is establishing linkages with major Scientific Academies and Societies and International Council of Scientific Union (ICSU) and International Scientific Unions. There are other Institutions which are in a position to conduct research and support and coordinate research in biotechnology include KEMRI, UNEP, HABITAT, ICRAF and ILARD and Industry Research Centres.

The Ministry of Research Science and Technology of Kenya is evolving as a Central Government Agency to coordinate and support research and transfer of technology. It has identified six major thrust areas for development and these are Forestry, Fisheries, Agriculture, Animal Disease Control, Industrial Development and Medical Research for Human Health. Long term planning is carried out by the National Council of Science and Technology (NCST), which is placed in this Ministry. NCST has established the Kenya Scientific Information, Documentation and Communication Centre (KENSIOC) to develop information services for elaboration and implementation of national S&T plans. NCST has specialist Committees and Research Committees. It is expected that the Ministry will also, in future, provide large support for research projects in Universities, Research Institutions of Government and Industry and coordinate international cooperation. It has already taken initiatives to identify programmes in biotechnology.

Biotechnology Initiatives

Realising the potential of biotechnology for socio-economic development of Kenya, a number of initiatives have been recently taken to identify areas and objectives specifically of value to Kenya and to explore strategies for pursuit of research and application in such areas. The NCST has prepared a Report on the subject in 1989 and has presented it to the Government. The following Workshops have been held:

- | | |
|-----------------|--|
| Jan 1989 | Biotechnology in Agricultural Research organised by KARI at the National Pyrethrum Research Centre, Molo and the National Horticultural Research Centre, Thika |
| May 24-26, 1989 | Plant Biotechnology Workshop: Present and future biotechnology research and applications for Kenya organised by KARI (for programme |

please see Annexure-III)

Feb 25 - National Conference on Plant and Animal
Mar 3, Biotechnology organised by KARI at Nairobi
1990 (For Programme please see Annexure IV)

Reports of these are not yet available. They provide a broad overview of the areas of potential interest. A Report entitled "The Potentiality of Biotechnology Research and Development in East African Universities and Institutions in Burundi, Kenya, Rwanda, Tanzania and Uganda is being finalised by Dr. Norah K. Olembo of the Department of Biochemistry, University of Nairobi, P O Box 30197, Nairobi. Dr. J. Bunders of the Department of Biology and Society, Faculty of Biology, Free University, de Boelelaan 1089, 1081 HV Amsterdam (Tel 20-5485708) has visited Kenya for discussions on areas of biotechnology with Ministries of Government and the University of Nairobi. She also arranged for a team of two colleagues, Miss Helena Sarink and Mr. Hans Langeveld to visit Kenya in November-December 1989 to make field surveys and have discussions with Research Institutions in different parts of Kenya with the assistance of Dr. Calestous Juma, Director, African Centre for Technology Studies to outline networking of biotechnology groups in Kenya. Dr. Juma has earlier published a book on Biotechnology in Kenya and Africa but a copy could not be obtained. The two Dutch colleagues of Dr. J. Bunders had discussions with Dr. S. Varadarajan in Nairobi but a meeting with Dr. C. Juma could not take place. These discussions and reports will be informative and useful in future planning of biotechnology in Kenya and the Region.

Review and Recommendations

Kenya's economic and social development plans and objectives clearly provide extraordinary opportunities for significant contributions through research and application of biotechnology. The economy is largely dependent on agriculture, food production, fodder, meat, dairy products, tea, coffee, oilseeds, fish, pyrethrum, medicinal and aromatic plants, fuel wood for energy, commercial forestry for timber and paper pulp, cotton and natural fibres, sugar and industrial development based on processing of agricultural products, meat, fish and milk. Kenya could be regarded as a Biotechnology country. It has, fortunately an excellent base in education, research and international cooperation in bio-sciences. Therefore, the needs for biotechnology are clear and expert human resources for its development are available. The following areas are particularly recommended for active pursuit:

Agriculture and Forestry

Varietal improvement in maize, wheat, sorghum, millets for drought and pest resistance

Tissue culture propagation in vegetables, fruits, flowers

Micro tubers in potato, cassava, sweet potato

New high quality tea and coffee varieties development for export

Introduction of Rubber, Oil Palms, Cashew, Cardamon, Cloves, Pepper, Ginger and Spices by tissue culture and genetic engineering

Mushroom cultivation, Cheese production

Fodder species with drought and salinity resistance

Mulberry cultivation and Silk production

Sugarcane improvements for higher sugar content

Quick growing tree plantations for timber by tissue culture

Bamboo cultivation with tissue culture

Paper pulp yielding varieties for commercial forestry

Fuel wood from quick growth species of eucalyptis, casuarina

Essential oil plants for perfumery for export

Special plants for providing natural pesticides, medicinal products (Neem, Pyrethrum, Dioscorea, Artemisia)

Biological Nitrogen Fixation to substitute imports of chemical fertilisers

Animal Husbandry, Fisheries

In vitro fertilisation and embryo transfer to effect herd improvements for meat and dairy products

Animal vaccines

Animal disease Diagnostics with Monoclonal Antibiotics

Fish farming, aqua-culture

Oilseeds development (Sunflower, Sesame, Safflower, Nigerseed) to provide oils and by product oilcakes for animal feed

Animal fertility Regulation Vaccines

Human Health

Diagnostic Devices for communicable diseases

Human Vaccines Development

Cultivation of Seaweeds for iodine extraction

Research in parasitic diseases and their control

Biological Methods of Control of Malaria and Parasites
(*Bacillus thuringensis*)

Local production of Antibiotics by fermentation

Environment and Ecology

Identification of plants for arid, semi arid areas and wastelands to retain soils and halt desertification

Drought resistant grasses, shrubs

Biological oxidation with specified organisms for effluent water treatment

Human waste treatment to produce biogas and bio-fertiliser for achieving better sanitation and hygiene

Regeneration of forests with tissue culture propagation

Municipal waste treatment by biological methods

Recycling of water from human settlements, industry

Wildlife disease control

Production of animal feeds and raw materials for zero grazing and stall feeding (Treated by products of agriculture and food, fish meal, meat industry by products, wheat bran, rice bran, oilcakes, forest oilseeds, enzyme and microbial treatment of straw to increase digestibility and food value)

Energy plantations for Rural Energy

Pollution Control in lakes, reservoirs, mining sites

Agro waste conversion to fertilisers

Industry

Silk production, introduction of mulberry

Enzymes for dehairing of skins

Enzymes for Leather production

Fermentation Industry for efficient production of alcohol and other chemicals from molasses

Microbial Technology Industries for Antibiotics, Vitamin C, speciality chemicals

Fermented dairy products (cheese, yoghurt)

Glucose, fructose syrup from sugar, starch

Starch from tubers, corn

Modified starches

Iodine from sea weeds

Alginates, gelling agents from algae

Caffeine from agro waste material

Rice bran oil extraction with stabilisation of enzyme

High quality wines, liquors from grapes, fruits, for export

Vitamin A production from lemongrass oil

High quality biological products from abattoir (Heparin, enzymes for cheese production, Dried blood, offal for animal feeds)

Microbial Nitrogen Fixation Organised culture production by fermentation

Treatment of Distillery waste to produce biogas and fertiliser

Monoclonal Antibody Diagnostics

Vitamin C production

Neem Extracts for Pesticides

Policies and Institutions for Biotechnology

In view of the interests in biotechnology, pervading many scientific disciplines and application areas, it is necessary to evolve a Central high level body to organise and coordinate research, development and application in a rapid and efficient manner. It is suggested that a National Commission or Board on Biotechnology be established, with Membership at high level of interested agencies and Ministries. The Commission should be provided with resources and powers and work as a semi

autonomous body. It will have the following functions to ensure quick development of infrastructure facilities and human resources and for promoting application.

- i) Long term and short term plans and identification of opportunities in all sectors
- ii) Training by provision of support to Universities, research institutions, industry
- iii) Funding of research, development and demonstration
- iv) Establishment of National Microbial, germ plasmion plant and animal species collections
- v) Information Bank
- vi) Regulation for Safety in Genetic Engineering and release of products
- vii) Large scale pilot demonstrations
- viii) International Cooperation
- ix) Inter institutional Coordination, Monitoring
- x) Creation of Risk Investment Ventures with partial funding in such companies
- xi) Promotion of companies for certified seed, microbial cultures for biological nitrogen fixation, production of tissue culture plants, micro tubers
- xii) Intellectual Property Rights - Purchase of Technologies, High yielding seeds, cultures for national use.
- xiii) Recommendations for fiscal incentives, customs tariffs for investments, import of equipment
- xiv) Special Awards for Achievements
- xv) Approvals for services of international consultants
- xvi) Support for Scientists for participation in international workshops, conferences and for organisation of such meetings in Kenya
- xvii) Innovative Schemes and Support for rural area biotechnology based schemes
- xviii) Support for engineering, project consultancy companies to prepare feasibility and project reports and for detailed engineering

- xix) Preparation of quarterly reports to Government and the public on the international and national developments and opportunities in biotechnology
- xx) Dissemination of Information through publications, radio, television, films, lectures
- xxi) Identification of gaps in trained human resources and effect remedies
- xxii) Early identification of emerging obsolescence in facilities, products, services and initiate measures for modernisation
- xxiii) Take all other needed steps in policy and institution building to evolve Kenya as a major biotechnology country in economic and social development and to meet National Plan Objectives efficiently and with speed.

It is essential that such a Commission is headed by a very Senior Member of Government. The Commission can function through Executive Committees for (a) Research, Development and Demonstration, (b) Infrastructure, (c) Technology Application and (d) Policy Formulations. Biotechnology is knowledge intensive and can also generate employment on a large scale in rural areas. Investments in a timely manner with critical sizes can result in high benefits. There are large possibilities for conservation of natural resources and for export of products, in addition to increasing food and nutrition security, human and animal health. The Reports of the Commission should be widely circulated and receive high level response for action in Government and Industry as well as in the local bodies and Communities.

International Cooperation

Biotechnology developments are very wide in the world and international cooperation is highly desirable. Kenya is highly suitable for the establishment of a Regional Network Centre. UNIDO may consider the promotion of such a Centre with the cooperation of Governemtn of Kenya and Governments of Countries of the Region. The Centre can be linked to the network of ICGEB and have roles for information, scientists exchange, training and for promoting Regional Research Projects and demonstration projects. A small office can be located in Nairobi within the campus of an Institution which has facilities for Library, Computers, Telecommunications, storage of special biochemicals or banks of micro organisms culture and germ plasm collections. The Centre should have a high level executive Council and Scientific Advisory Committee.

Acknowledgements

It is a pleasure to acknowledge the assistance received from a large number of officials and scientists during the visit. My thanks are due to Dr. K. Venkataraman of UNIDO, Vienna and Mr. A. Pagani of SIDFA, UNDP office, Nairobi and his colleagues. I am grateful to Professor A. Mutahi, Permanent Secretary, Ministry of Reclamation and Development of Arid, Semi Arid Areas and Wastelands. I am happy to record my appreciation of the helpful information and of discussions with Heads and staff of Research Institutes, officials of Government, Faculty of Universities and senior Members of HABITAT, UNEP and ICIPE and for the assistance received from all of them.

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DR. S. VARADARAJAN

Visit to Kenya

Programme

Nov. 1989

Sunday 19

Arrival in Nairobi at 23.00 Hrs.

Met at airport by Dr. A. Ramachandran
Executive Director, HABITAT
Stay at Norfolk Hotel

Monday 20 am

Mr A. Pagani, SIDFA
UNDP office

24 floor
Kenya International Conf.
Centre

pm

Ministry of Reclamation and
Development of Arid, Semi Arid
areas and Wastelands
Prof. Karega Mutahi
Permanent Secretary
Mr. J.S. Omambic, Dy. Secretary
Mr. M.A. Obudo, Dy. Secretary

26th floor
Kenya International Conf.
Centre

Tuesday 21 am

Ministry of Livestock Development
Mr. A. Mutai, Director

Kilimo House

pm

Mr. A. Pagani, UNDP

Wed. 22 am

Ministry of Agriculture
Mr. D. Name, Permanent Secretary
Dr. Mathias W. Oggema
Research Liaison Director
Mr. Muchiri Gichuki, Engineering
Mr. I.R. Kiiree : Farm Planning
Mr. G. Pgolla : Training
Mr. Mr. M.O. Were: Crops

Kilimo House

11.00am Travel by Car (200 km) to Nakuru,
Njoro

3.30pm Arrival Egerton University

Nakuru, Njoro

Professor Oliver S. Achwanya
Faculty of Science
Professor J Lugogo, Dy. Vice
Chancellor, Research & Extension

Professor Itolya, Plant Biotechnology

Thu. 23 am Mr. A. Pagani, UNDP

pm International Centre for Insect
Physiology and

Dr.N.N. Hossanga

Fri 24 am Meeting with Group from Netherlands
(students of Dr. J. Bunders)

Miss Helen Sarink

Mr. Huib de vriend

of the Department of Biology and Society,
Faculty of Biology, Free University,
de Boelclaan 1087
1081, H.V. Amsterdam

pm High Commission of India
Mr P.P.D'Souza, High Commissioner

Sat. 25 am Visit to Nairobi National Park

pm Mr. Nelson S. Mecrani
Director of Policy Development & External
Relations and Special Representative of
the Executive Director for Inter Organisa-
tional Affairs
United Nations Environmental Programme, Paris

Mon. 27 am& University of Nairobi
pm College of Agriculture and
Veterinary Sciences

Chirom Campus
outside Nairobi

Prof. Mukunya, Director of
Campus

Dr. Mrs. Norah Olembo

Dr. Norah K. Olembo (Biotechnology)
Professor Weenidi (Zoology)
Professor Kumani Waithaka (Horticulture)
Dr. Andrew E. Okerjo (Meteorology)

Dr. J.O. Midiwo (Chemistry)
Professor Richard (Botony)
Professor B. Bhat
Professor West (Mathematics)
Dr. J.O. Makowic (Natural Products)

Professor Kimolthi (Parasitology)
Professor Kamaale (Medical Results Communicate
Diseases)
Professor Karu (Virology - Ecology)
Professor Mahooti Fresh Water Ecology
Professor Mohanty Insect Physiology
Professor Karanja Cell Biology - Fertility
Regulator in Fish

pm Dr. A Ramachandran
Executive Director, HABITAT

Tues. 28 am Mr. A. Pagani

am& International Centre for Insect Physiology
pm and Econoly

Prof. Thomas R. Odiambo, Director
Dr. N N Massamba (Genetic Engineering)
Dr. W.A. Otiens
Dr. E. Osir (Moleculer Biochemistry)
Dr. G.P. Kaaya (Biological Control)
Dr. L.H. Otiens, Tgestes Research

Professor Thomas Odiambo Director
Dr. Paul H. Copstic, Dy. Director
Dr. Ne Ngangu Massambe (Genetic Energee)
Miss Rose A.N. Washika
(Principal Communication offices)

Wed. 29 am Ministry of Research, Science & Utalli House
Technology

Mr. S.N. Arasa, Peranent Secrelary

Mr. A.R. Gachuhi: Deputy Director
(Kenya Industrial Research and
Development Institute)

Dr. J.K. Wanjama, Asst. Director
(Biotechnology)

Dr. Ms. Rista Odingo, Research Officer
(Biotechnology & Veterinary Sciences)

Mr. S.M. Muthoka, Sr. Research Officer
(Arid Lands and Agriculture)

National Council for Science and Technology
Dr. B.N. Majisu Utalii House

pm Discussions continued

Thurs. 30 am Ministry of Reclamation and Development Kenya
of Arid, Semi Arid, Areas and Wastelands International
Conference
Centre
Mr. J.S. Omambic, Dy. Secretary
Mr. M.A. Obudo, Dy. Secretary

pm Kenya Agricultural Research Institute Kenya House
Dr. A. Mairu

Fri 1 Dec. am Mr. S. Ramakrishnan
Senior Adviser, Ministry of Finance
Office of Vice President of Kenya

pm Attend Reception hosted by High
Commissioner of India
Mr. P.P. D'Souza

Departure for Delhi via Bombay

Sat. 2 Dec. pm Arrival Delhi

Kalenga

KENYA AGRICULTURAL RESEARCH INSTITUTE

PLANT BIOTECHNOLOGY WORKSHOP: PRESENT AND FUTURE BIOTECHNOLOGY

RESEARCH AND APPLICATIONS FOR KENYA

WORKSHOP PROGRAMME

Wednesday, May 24, to Friday, May 26, 1989

OBJECTIVES OF THE WORKSHOP

The principal objective of the workshop is to bring Kenyan scientists together to discuss the present and future role of plant biotechnology in Kenya. Tissue culture and other novel technologies for improving quality and increasing efficiency of production of agricultural crops and commercial products of industrial use will be the focus for discussion.

It is also intended to promote collaboration and coordination in biotechnology research and to establish priorities for the enhancement of future biotechnology research and application in Kenya.

MEMBERS OF THE ORGANIZING COMMITTEE

- | | | | |
|----|---|---|--|
| 1. | Florence Wambugu (Chairperson) | - | Research Officer, NARC, P.O. Box 30148, Nairobi. |
| 2. | Dr. Mary Thomas-Compton (Treasurer/Secretary) | - | NARC-KARI/MIAC Consultant, National Agricultural Research Centre, P.O. Box 450, Kitale |
| 3. | Dr. A. Abou-Zeid | - | GTZ Consultant, Genbank, NARC. Muguga, P.O. Box 47351, Nairobi. |
| 4. | Prof. K. Waithaka | - | Dept. of Crop Science, Kabete, University of Nairobi. P.O. Box 30197, Nairobi |

5. Dr. J. Mwangi - Principal Research Officer,
Kenya Forestry Research
Institute, P.O. Box 74, Kikuyu
6. Mr. J. K. Rutto - Deputy Director, Crops, Soil
and Water, KARI Headquarters,
P.O. Box 57811, Nairobi

PROGRAMME

Wednesday, 24th May, 1989

Time	Activity/Speaker	Speaker/Organizer
7.00 p.m.	Welcoming Guests Silver Springs Hotel	Mr. J. K. Rutto and other members of organizing committee

Thursday, 25th May, 1989

SESSION I - Chairman, Dr. C. G. Ndlovu

	Opening the Workshop	Dr. Ndlovu, Director, KARI
8.30-9.00 am	Registration	
9.00-9.20 am	Welcoming and Introduction	
9.20-9.50 am	Opening Speech	Hon Muhoho, Minister, MRS&T
9.50-10.00 am	Vote of Thanks Management	Chairman KARI Board of
10.00-10.15 am	Coffee/Tea Break	

SESSION II - Chairman - Dr. J. Mwangi

10.15-10.40 am	Keynote Address - The role of Biotechnology in Kenya's Agriculture	Dr. B. N. Majum
10.40-11.00 am	The Role of Biotechnology in Forestry Improvement in Kenya	Dr. Odera, Director KEFRI
11.00-11.20 am	Application of Biotechnology in the Improvement of root and tuber crops	Dr. Nganga, CIP
11.20-11.40 am	Current Status of Biotechnology Applications in Plant Improvement	Mrs Florence Wambugu, NARC, Muguga
11.40-12.00	Future Trends in Biotechnology and the role of universities in manpower development	Prof. Walthaka, University of Nairobi
12.00-12.20 am	Role of Biotechnology in the Production of Root and Tuber Crops in Kenya	Mr. Njoroge, Potato Research Centre, Tigoni
12.20-12.40 am	Potential Role of Biotechnology in the Production and Improvement of Cereal Crop Production in Kenya	Dr. Oggema, NPBR, Njoro
12.40-1.00 pm	Discussion	
1.00-2.00 pm	Lunch	

SESSION III - Chairman, Prof. Walthaka

2.00-2.20 pm	Biotechnology in Plant Germplasm Conservation and Distribution	Mr. Seme Gerebank, NARC, Muguga
2.20-2.50 pm	Advances in Plant Biotechnological Research and Application in KEFRI	Dr. J. Mwangi, KEFRI
2.50-3.10 pm	Potential Applications of Biotechnology in Maize Breeding for Kenya	Mr. Ochieng, NARC, Kitale
3.10-3.30 pm	Coffee/Tea Break	

SESSION IV - Chairperson, Mrs F. Wambugu

3.30-3.50 pm	The Use of Biotechnology in Crop Protection	Mr. Self, NAL, Nairobi
3.50-4.10 pm	Challenges in Sorghum Improvement for Kenya where Biotechnology might assist	Mr. Ochara, WARC, Alupe
4.10-4.30 pm	Biotechnology Application in Protection of Plants From Insect Pests	ICRPE Representative
4.30-5.00 pm	Discussion	
7.00 pm	Cocktail - Silver Springs Hotel	All participants and invited guests

Friday, 26th May, 1989

SESSION V - Chairman, Dr. Mwangi

9.00-9.20 am	The Use of Biotechnology to Increase Pyrethrum Production in Kenya	Mr. Ottaro, NPRC, Molo
9.20-9.40 am	The Role of Biotechnology in Horticultural Research in Kenya	Mr. Madumadu, NARC, Thika
9.40-10.00 am	The Use of Biotechnology in the Enhancement in Nitrogen Fixation in Plants	Dr. Nancy Karanja, NARC Muguga
10.00-10.15 am	Coffee/Tea Break	

Preparation of Paper - a lot of
Use of mycorrhiza
V. al

SESSION VI - Chairperson, Mrs F. Wambugu

- 10.15-10.35 am *Advances In Plant Quarantine Procedures: Important Applications of Biotechnology for Kenya* Dr. Okloga
- 10.35-11.45 am *Open Discussion*

Topics

1. Establishment of a Biotechnology Centre in KARI
2. Priority research areas that would be included in such an establishment
3. Resources required (e.g. personnel, equipment, supplies, information, etc)
4. Resources currently available
5. Coordination and collaboration within Kenya
6. Collaboration and linkages outside Kenya
7. Feasibility studies
8. Funding opportunities
9. Biotechnology Society of Kenya

11.45-12.00 noon *Break*

SESSION VII - Closing; Chairman, Mr. Rutto

- 12.00-12.20 *Workshop Summary* Dr. Mary Thomas-Compton
- 12.20-12.40 *Closing Speech - Establishment of Biotechnology in relation National Research Strategy* Dr. Wang'ati, NCST
- 12.40-1.00 pm *Closing Remarks* Chairperson
- Mrs. F. Wambugu
- 1.00-2.30 pm *Lunch*
- 2.30-3.30 pm *Plant Biotechnology Task Force Meeting:*
- Chairperson - Mrs F. Wambugu
- All Members of Organising Committee
- Invited guests

BIO-TECHNOLOGY CONFERENCE

Tentative Programme

Feb 25 - March 2, 1991

Sunday, Feb. 25

Registration

Venue: Marayatta Conference Centre

Monday, Feb. 26

A.M. Session I: Opening

0900 Welcome address: Chairman, KARI
Board Management

0910 Minister

0930 Mission Director, USAID

1000 Coffee Break

1030 Keynote address: Prof. S.O. Keya

1200 Lunch

P.M. Session II: Overview Papers

1400 Biotechnology and its Potential in
Plant Improvement E.C. Cocking

1430 Biotechnology and its
Potential in Animal Improvement
O. Ole Moi Yoi

1500 Tissue Culture for Propagation and
Production of Disease Free Plants
K. Maithaka

1530 Tea Break

1600 Animal Improvement Through Embryo
Manipulation and Transfer R. Maplettoft

1630 Discussion

Tuesday, Feb. 27

0900 Session III

0930 Biotechnology and Improvement of
Cattle Production

0900 Plant Protocols: Tissue Fusion and Somatic
Hybridization for Crop Improvement
O. Schieder

0930 In Vitro Cytoplasm Conservation,
Storage and Distribution, K. Kartha

1000 Discussion

1030 Coffee Break

1100 In Vitro Production of Plant Seco-
ndary Metabolites Y. Yamada

1130 Biological N₂ Fixation: Potential
for Maximizing Agricultural
Production S. O. Keya

1200 Discussion

1230 Lunch

P.M. Session IV:

**Biotechnology for Improvement of Animal
Vaccines**

1400 Prospects for Production of
Multivalent Vaccines
T. C. McGuire

1430 Genetically Engineered Viral
Vaccines T. Yilma

1500 Tea Break

1530 Progress Towards Production of
Vaccines against Tuberculosis
A. Musoke

1600 Progress Towards Production of
Vaccines against Other Haemo-
parasites G. Palmer

1630 Discussion

Wednesday, Feb. 28

A.M. Session V:

Animal Transgenics: Practical Applications

0900 Transgenics: Aids for Better
Diagnosis and Food Utilization
R. E. Hammer

0930 Transgenic Animals for
Generation of Bio-active
Products K. Ebert

1000 Discussion

1030 Coffee Break

1100 Monoclonal and Nucleic
Acid Probes in Disease
Diagnosis M. Liao

1130 Use of Restriction
Fragment Length Poly-
morphisms S. Davis

1200 Discussion

1230 Lunch

P.M. Session VI:

**Plant Transgenics: Practical
Applications**

1400 Transgenic Plants for
Resistance to Pests
R. N. Beachy

1430 Transgenic Plants for
Generation of Bio-active
Products J.I. Cohen

1500 Discussion

1530 Tea Break

1600 Simultaneous Workshop
Sessions on Potential for
Use of Transgenic Plants
and Animals

1630 Reporting and Discussion

Thursday, 1 March

P.M. Session VII:

**Private Sector and Biotechnology
Research**

0900 Role of the Private Sector
in Biotechnology R. Meussen

- 1000 Encouragement for Private Sector Participation in Agricultural Research D.N. Duvick
- 1005 Current Trends in Private Sector Animal Biotechnology Research D.E. Shaw
- 1010 Session VIII:

Workshop Concerns in Biotechnology Agricultural Research

- 1400 Development of Guidelines and Regulations for Biotechnology Research E. Jaworski
- 1430 Field Visitation to Bio-engineered Plant and Animal Products P. Hall
- 1500 Tea Break
- 1530 Simultaneous Workshops on Bio-safety Concerns and Regulations for Plants and Animals
- 1600 Summary and Recommendations

Friday, 2 March

A.M. Session VIII:

Internal Funding Agency Support of Biotechnology Research

- 0900 The Rockefeller Foundation's International Programme in Biotechnology G. Toenniessen
- 1000 World Bank Initiatives in Agricultural Biotechnology A. Pritchard
- 1100 Tea Break
- 1130 Workshop Session on Donor Agencies Support for Third World Agriculture Biotechnology Research

Plant Biotechnology Transfer
 J.M. Dodds Fax 51-14-351570
 1200 Office of International Centres
 Animal Biotechnology Transfer
 J. Doyle

P.M. Session IX:

Simultaneous Workshops on Kenya's Priorities for Plant and Animal Biotechnology

- 1400 Plant and Animal Workshops
- 1500 Tea Break
- 1530 Preparation of Each Workshop Conclusions and Recommendations
- 1600 Presentation of Workshop Summaries

Saturday, 3 March

A.M. Session X:

- 0900 Closing Ceremony

KENYA AGRICULTURAL RESEARCH INSTITUTE

NATIONAL CONFERENCE ON PLANT AND ANIMAL BIOTECHNOLOGY

February 25-March 3, 1990

KENYATTA INTERNATIONAL CONFERENCE CENTRE

Conference Objectives:

- To acquaint Kenyan scientists and officials with biotechnological advances and their potential in plant and animal science
- develop recommendations on priority areas for research
- draw up an action plan for establishing a biotechnology in Kenya for research and training