PN-ABD-256
62734

ROUTING AND TRANSMITTAL SLIP Date 8/17/89

TO: (Name, office symbol, room number, building, Agency/Post)	Initials	Date
1. PPC/CDIE, Library		
2.		
3.		
4.		
5.		

Action		File		Note and Return	
Approval		For Clearance		Per Conversation	
As Requested		For Correction		Prepare Reply	
Circulate	X	For Your Information		See Me	
Comment		Investigate		Signature	
Coordination		Justify			

REMARKS

Regional

Subject: 1 Seminar on the Role of Chemistry in Improving Food Supplies in Africa.

DO NOT use this form as a RECORD of approvals, concurrences, disposals, clearances, and similar actions

FROM: (Name, org. symbol, Agency/Post)	Room No.—Bldg.
Sandy Malone-Gilmer	306C SA-18
	Phone No. 875-5810

5041-102

OPTIONAL FORM 41 (Rev. 7-76)
Prescribed by GSA
FPMR (41 CFR) 101-11.206

* U.S. GPO: 1988 — 241-174

PN-ABD-256

CHEMRAWN II SEMINAR ON THE ROLE OF CHEMISTRY IN IMPROVING FOOD SUPPLIES IN AFRICA: Nairobi 17-20 July 1988

LIST OF PARTICIPANTS

(a) Overseas Participants

1. Prof. Cyril Ponnamperuma
Chairman
CHEMRAWN II Future Actions Committee
and Director
University of Maryland
U.S.A.

2. Dr. Bryant W. Rossiter
Chairman
CHEMRAWN Committee
International Union of Pure and Applied Chemistry

3. Sir Leslie Fowden
Director
Rothamsted Experimental Station
United Kingdom

4. Dr. Nyle C. Brady
Senior Administrator
Agency for International Development
Washington, D.C.

5. Dr. Aries Kovoor
Laboratoire de Physiologie de la Differenciation Cellulaire Vegetable
Universite Paris VII
France

6. Dr. J. Moore
Assistant Dean
International Activities
College of Life Sciences and Agriculture
University of Maryland
College Park, MD, 20742,U.S.A.

7. Dr. Lewis B. Williams
Regional Coordinator
African International Fertilizer Development Centre

8. Dr. Tshikala Tshibaka
Project Director
Fertilizer Policy in Africa
International Food Policy Research Institute
Washington D.C.

9. Dr. T.E. Shehata
Acting Director
International Affairs
University of Maryland
College Park
MD 20742
U.S.A.

10. Dr. Sylvan Witter
Director Emeritus
Michigan Agricultural Experiment Station
108 Agriculture Hall
East Lansing
Michigan, U.S.A.

11. Dr. David Mog
India Programme Officer
National Research Council
2101 Consittution Avenue, N.W.
Washington, D.C. 20418, U.S.A.

12. Dr. Hans Geissbuhler
Head
Ciba-Geigy Divisional Research and Development
Basel, Switzerland

List of Participants contd.

13. Professor Aleksandra Kornhanser
Director
International Centre for Chemical Studies
Edvard Kardelj University
Yugoslavia

14. Dr. M. Hassan
President
Third World Academy of Sciences
P.O. Box 586
STRADA COSTERA II
34100 TRIESTE, Italy

(b) Regional Participants

15. Professor Thomas R. Odhiambo
President and Chairman, African Academy of Sciences
Director
International Centre of Insect Physiology and Ecology
P.O. Box 30772
Nairobi, Kenya.
Telex: 22053

16. Professor C.J. Chetsanga
Chairman of Scientific Council of Zimbabwe and
Professor of Chemistry
University of Zimbabwe
P.O. Box MP 167
Mount Pleasant
Harare, Zimbabwe.
Telex: 4-152 ZW

17. Professor S.O. Keya
Dean, Faculty of Agriculture
University of Nairobi
P.O. Box 30197
Nairobi, Kenya

18. Professor M.N. Siamwinza
Deputy Secretary General
National Council for Scientific Research
P.O. Box CH 158 Chelston
Lusaka, Zambia

19. Dr. Henry Ssali
International Fertilizer Development Corporation
c/o ICRISAT
P.O. Box 776
Bulawayo, Zimbabwe
Telex: 3570 ICIUAID ZW

20. Professor J. Mukiibi
Faculty of Agriculture
Makerere University
P.O. Box 7062
Kampala, Uganda

21. Dr. Frank Attere
International Board for Plant Genetic Resources (IBPGR)
Regional Office for Eastern and Southern Africa
P.O. Box 30729
Nairobi, Kenya

22. Professor John Kyomo
Director
Southern Africa Centre for Cooperation in Agricultural Research (SACCAR)
Private Bag 00108
Gaborone, Botswana
Telex: 2752 SACCAR BD

23. Mr. Melaku Worede
Director
Plant Genetic Resources Centre
P.O. Box 30726
Addis Ababa, Ethiopia

Telex: 21460 GTZ FP/ET

24. Mrs. J. Maud Kordylas
Consultant
Arkloyds Food Laboratory
Laboratory for Research and Development of Tropical Food Products
B.P. 427
Douala, Cameroon
Telex: 5532 KN Novotel

2

List of Regional Participants contd.

25. Dr. Salah E.O. Mahgoub
Lecturer in Food Science and Nutrition
Dept. of Biochemistry and Soil Science
Faculty of Agriculture
University of Khartoum,
SHAMBAT, Sudan

26 Dr. Ahmed Hassanali
Head
Chemistry and Biochemistry Research Unit
International Centre of Insect Physiology and Ecology
P.O. Box 30772
Nairobi, Kenya
Telex: 22053

27. Professor L.A. Odero-Ogwel
FAO Representative
P.O. Box 3582
Monrovia, Liberia

Telex: 44539 FOOD AFRI L1

28. Dr. A. Pala Okeyo
Head
Social Sciences Interface Research Unit
International Centre of Insect Physiology and Ecology
P.O. Box 30772
Nairobi, Kenya.
Telex: 22053

29. Professor J.A. Odera
Director
Kenya forestry Research Institute
P.O. Box 74
Kikuyu, Kenya

30. Dr. L. L. Kiriama
Director
Technology Department
Centre for Agricultural Mechanisation and Rural
P.O. Box 764
Arusha, Tanzania

31. Dr. Kassiap Deepchand
Mautirius Sugar Authority
2nd Floor KEN LEE Building
Edith Cavell Street
Port Louis
Mauritius
Telex: 4887 SUGNUTH 1W

32. Professor Lydia P. Makhubu
Vice Chancellor and Head
University of Swaziland
Private Bag
Kwaluseni Campus
Mbabane, Swaziland
Telex: 2087 WD

33. Professor K.N. Saxena
Programme Leader, Crop Pests Research Programme
ICIPE Mbita Point Field Station
P.O. Box 30
MBITA
South Nyanza, Kenya

34. Dr. Walter Masiga
Director
OAU Inter Africa Bureau for Animal Research
P.O. Box 30786
Nairobi, Kenya

35. Professor Raphael M. Munavu
Dean, Faculty of Science
University of Nairobi
P.O. Box 30197
Nairobi, Kenya
Telegram: Varsity

36. Professor M.S. Ntamila
Regional Director
UNESCO Regional Office for Science and Technology
P.O. Box 30592
Nairobi, Kenya

List of Regional Participants contd.

37. Dr. Dean L. Haynes
Deputy Director
International Centre of Insect Physiology and Ecology
P.O. Box 30772
Nairobi, Kenya.
Telex: 22053

38. Professor Douglas Odhiambo
Vice Chancellor
Moi University
P.O. Box 3900
Eldoret, Kenya

39. Professor S.O. Wandiga
Deputy Vice Chancellor
University of Nairobi
P.O. Box 30197
Nairobi, Kenya

40. Dr. Francois Gasengayire
Director General of Scientific and Technical Research
Ministry of High Education and Scientific Research
B.P. 624
Kigali, Rwanda.

41. Dr. Maryan Farrah Warsame
The President
Somali Academy of Science and Arts
P.O. Box 1228
Mogadishu, Somalia
Telephone: 22493
Cable: SOMAC

42. Professor Chodziwadziwa C. Mjojo,
Head,
Chemistry Department
Chancellor College
University of Malawi
P.O. Box 280
Zomba, Malawi
Telex: 4742 or 4389

43. Dr. C.R.C. Migiro
Head
Dept. of Chemical and Processing Engineering
University of Dar es Salaam
P.O. Box 35131
Dar es Salaam, Tanzania.
Telex: 41561 UNIVIP

44. Dr. Annalee Ng'eny-Mengech
Senior Lecturer
Chemistry Department
University of Nairobi
P.O. Box 30197
Nairobi, Kenya.

45. Dr. Wilber Lwande
International Centre of Insect Physiology and Ecology
P.O. Box 30772
Nairobi, Kenya.
Telex: 22053

46. Dr. Ellie O. Osir
International Centre of Insect Physiology and Ecology
P.O. Box 30772
Nairobi, Kenya.
Telex: 22053

47. Dr. B.E. Grimwood
Natural Resources Adviser
British Development Division in Eastern Africa
P.O. Box 30465
Nairobi, Kenya
Telex: Nairobi 22219

48. Leo A. Arao
Regional Pesticide Adviser
US Agency for International Development
Regional Economic Development Services Officer for Eastern and Southern Africa (REDSO/ESA)
P.O. Box 30261
Nairobi, Kenya.

49. Professor H.M. Thairu
Chairman
Chemistry Department
Kenyatta University
P.O. Box 43844
Nairobi, Kenya

50. Dr. James O. Ochanda
Lecturer
Biochemistry Department
University of Nairobi
P.O. Box 30197
Nairobi, Kenya.
Telegrams: Versity Nairobi

51. Mr. N.V. Popat
General Manager
Oil Crop Development
East African Industries Limited
P.O. Box 30062
Nairobi, Kenya
Telex: 22507

52. Dr. J.A. Ogur
Department of Chemistry
University of Nairobi
P.O. Box 30197
Nairobi, Kenya.

53. Dr. F.J. Wangati
Secretary
National Council for
Science and Technology
P.O. Box 30623
Nairobi, Kenya.
Telegrams: SCIENCETECH

54. Professor R.J. Olembo
Deputy Assistant Executive
Director
Office of the Environment
Programme
United Nations Environment
Programme
P.O. Box 30552
Nairobi, Kenya
Telex: 22068 UNEP KE

55. Dr. D.A. Otieno
Scientific Secretary
International Council of Scientific
Unions
Committee of Science and Technology
for Developing Countries
Regional Office for East Africa
Moi University
P.O. Box 3900
Eldoret, Kenya.
Telex: 35047 MOIVARSITY

56. Dr. Ne Nganga Massamba
Academy Administrator
African Academy of Sciences
P.O. Box 14798
Nairobi, Kenya

Telex: 25066 DUDU

57. Dr. Fred Owino
Senior Visiting Scientist
International Council for Research
in Agroforestry (ICRAF)
P.O. Box 30677
Nairobi, Kenya.
Telex: 22048
Telefax: 521001

58. Dr. M.J.W. Cock,
Scientist-in-Charge
International Institute of
Biological Control
Kenya Station
P.O. Box 30148
Nairobi, Kenya.
Telex: 25510 DESLOC (KE)

59. Dr. R.W. Michieka
Faculty of Agriculture
Crop Science Department
P.O. Box 29053
Kabete, Kenya
Telegrams: VARSITY Nairobi

60. Ms. Mary W. Ngechu
Radio Lecturer
College of Adult and Distant Education
University of Nairobi
P.O. Box 30688
Nairobi, Kenya.

61. Professor John Kokwaro
Chairman
Botany Department
University of Nairobi
P.O. Box 30197
Nairobi, Kenya.

62. Dr. S. Essuman
International Centre of Insect Physiology and Ecology
P.O. Box 30072
Nairobi, Kenya.

63. Mr. George Imbanyi
Agricultural Technical Officer
National Youth Service Headquarters
P.O. Box 30397
Nairobi, Kenya.

64. Dr. N.K. Olembo
Senior Lecturer
Department of Biochemistry
University of Nairobi
P.O. Box 30197,
Nairobi, Kenya.

65. Dr. Mabel Imbuga
Department of Chemistry
University of Nairobi
P.O. Box 30197,
Nairobi, Kenya.

66. W.W. Wapakala
Director of Research
Kenya Agricultural Research Institute
P.O. Box 57811
Nairobi, Kenya.

67. L. Rittershans
Agricultural Attache
Royal Netherlands Embassy
P.O. Box 41537,
Nairobi, Kenya.

Volume 66, Number 46
C&EN 66 (46) 1-80
ISSN 0009-2347
NEWS
NOVEMBER 14, 1988

After six years, CHEMRAWN II still at work

Six years after CHEMRAWN II convened in Manila, its effects are still being felt. Africa is the latest recipient of followup efforts begun at the behest of the December 1982 international conference that dealt with the theme of "Chemistry and World Food Supplies: The New Frontiers."

"The role of Chemistry in Improving Food Supplies in Africa" was the focus of a seminar held last summer in Nairobi, Kenya. It was one of a series of regional seminars created by CHEMRAWN II.

Lack of food is an urgent problem in sub-Saharan Africa. Over the past two decades, Africa has dropped from a position of self-sufficiency into a deepening food crisis. For example, the World Bank estimates that per capita food production has fallen 20% in Africa since 1969, compared with increases of some 15% in Asia and Latin America.

It is this sort of situation that CHEMRAWN II was designed to aid. CHEMRAWN is an acronym for chemical research applied to world needs. The concept embodied in the acronym is an initiative of the International Union of Pure & Applied Chemistry.

The program got under way with a conference in Toronto in July 1978 on the topic of future sources of raw materials. The Manila conference (C&EN, Dec. 20, 1982, page 9) was succeeded by CHEMRAWN III in 1984 in The Hague on future sources of chemical feedstocks; CHEMRAWN V in 1986 in Heidelberg on chemistry's contributions to health; CHEMRAWN VI in May 1987 in Tokyo on advanced materials for innovations in energy, transportation, and communication; and the anomalously numbered CHEMRAWN IV in October 1987 in Keystone, Colo., on the chemistry and resources of the global ocean.

Early on, IUPAC recognized that if chemistry was to be brought to bear on world problems, more than just a meeting of scientists was required. Rather the whole system of human activity related to the problem had to be involved. Reflecting this approach, the CHEMRAWN II conference report, published in 1983, reviewed opportunities for chemical research to help developing countries in the areas of soils, plant chemistry, food processing, integrated farming, chemical analysis, and environmental monitoring.

For CHEMRAWN II, this thrust has been carried forward by a Future Actions Committee, formed by the organizers of the conference and charged to plan activities that would carry the results of the conference to the attention of scientists and policy makers in Africa, Asia, and Latin America. Chief among these activities is a series of regional outreach seminars on the subject of food and agriculture problems of developing countries. The first of these seminars was held in Colombo, Sri Lanka, in 1985, and the second in Buenos Aires in 1986.

The Nairobi seminar was organized locally at the International Centre for Insect Physiology & Ecology (ICIPE) and was cosponsored by ICIPE, the CHEMRAWN Committee of IUPAC, the African Academy of Sciences, the Third World Academy of Sciences, and the American Chemical Society. Financial assistance came from the CHEMRAWN Committee, the National Research Council in the U.S., and the U.S. Agency for International Development. Staff support was provided by ICIPE and the ACS Office of International Activities.

Staffer demonstrates intercropping method in African test plot operated jointly by Unilever Ltd. and the University of Nairobi

The seminar brought together nearly 80 scientists from Africa, Asia, Europe, and the U.S. Twelve African countries were represented. Cochairmen of the seminar were Thomas A. Odhiambo, president of the African Academy of Sciences and director of ICIPE, and Cyril Ponnamperuma, chairman of the CHEMRAWN II Future Actions Committee.

Food production in Africa depends heavily on the efforts of resource-poor small landholders, as many seminar speakers noted. The landholders are growing rapidly in numbers, but individual productivity is impeded by serious natural and socioeconomic barriers. Endorsing the broader recommendations of CHEMRAWN II, seminar participants agreed on a number of recommendations focusing on Africa. Among them:

- An infrastructure in biotechnology should be developed in Africa, an activity that will require establishing a regional training center.
- Policy makers in Africa should encourage client-driven research, defined as that focused on problems linked directly to local agricultural enterprises.
- An effective system of electronic communications should be established among African scientists to overcome the isolation experienced by those operating independently.
- Governments must find ways to eliminate or reduce import duties on the materials needed to set up an agrochemical industry in African countries.
- Governments must create programs for the education of local farmers; the important role of women in African agriculture must be recognized.
- Existing institutions in Africa should redouble their efforts in integrated pest management and biological control.

The next CHEMRAWN regional seminar on food supplies is planned for West Africa. It will take place in late 1989.

James Krieger

ABSTRACTS

REGIONAL SEMINAR ON THE ROLE OF CHEMISTRY IN IMPROVING FOOD SUPPLIES IN AFRICA

Nairobi, Kenya. 17-21 July 1988

Sponsors

African Academy of Sciences
CHEMRAWN Committee,
International Union of Pure and Applied Chemistry
American Chemical Society
International Centre of Insect Physiology and Ecology

8'

CHEMISTRY AND WORLD FOOD SUPPLIES: THE CHEMRAWN PROCESS

Dr. Bryant W. Rossiter,
Chairman, CHEMRAWN COMMITTEE,
International Union of Pure and Applied Chemistry,

CHEMRAWN, an acronym for CHEMical Research Applied to World Needs, is a major program of the International Union of Pure and Applied Chemistry. CHEMRAWN was created to provide leadership and an independent, non-political, central forum for the discussion of world needs amenable to solution through Chemistry. CHEMRAWN is more than a series of international conferences. It is a highly interdisciplinary process for the social, geo-economic, and environmental factors as well as the technical components involved.

CHEMRAWN II, the "INTERNATIONAL CONFERENCE ON CHEMISTRY AND WORLD FOOD SUPPLIES," was held in December 1982, Manila, Philippines, and was directed largely to the needs of developing nations. It was the first major international, interdisciplinary conference to bring together world leaders from governments, industries, academia, and international development organizations for the purpose of developing a strong sense of future research directions, designed to meet mounting food needs.

And what are these needs? Given present trends, world population will expand to more than 8 billion people by the year 2020. Superimposed will be the rapidly growing demands of a rising middle class for less efficiently produced and more costly diets. This means that in the next 40 to 50 years annual food production must be increased by two to three times that achieved since the dawn of agriculture 1200 years ago. This food challenge is one of the enormous complexity involving many technical, political, economic, and human factors. But many food experts are optimistic that we will be able to meet this challenge. This optimism is based on our growing understanding of the fundamental chemical processes that underlie food production, nutrition, stabilization, and storage. In short, many believe we stand at the edge of a new era where the complexities of the food system need no longer be an excuse for our failure to understand many basic chemical processes and to use them to the fullest extent possible for the benefit of all mankind.

ROLE OF THE INTERNATIONAL ORGANIZATION FOR CHEMICAL SCIENCES IN DEVELOPMENT (IOCD) IN IMPROVING AGRICULTURAL PRODUCTION

Sir Leslie Fowden,
Director. Rothamsted Experimental Station,
United Kingdom.

The International Organization for Chemical Sciences in Development (IOCD) was established in 1981 by a group of distinguished scientists as a non-governmental tax-exempt body. IOCD aims to foster international collaboration in the chemical sciences by seeking (a) to support the research of scientists in developing countries and thereby helping them to make useful contributions to the needs of their countries, and (b) to encourage the search for new chemical knowledge and to promote its application to urgent problem areas, e.g. population, health, medicine and agriculture, in developing countries. The administration, funding and working procedures used to encourage research will be described.

Three main programmes are being developed under the aegis of IOCD;

(i) synthesis of compounds directed to the regulation of male fertility;
(ii) synthesis of new agents for the treatment of tropical diseases, e.g. malaria, filariasis, trypanosomiasis, etc;
(iii) plant chemistry with applications to agriculture and medicine.

Aspects of the research will be presented briefly. To support this research, IOCD has organized analytical services centres and biological screening services for third world scientists who otherwise do not have access to such services.

LONG - TERM NEEDS FOR MANAGING NATURAL RESOURCES: SOILS, WATER, MINERALS, AND THE ENVIRONMENT

Dr. Nyle C. Brady,
Senior Assistant Administrator for Science and Technology,
Agency for International Development
Washington D.C., U.S.A.

There is a great variability in Africa's natural resources. Overall compared to Asia and Latin America, Africa is a relatively dry continent. Its water resources may be superabundant, as in the tropical forests of the Congo and deficient, as in large areas of the Sahel. Soil resources also vary greatly from the vast areas of highly leached acid soils to some relatively fertile valley soils. Forest and other woody resources are equally variable, ranging from the scrub bushlands or parts of the Sahel to the lush Tropical forests of parts of Zaire. The survival of a wide variety of biological species associated with African forests depends heavily on conservation efforts. While the mineral resources vary from area to area in Africa, they are not as abundant nor used to the same extent as those in Asia and Latin America.

The natural resources of Africa face a wide spectrum of use and misuse. Some Fertilizer deposits are underused or are not being used at all, and some mineral deposits that may have industrial uses are relatively undeveloped. Likewise, storage of water for irrigation is not well developed. The misuse of Africa's forest areas, meantime, extends from excessive destruction of tropical forests to deforestation caused by fuelwood and agricultural demands in the sub-humid to semi-arid areas. Deforestration results in soil degradation and depletion of water for crop production.

The widely used "slash-and burn" system of land use presents both social and natural problems of worldwide significance. Alley cropping, which keeps the soil surface covered, is one of the alternatives to this damaging agricultural practice that is being tested. Also, the use of moderate levels of fertilizers to improve crop productivity is being evaluated. African leaders and scientists are beginning to realize the full consequences of environmental degradation. Major efforts are needed in Africa to effectively conserve and wisely use the soil, water, forest, and mineral resources for human and economic development.

TISSUE CULTURE AS A TOOL FOR REFORESTATION AND AS A DETERRENT TO DISERTIFICATION

Dr. A. Kovoor,
Laboratoire de Physiologie de la Differenciation
Cellulaire Vegetale,
Universite Paris VII,
France.

CHEMRAWN II pointed out that in terms of area, drought stress constitutes 60 percent of the physical and chemical constraints to food production in the tropics. This is not a static constraint but a dynamic one, moving in the wrong direction. Some 1300 million hectares in the world are prone to forests getting savannized, savannas sahelized, and the Sahel desertified. In Africa alone, desertification gallops at 2 to 3 million hectares per year. The obvious counter-move of urgent and massive. Replanting may be assorted into three approaches: (a) winning back the desert, (b) deterring the savannah, and (c) consolidating the forest.

Plant biotechnology has made great strides, thanks to the solid ground of "in vitro" techniques on which it treads. Even without resorting to the sophisticated prospect of genetically manipulating plants, many of the simpler tissue culture practices of the last few decades can be of immense value in solving the problem that is facing us today.

ESTABLISHMENT OF REGIONAL RESEARCH AND TRAINING IN MOLECULAR BIOLOGY

Professor C J Chetsanga,
Chairman, Research Council of Zimbabwe,
Zimbabwe.

The exciting developments in molecular biology during the last 10 years have made an unprecedented impact on human society. The majority of the advancements in molecular biology have brought such exacting refinements in research methodologies that they have actually revolutionised biological experimentation.

5.

I shall summarize some of the new technological advancements that have resulted from the fundamental developments in molecular biology and illustrate how they gave rise to biotechnology. The field of molecular biology has not yet gained the needed momentum in Africa. I shall argue that both molecular biology and biotechnology are too important for Africa not to seek to urgently establish strong programmes in them. The importance of biotechnology lies in the fact that its experimental results can be readily tapped for industrial exploitation. This often results in very lucrative patents. In order for Africa to enter these exciting fields and make scientific impact, the case for the establishment of well equipped regional research and training centres is made. It is hoped that the combination of financial support by national governments and aid agencies will be provided to boost the emergence of strong research groups for these regional programmes.

DEVELOPMENT OF AN AGROCHEMICAL INDUSTRY IN AFRICA

Dr. Lewis B. Williams,
Regional Coordinator - Africa,
International Fertilizer Development Centre,
Muscle Shoals, Alabama, U.S.A.

Since Africa is composed of many countries having relatively small populations and small markets, it is a continent that presents distinct constraints to industrialization efforts. Because most available industrial technology has been developed in the larger countries having large populations and thus large markets, this know-how is usually not appropriate to meet the needs of the small African Countries.

The agricultural industry is no exception. Modern agricultural industries are in themselves either very sensitive to capacity (that is, to scale of operations) or dependent on by-products of industries that are sensitive to operating scale. The fertilizer situation in Africa South of the Sahara (excluding South Africa) illustrates the kinds of difficulties that are faced.

The first requirement in creating a viable fertilizer industry is to have positive Government policy that will support its development. The resolution of several important policy issues is required in order to develop a vital fertilizer industry.

Considering the region of Africa south of the Sahara as a whole, most basic raw materials are available in adequate amounts to serve all of its needs. If these resources are to be utilized, there are three available alternatives, these are:

1. Finding ways that regional plants with multiple-country participation can establish an adequate and growing market for their products;
2. Encouraging foreign investment and participation whereby during the early development stages much or even most of the production can be exported from the region;
3. Using or developing technology that utilizes, where possible, indigenous resources and that is not so sensitive to scale but is better adapted to conditions of small countries and small but growing markets.

Indigenous resources include personnel. Staff must be trained to manage all segments of a fertilizer industry. Procedures for increasing efficiency in the existing situation while advancing toward a modern fertilizer industry will be cited.

A new initiative to serve the fertilizer sector of at least West Africa and possibly Africa South of Sahara will be indicated. This undertaking will be an African fertilizer centre having close affiliation with the International Fertilizer Development Centre (IFDC) but also enough autonomy of direction and function that it will be dedicated solely to the problems of Africa concerning the production, marketing, and use of fertilizers for the benefit of agriculture. This African centre will promote the full utilization of indegenous resources wherever it is economically feasible.

PRESENT AND FUTURE SOURCES OF PHOSPHATIC AND POTTASSIC FERTILIZERS FOR AGRICULTURE

Dr. Henry Ssali,
Research Agronomist,
International Fertilizer Development Centre,
Bulawayo, Zimbabwe.

There are about 20 known phosphate deposits and 3 potassic deposits in the Eastern and Southern African Region. Only 2 of the phosphate deposits (and none of the potassic

deposits) are currently being exploited mainly because the majority of the deposits are of marginal quality and not amenable to conversion to conventional fertilizers. Furthermore, the phosphate rocks are relatively unreactive and hence unsuitable for direct application. Efforts to adapt technology to produce cheaper agronomically acceptable fertilizers e.g. partially acidulated phosphate rock, for local consumption are discussed. The Eastern and Southeastern African Fertilizer Management and Evaluation Network (ESAFMEN) through which the facilities and expertise of the International Fertilizer Development Centre (IFDC) are being shared to help countries of the region exploit indigenous agromineral deposits is used to illustrate how institutional linkages can promote the utilization of existing and/or adapted technology.

THE NEED AND OUTLOOK FOR NEW CHEMICAL AND NATURAL PESTICIDES

Dr. Hans Geissbuhler
Head, Agricultural Research and Development Division,
CIBA-GEIGY,
Basel Switzerland

Medium- and long-term agricultural programs recently proposed by the organization of African Unity and the Food Agricultural Organization emphasize the high priority for increasing the local production of staple food crops in African countries and for bringing this production into the proper balance with export or cash crops. Chemical and biological plant protection inputs can make significant contributions to this objective provided they are consciously and intelligently adapted to fit the corresponding production techniques.

These techniques include conservation farming methods (mixed cropping, reduced tillage, etc) and the exploitation of traditional crops (millet, sorghum, cassava, etc) in order to avoid soil erosion, contamination, water degradation, and desertification. In addition, the chemical and biological plant protection inputs must be sufficiently simple, practical, economical, and safe to be useful to the small farmer.

While many of the already available chemical and biological control agents are technically and economically well suited to fulfil the needs and objectives outlined above, there are a number of new chemicals and biologicals under development that will offer more flexibility and safety and even alternative approaches.

In weed control, the observance of thresholds and the use of low rate concepts and compounds, post-emergent control agents, and safeners (antidotes) is making continuous progress.

In crop growth control, recent inhibitors and retardants allow a more rational and efficient approach to vegetation management.

In disease control, the structural variety of low-rate systemic compounds is expanding, which permits strategies for preventing resistance development as well as efficient exploitation of seed application and mobilization of plant-defense mechanisms.

In insect control, growth and hormone-regulators will provide improved selectivity, and pheromones will allow more judicious and localized insecticide placement.

These advances are accompanied by substantial progress in pest and residue monitoring, forescasting and formulation design and application technology, all of which will assist in the gradual implementation of Integrated Pest Management.

BIOCONTROL STRATEGIES FOR THE LIMITED-RESOURCE FARMER

Prof. J. Mukiibi,
Dean, Faculty of Agriculture,
Makerere University
Kampala, Uganda.

Many biological agents with the potential to control pests of crops and animals in the farming systems practised by resource limited farmers are available. However, by its very nature, biocontrol is not a measure which can be practised by farmers on an individual basis. Hence its success is Eastern and Southern Africa would depend on:

(a) The establishment of active national biocontrol programmes (NBCP);

(b) The establishment by NBCP's, of collaborative links with several international research organizations working in the area of biocontrol especially in research on the bionomics of parasitoids and on molecular biology;

(c) The development of mass rearing or mass culturing techniques;

(d) The determination of the most favourable conditions for the establishment and release of parasitoids;

(e) In the case of entomopathogens, the development of the most suitable methods for storing inoculum;

(f) The development of appropriate formulations for the application of entomopathogens; and

(g) The creation of appropriate integrated pest management systems incorporating biocontrol.

THE PRESERVATION AND IMPROVEMENT OF GERMPLASM : AN OVERVIEW

Dr. A.F. Attere,
International Board for Plant Genetic Resources,
Regional Office for Eastern and Southern Africa,
Nairobi, Kenya.

Genetic resources activities are becoming an important component of research activities in Eastern and Southern Africa, especially following the catalytic role played by the International Board for Plant Genetic Resources since its inception. The IBPGR has played an active role in the collection, conservation and utilization of germplasm in the region.

During the past few years, more than 50 collecting missions, to collect major genetic resources, were funded and organized in collaboration with national and international organizations. Various conservation structures were rehabilitated or established in several countries. Systematic characterization and documentation was initiated.

17

More than 80 research staff in the region were trained for plant genetic resources activities. The promotion of coordinated action at national level has led to the emergence of national genetic resources programmes in several countries and this is now leading to the establishment of a collaborative regional network in Southern Africa.

The International Agricultural Research Centres (IARCs), in close collaboration with the existing breeding programmes, are greatly contributing to the utilization of the resources by making available to farmers in the region improved material of their mandate crops, derived from the germplasm collected in the region.

A COORDINATED EFFORT TO IMPROVE AND PRESERVE ANIMAL GERMPLASM IN EASTERN AND SOUTHERN AFRICA

Prof. M.L. Kyomo,
Director,
Southern African Centre for Cooperation,
in Agricultural Research,
Gaborone, Botswana

Domesticated animals contribute to people food, fibre and skins, farm power, manure, cultural and sport activities. The indigenous livestock found in Eastern and Southern Africa region like elsewhere in developing countries have been neglected, despite their high adaptability to the environments in which they are found, and instead exotic breeds have been imported for pure breeding or indiscriminate cross breeding. The indigenous breeds and types are numerous in the region and if planned improvements and conservation programmes can be developed, greater economy and other gains will be realised by the farmers and governments. The environment in which these animals have survived and continued to reproduce for centuries, is prone to frequent droughts and high incidences of pests and diseases. They have, therefore, a valuable reservoir of genes which could be used for incorporation into high yielding breeds of the future. Investigations into the yield traits in these animals, have shown that there is a lot of variation, and continuous selection could lead to the development of valuable strains as it has been the case with the Boran for beef and the Blackheaded Persian sheep for mutton.

A sub-region of Africa, namely the Southern African Development Coordination Conference (SADCC) has developed a regional project on the conservation of crop and forest seeds. This regional genebank will be supported by national genebanks in nine member states. National Plant Genetic Resources Committees will be established in order to plan activities of national and regional levels on: exploration and collection, characterization, evaluation, rejuvination, multiplication and documentation of indigenous and exotic plant genetic resources material, exchange of germplasm for breeding purposes and general information on the subject and networking in general.

It is expected, therefore, that there will be a horizontal development of the discipline of conservation and improvement of plant genetic resources across the region. It is being recommended that because there is also a great danger of losing through the disappearance (erosion) of indigenous breeds of livestock, a regional project on the conservation and improvement of animal germplasm be developed. FAO Expert Consultation on Animal Genetic Resources Conservation and Management recommended in 1981 the development of such projects at regional and national levels. At national levels the activities recommended are: evaluation, genetic improvement, monitoring and conservation. At regional level the activities are: evaluation, monitoring, networking including information services, establishment and development of breed organisations and development of regional semen and embryo banks. They also recommended activities at inter-regional and international levels mainly in the area of exchange of information on progress related to the activities of national and regional levels. It is being recommended in the paper that success in improvement and conservation of indigenous animals for the benefit of present and future generations will come about if action was first initiated and strengthened at the national level.

19

DEVELOPMENT OF DROUGHT-RESISTANT CROPS

Mr. Melaku Worede,
Director,
Plant Genetic Resources Centre,
P.O. Box 30726,
Addis Ababa, Ethiopia.

Drought is one of the primary factors in depressing yield in chronic areas and in destabilizing crop production in drought prone areas. Breeding for drought resistance is a pre-requisite to raising yield potential in those areas. Successful breeding strategies must include consideration of local agroclimates and quantitative responses of the existing germplasm. Various plant breeding systems and strategies that appear to have merit in drought prone production areas are examined and discussed. The need for extensive collection and mass screening as well as multi-location testing of germplasm and pre-breeding work, is stressed. Cooperative roles pertaining to a national/regional network of such activities are also discussed.

FOOD PRESERVATION, FOOD PROCESSING AND QUALITY CONTROL

(SETTING UP AN EFFECTIVE R & D SYSTEM TO STIMULATE DEVELOPMENT OF THE FOOD SECTOR)

Dr. J. Maud Kordylas,
Arkloyd's Food Laboratory,
Laboratory for Research and Development
of Tropical Food Products,
Cameroon.

The paper looks at the development of the food sector in Africa which has been based on a policy of import substitution, and implemented through indiscriminate importation of foreign technology. It argues that the policy has been very costly to the importing countries and has caused a chronic dependency on the exporting countries for equipment maintenance, management, spare parts and in some cases for the supply of raw materials. At best the

action taken has succeeded in superimposing a sophisticated, unstable and an illusionary industrial growth upon a largely underdeveloped base, which does not have the technical infrastructure to support such a high technological system. the structure thus imposed have failed to bring about a genuine development to the people.

Most African countries now find themselves with foreign exchange problems and have accumulated high levels of foreign debts which is bringing about a rethinking. Difficulties experienced by the food sector are being transmitted to the people. This has stimulated a search for appropriate information on food processing technology. People are looking for skills that would enable them to set up food processing industries at their own level. The paper proposes an R & D system for the food sector which combines Agricultural Research, Food Research and Training into one unit. The proposal is detailed and advantages of the combined system are discussed.

PRESERVATION AND PROCESSING OF PERISHABLE FOOD CROPS

Dr. Salah E. O. Mahgoub,
University of Khartoum,
Department of Biochemistry and Soil Science,
Faculty of Agriculture,
Shambat, Khartoum, Sudan.

Programmes for increased food production have been numercus and long standing. However, the general awareness of the potential contribution to available food supplies by the reduction of post-harvest food losses is more recent. It is found that it is much easier to increase food supply by 10-20% by reducing losses than it is to improve the yield of food crops by a few per cent.

The magnitude of loss is highly variable. It is estimated that about ¼ of the world's food production is lost after harvesting. Losses occur where food is grown, during distribution, storage, processing and marketing and in the home. Perishable foods (e.g. fruits and vegetables) are more affected. Losses are more important in developing countries. The forms of loss include reduction of nutritive value as well as quantitative and qualitative losses. Causes of loss and the control of it are outlined and discussed.

Despite the availability of several methods of food preservation such as drying, canning, freezing and fermentation, huge losses still occur in many parts of the world especially in tropical zones where most developing countries are situated. There is therefore a need for new technologies and the improvement of existing ones to suit local conditions of each country. This will both help reduce food losses and make use of seasonal surpluses. The paper discusses what needs to be done in this direction and the measures to be followed to reduce loss. Home-scale food processing and preservation, the development of new inexpensive packaging material, the possible utilization of food irradiation and the improvement of storage facilities are among these measures. Some suggested recommendations are also discussed. The probable future directions in R & D are suggested to go along three lines: technology transfer, regional and international cooperation and innovative technologies. Research needs, and some aspects of R & D are discussed within this context.

THE USE OF NATURAL PRODUCTS IN CROP AND LIVESTOCK PROTECTION: IMMEDIATE AND LONG-TERM PROSPECTS

Dr. A. Hassanali,
Head, Chemistry & Biochemistry Research Unit,
International Centre of Insect Physiology and Ecology,
P.O. Box, 30772,
Nairobi, Kenya.

Two categories of natural products with potential for use in pest management are discussed:

(a) Secondary metabolites isolated from "wild" plants which have also played an important role in traditional medicine and methods of protection against pests;

(b) Secondary compounds which mediate host-predator relationships and the chemical communication systems of the predators.

In Africa, communities in different locations have evolved their own grain protection strategies based on specific situations in their areas and the flora available around them. Unfortunately, these practices remain largely undocumented and the scientific rationale for their continued use has remained, by and large, uninvestigated. The need to take these practices seriously will be

demonstrated by reference to a recent study at ICIPE on the leaves of Ocimum suave and the flower buds (cloves) of Eugenia caryophyllata used as traditional crop protectants.

Recent isolation in limited screening programmes of a variety of antipest agents attests to the existence of yet untapped resources of bioactive compounds from African plants. A number of promising agents are now available for use in crop protection including vegetable oils for stored grain, limonoids and rotenoids for pre- and post-harvest crop protection, etc.

In the longer term, a thorough study of the chemical ecology of pests and disease vectors coupled with imaginative uses of the "ecochemicals" is likely to generate novel means of protecting crops and livestock. This will be illustrated by reference to a parasitic weed (Striga), a disease vector (tsetse fly) and a crop pest (Chilo partellus).

For natural products chemists in Africa the above promises represent an opportunity to contribute directly to solving agricultural and food problems. To effectively do so, however, would depend not only on the research facilities in hand but also on new approaches to natural products research, and on closer intellectual and collaborative associations with biological colleagues.

SOCIOECONOMIC FACTORS AFFECTING CROP AND HUSBANDRY PROGRESS

Dr. Tshikala B. Tshibaka,
Africa Sector Studies,
The International Food Policy Research Institute,
Washington, D.C.
U.S.A.

Population growth is increasing the pressures on land resources in many areas of Africa, leading to intensive use of land with subsequent fall in soil fertility. In sparsely populated zones, the shifting cultivation mode of production is destroying large areas of forest, presenting a threat to the ecology of this region of the World prone to desertification. The food sector in this part of the world is characterized overall by low land and labor productivities.

Many studies in Tropical Africa have found that fertilizers coupled with appropriate land management can stabilize farm fields, increase the long-term productive capacity of land,

and enhance the use and the productivity of labour.

Currently, the ability of policy makers in most African Countries to devise a policy framework that can promote a fertilizer intensive agriculture is largely constrained by lack of in-depth analysis about how key policies influence the supply and demand of fertilizers and other technology-carrying inputs. Henceforth, research on fertilizer use has to be comprehensive to provide policy makers with data for effective policy formulation.

REGIONAL PERSPECTIVES ON SOCIO-ECONOMIC CONSTRAINTS TO FOOD PRODUCTION AND USE: THE CASE OF AFRICA

Prof. L.A. Odero-Ogwel,
FAO Representative,
Monrovia, Liberia.

The dismally poor performance of the food sector within the context of agricultural and overall economic development in Africa and the concomitant and recurrent food crisis on the continent have been a major pre-occupation of African governments and the international community as a whole. This paper is an attempt to document and analyse the socio-economic constraints which have been behind this stagnation and decline for nearly two decades.

While the international economic and political climate, Africa's farming environment as well as natural and man-made disasters are cited as constraints contributing to the worsening of food and agricultural trends, these are regarded merely as predisposing and aggravating causes. The paper argues that the main brunt of the blame falls squarely upon African governments themselves. By underestimating the effort required to develop food and agriculture and by abetting the development bias against the sector and altogether perpetuating the long neglect of smallholder farming, African governments have hampered the release of development potential, thwarted social change and retarded progress. An examination of a wide range of constraints, policy issues as well as of the patterns of public investment and expenditure in African agriculture bear testimony to this indictment.

What hope is there for Africa? The answer to this seemingly intractable question is attempted by documenting a few success stories and analyzing the region's potential to feed its people. Policy options and measures required to

overcome the formidable constraints abounding in the African food and agriculture sector and to lay the foundation for economic recovery and sustained growth and development are proposed and addressed, as food for thought, to those concerned with the critical and urgent task of turning the tide of growing hunger, malnutrition and poverty in the region.

ASSIMILATION OF NEW AGRICULTURAL TECHNOLOGY: FARMERS' PERSPECTIVES

Dr. A. Pala Okeyo,
Social Anthpologist,
Head, Social Science Interface Research Unit
International Centre of Insect Physiology and Ecology,
Nairobi, Kenya.

The central thesis of this presentation is that understanding the cultural context into which new or improved technology may be assimilated provides important insights on farmers' perspectives on new technology. With regard to agriculture key aspects of the cultural context include **knowledge base** (or cumulative experience and experimentation); **social structure** (organization of society for production); **language** (the medium of knowledge transmission); and **time**.

Taking Africa as a reference point, the paper questions three prevailing assumptions that (a) African technological development can be grounded on exogenous cultural foundations i.e. that Africa only needs "new" technology and that technology from other cultures is value free; (b) investment in strengthening endogenous knowledge base and farming culture is not a major development priority; and (c) that farmers are merely being expected to respond to technology coming from outside their environment. Illustrative examples to support the central concern are drawn from agricultural research in the region.

CONSTRAINTS OF ENERGY IN AGRICULTURAL DEVELOPMENT - TANZANIAN EXPERIENCE

Dr. L. L. Kiriama,
Director of Technology Development,
Centre for Agricultural Mechanisations and Rural Technology
Arusha, Tanzania.

The paper reviews the trend of agricultural development in Tanzania. Energy constraints in agriculture with special reference to Tanzanian small holders are discussed. The three levels of technology namely handtool, animal power and mechanical power are considered together with their associated problems.

The cost of conventional energy sources is ever rising hence calling for development of renewable energy technologies.

Proper choice and management of technologies may ensure efficient use of the available energy resources.FOREST

MANAGEMENT FOR WOODFUEL

Dr. J. Odera,
Kenya Forestry Research Institute,
P.O. Box 20412,
Nairobi.

Biomass-based energy which is currently the most important form of energy in all developing countries, is derived almost entirely from combustion of woodfuel, crop residues and animal dung. Woodfuel comprising charcoal and fuelwood accounts for over 90 per cent for domestic purpose, and 77 per cent of the total energy used in Kenya.

This heavy dependence on woodfuel has led to widespread deforestation, land degradation and instances of desertification in some areas. Evidence presented show that stocks are currently being cropped to help meet the growing demand. In 1980 fuelwood requirements alone was estimated at about 20.6 m tonnes per annum, and is estimated to rise to 29 m tonnes in 1990, and to 40 m tonnes in the year 2000; against an estimated supply of only 13 m tonnes annually.

It is noted that woodfuel shortage has not yet been addressed concertedly because it lacks the photogenic characters of famine. Although the rather unplanned and sometimes indiscriminate use of our forest resource has brought the country to the brink of environmental disaster, the growing deficit in the supply of woodfuel, a basic need, has not attracted as much attention as the petroleum based energy crisis of early seventies or the food shortage of the early eighties.

The paper discusses the recent initiatives by the government and other agencies in providing sustained supply of wood energy resources without causing forest destruction. A number of options for improving productivity within existing land use alternatives including improvement of per unit land and labour yield within the existing forest area through genetic tree improvement and silvicultural mainpulation strategies; expansion into the marginal arid and semi-arid land areas; and the development of farm forestry and agroforestry systems are examined.

In a final chapter the paper presents a five point plan advocating the pursuit of:

(a) a strong research and development programme covering development of improved cultivars and clones of provenances and species suited to the planting sites, simple establishment and production management protocols;

(b) promulgation of woodfuel energy policy and legal reforms consistent with the management of private forests and trees in trust land areas, and government forests;

(c) education and training;

(d) development of more efficient packages for the utilization of wood;

(e) substitution of woodfuel energy

under a nationally coordinated programme to ensure sustainable self sufficiency in the production of woodfuel for all times.

FUEL FROM FERMENTATION PROCESSES: BIOGAS AND ETHANOL

Dr. Kassiap Deepchand,
Chairman,
The Mauritius Sugar Authority,
Port-Louis, Mauritius.

Fermentation of biomass for the production of energy carriers such as ethanol and biogas is to-day a worldwide trend to alleviate the energy problem faced by oil importing developing countries. The first part of this paper relates to biogas. The anaerobic digestion process is first described and factors like potential raw materials, digester loading, starter culture, pH, temperature, nutrients and agitation, which affect the digestion process, are discussed. Experience at the University of Mauritius using cow dung and sugar cane fibrous products are highlighted. Uses of biogas and some economic aspects of the process using an Indian KVIC model and a locally designed overground metallic digester are also considered.

The second part of the paper deals with ethanol. The fermentation process and potential yield, the raw materials, the production technology, the economics of ethanol production from molasses diluted with juice from sugar cane tops and leaves, the uses as fuel for cooking, in internal combustion engines and boilers and some economic implications are discussed.

Although, under the current circumstances of low international prices of fossil based energy carriers, these fuels are not attractive, it is felt that, in the long term, energy strategies based on these indigenous resources would be beneficial economically, socially as well as politically.

EDUCATION FOR AGRICULTURAL DEVELOPMENT

Prof. Aleksandra Kornhauser
Faculty of Science and Technology
Edvard Kardelj University
Ljubljana, Yugoslavia

Among the main problems of mankind - lack of food and energy, diseases, pollution, population explosion - lack of food seems to have many promises for solution through research. Science offers new knowledge against starving and malnutrition, combined with more care for the environment. Biological life cycles are better understood, and thus they can be more efficiently controlled. Hormones, pheromones and selfdefense structures combined with a carefully planned nutrition, give promising results. Products and techniques for more efficient pest control are being developed. Improvements have been achieved not only in food production, but also in food preservation, conservation of soil nutrients, and better use of energy in agriculture. Food from the sea makes an essential contribution to world food production, and biotechnology offers a whole range of new approaches to the food problem.

Science is the greatest opportunity of mankind. However, it is only a promise when transferred to the minds and activities of many people. For this, a better education for agricultural development is needed.

Education for development means a careful selection of content, bearing in mind the state-of-the-art in science and technology. It also means introducing powerful methods and techniques for trhe development of problem solving abilities, the needs of countries, in particular of developing ones, also require a much better education for action, often called development of entrepreneurship. Examples of these approaches will be given, and some results in introducing them reported.

REGIONAL COOPERATION IN EDUCATION FOR ACCELERATED DEVELOPMENT

Professor Lydia P. Makhubu,
Vice Chancellor,
And Head, Chemistry Department,
University of Swaziland.
Swaziland.

The high level of investment in education by all African countries in the past 20 - 30 years has derived from a recognition that education is a prerequisite to economic development. The latter part of these years has been marked by social, political and economic upheavals which have almost eroded past development gains and frustrated progress. At this same time, major scientific and technological advances with a potential to accelerate African development have emerged elsewhere in the world. However, in order to harness these advances in the solution of urgent problems and in the long-term furtherance of development strategies, diverse expertise and infrastructure which are beyond the capability of a single country are required. Regional cooperation in education to intensify the production and exchange of specialists and the sharing of facilities has become imperative, if the continent is going to accelerate its pace of development.

POCKETS OF SUCCESS: HARBINGERS TO EMULATE

Dr. Sylvan H. Wittwer,
Director,
Agricultural Experiment Station
Michigan State University,
East Lansing, Michigan,
U.S.A

The presentations during this three-day seminar have focussed on the role of chemistry for improving food supplies for African nations through the use of new production and utilization technologies, improved agricultural infrastructures, dealing with socio-politic economic constraints, and by developing educational and training programs for human resource development. My paper identifies "pockets of success" and describes how applications of science and technology and training programs in many countries have markedly improved food supplies and

have been a source of income through foreign trade. Similar approaches relating to these models for success might be helpful for African nations.

"Pockets of success" will be illustrated by the production of grain in India's Punjab, wheat in Turkey, rice in Colombia, hybrid cotton in India, hybrid corn in the U.S.A., and maize in Mexico's Yaqui Valley and also by the "Masangana 99 Project" of the Philippines, the "Comilla Project" in what is now Bangladesh, and the White (milk) Revolution or "Operation Flood" in India's Gujarat. Additional examples will include production of cotton, wheat, and rice in China, rice in Indonesia, cassava, yams, and cowpeas in Nigeria and other nations, maize in Zimbabwe and Egypt, strawberries in California, asparagus, tomatoes, and wax apples in Taiwan, witloof chicory and leeks in Belgium, corn and wheat in the European Economic Community, tropical soybeans for Africa, beef in Central America, "canola" for Canada, and oil palm in Malaysia.