Oil crops: sesame and sunflower subnetworks

Proceedings of the joint second workshop held in Cairo, Egypt,
9–12 September 1989
The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre’s activity is concentrated in six sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; earth and engineering sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre’s headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

Le Centre de recherches pour le développement international, société publique créée en 1970 par une loi du Parlement canadien, a pour mission d’appuyer des recherches visant à adapter la science et la technologie aux besoins des pays en développement; il concentre son activité dans six secteurs : agriculture, alimentation et nutrition; information; santé; sciences sociales; sciences de la terre et du génie et communications. Le CRDI est financé entièrement par le Parlement canadien, mais c’est un Conseil des gouverneurs international qui en determine l’orientation et les politiques. Etabli à Ottawa (Canada), il a des bureaux régionaux en Afrique, en Asie, en Amérique latine et au Moyen-Orient.

El Centro Internacional de Investigaciones para el Desarrollo es una corporación pública creada en 1970 por el Parlamento de Canadá con el objeto de apoyar la investigación destinada a adaptar la ciencia y la tecnología a las necesidades de los países en desarrollo. Su actividad se concentra en seis sectores: ciencias agrícolas, alimentos y nutrición; ciencias de la salud; ciencias de la información; ciencias sociales; ciencias de la tierra e ingeniería; y comunicaciones. El Centro es financiado exclusivamente por el Parlamento de Canadá; sin embargo, sus políticas son trazadas por un Consejo de Gobernadores de carácter internacional. La sede del Centro está en Ottawa, Canadá, y sus oficinas regionales en América Latina, Africa, Asia y el Medio Oriente.

This series includes meeting documents, internal reports, and preliminary technical documents that may later form the basis of a formal publication. A Manuscript Report is given a small distribution to a highly specialized audience.

La présente série est réservée aux documents issus de colloques, aux rapports internes et aux documents techniques susceptibles d’être publiés plus tard dans une série de publications plus soignées. D’un tirage restreint, le rapport manuscrit est destiné à un public très spécialisé.

Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.
OIL CROPS:
SESAME AND SUNFLOWER SUBNETWORKS

Proceedings of the Joint Second Workshop
held in Cairo, Egypt, 9–12 September 1989

Edited by
Abbas Omran
Technical Adviser, Oil Crops Network

Organized by
Agricultural Research Centre, MOA, Giza, Egypt
and
International Development Research Centre, Canada

Sponsors
Food and Agriculture Organization, Industrial Crops and European Office, Rome
International Bureau of Plant Genetic Resources, Rome
International Development Research Centre, Canada

Scientific and Organizing Committee
Dr Abbas Omran
Dr Badr A. El-Ahmar
Dr Eglal Rashed
Material contained in this report is produced as submitted and has not been subjected to peer review or editing by IDRC Communications Division staff. Unless otherwise stated, copyright for material in this report is held by the authors. Mention of proprietary names does not constitute endorsement of the product and is given only for information.
FOREWORD

In September 1989, the Sunflower and Sesame subnetworks held their bi-annual meetings in Cairo, Egypt. The meetings were well attended and papers, presented in these proceedings, provide a very informative overview of some of the cropping systems, management practices, production constraints and research highlights for both crops in several countries.

Chronic edible oil deficit is a major problem facing many developing countries in Africa and Asia where most countries are forced to import large quantities to satisfy the requirements of their growing populations. With the present rates of population increase and the improvement of nutrition standards it is likely that the consumption of edible oil will rise over the years, increasingly drawing on scarce foreign exchange for the importation of this vital food staple. For this reason, several countries have opted to increase self-sufficiency in edible oil.

Production deficits are due to a number of factors, among which neglect in oilcrops research, in both developed and developing countries has been a major one. This is particularly true for minor crops such as sesame. In the context of the IDRC oilcrops network, initiated in 1981, the interchange of information and the sharing of results between scientists have proved to be very useful and beneficial for the generation of scientific knowledge and the stimulation of research in this important area. It is hoped that conclusions and recommendations of this meeting will stimulate further research and development in the future.

A second important reason for limited national production has been the exceptionally low levels of world prices for oils and fats in the 1980's and the comparative advantage of importation over production for developing countries. The description of a case study using a system's approach to analysis the Vegetable Oil/Protein System of Kenya has stirred much interest during the Cairo meetings and it is hoped that similar work can be carried out in other countries in the future.

The Cairo meetings will also unfortunately be remembered as the one which has witnessed the diagnosis of the fatal disease of late Dr. Hiruy Belayneh, Chairman of the Brassica Subnetwork. We will all regret his absence.

On behalf of IDRC and of all participants, I would like to thank the Government of Egypt for its hospitality, the organizers for the excellent arrangements and all those who contributed to the success of these meetings by their presentations and discussions.

Eglal Nached,
Senior Program Officer,
IDRC, Cairo
# CONTENTS

<table>
<thead>
<tr>
<th>Forward</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Participants</td>
<td>vi</td>
</tr>
<tr>
<td>Introduction</td>
<td>ix</td>
</tr>
</tbody>
</table>

## Part 1. SESAME SUBNETWORK - II

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sesame Genetic Resources: Collection, Evaluation and conservation</td>
<td>2</td>
</tr>
<tr>
<td>AMRAM ASHRI</td>
<td></td>
</tr>
<tr>
<td>Sesame Research in the Sudan</td>
<td>10</td>
</tr>
<tr>
<td>MOHAMED EL-HASSAN AHMED</td>
<td></td>
</tr>
<tr>
<td>Progress in Sesame Research in Ethiopia</td>
<td>13</td>
</tr>
<tr>
<td>HIRUY BELAYNEH, BULCHA WEYESSA AND ELIAS URAGE</td>
<td></td>
</tr>
<tr>
<td>A Brief Outline of Sesame (Sesamum Indicum L.) Research in Tanzania</td>
<td>17</td>
</tr>
<tr>
<td>J.Y CHAMBI AND E.M. KAFIRITI</td>
<td></td>
</tr>
<tr>
<td>Scope of Sesame (Sesamum Indicum) in Pakistan</td>
<td>21</td>
</tr>
<tr>
<td>MUHAMMAD ASLAM, MASOOD A. RANA AND M. SIDDIQUE MIRZA</td>
<td></td>
</tr>
<tr>
<td>Status of Sesame as Oilseed in Bangladesh</td>
<td>24</td>
</tr>
<tr>
<td>M.A. KHALEQUE AND HASINA BEGUM</td>
<td></td>
</tr>
<tr>
<td>Problems and Progress of Sesame Production In India</td>
<td>27</td>
</tr>
<tr>
<td>S. THANGAVELU, G. KANDASAMY, M. SIVANADAM AND R.K. MURALI BASKARAN</td>
<td></td>
</tr>
<tr>
<td>Pests of Sesame and their Control</td>
<td>31</td>
</tr>
<tr>
<td>S. THANGAVELU</td>
<td></td>
</tr>
<tr>
<td>Review and Prospects on Sesame Production in China</td>
<td>41</td>
</tr>
<tr>
<td>TU LICHUAN</td>
<td></td>
</tr>
<tr>
<td>Sesame Irrigation in Egypt</td>
<td>44</td>
</tr>
<tr>
<td>AHMED MOHAMED EL-WAKIL</td>
<td></td>
</tr>
<tr>
<td>Agronomic Studies on Growth, Yield and Yield Components of Sesame</td>
<td>48</td>
</tr>
<tr>
<td>SAMIR TAHA AND MOHAMED EL-SROGY</td>
<td></td>
</tr>
<tr>
<td>Sesame Research and Progress in Egypt</td>
<td>52</td>
</tr>
<tr>
<td>NESSIM R. GUIRGUIS</td>
<td></td>
</tr>
<tr>
<td>Root-Rot and Wilt Diseases of Sesame in Egypt</td>
<td>55</td>
</tr>
<tr>
<td>A.A EL-DEEB</td>
<td></td>
</tr>
<tr>
<td>Highlights on Improving Production of Sesame in Egypt</td>
<td>59</td>
</tr>
<tr>
<td>A.F. IBRAHIM</td>
<td></td>
</tr>
<tr>
<td>Evaluation of Some Cultivars and Promising Strains of Sesame</td>
<td>61</td>
</tr>
<tr>
<td>(Sesamum indicum L.)</td>
<td></td>
</tr>
<tr>
<td>A.A. EL-SHIMY AND M.Z. EL-HIFNY</td>
<td></td>
</tr>
</tbody>
</table>

## Part 2. SUNFLOWER SUBNETWORK - II

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of Wild Species in Sunflower Breeding</td>
<td>70</td>
</tr>
<tr>
<td>DRAGON SKORIC</td>
<td></td>
</tr>
<tr>
<td>Sunflower Breeding: General Objectives and Recent Advances</td>
<td>95</td>
</tr>
<tr>
<td>JOSE FERNANDEZ MARTINEZ</td>
<td></td>
</tr>
<tr>
<td>Progress in Sunflower Research in Ethiopia</td>
<td>102</td>
</tr>
<tr>
<td>HIRUY BELAYNEH</td>
<td></td>
</tr>
<tr>
<td>Sunflower Adaptation in Morocco</td>
<td>106</td>
</tr>
<tr>
<td>S. QUATTAR, T.E. AMEZIANE AND A. BAIDADA</td>
<td></td>
</tr>
</tbody>
</table>
Effect of Maturity Stages and Desiccant Application on Yield, Oil Content and Oil Quality of Sunflower.
MASOOD A. RANA, CHAUDHRY A. OZAIR, M. AYUB KHAN AND SHAFIULLAH .................................114

Trends and Strategy of Sunflower Production in Pakistan.
MASOOD A. RANA ........................................125

Sunflower Production in India - Problems and Prospects.
M. RAI AND P.S. BHATRANGAR ..........................128

MANGALA RAI ............................................135

Status of Sunflower as Oilseed in Bangladesh.
M.A. KHALEQUE, AND S.H. MIRZA ........................142

Some Aspects Towards Overcoming Vegetable Oils insufficiency in Egypt: Production of Sunflower and its Improvement in Suez Canal Region.
ABDEL-FATTAH MOHAMED ABDEL-WAHAB ..............144

SALWA I. EL-MOHANDES .................................155

Sunflower Research and Production in Egypt.
BADR A. EL-AHMAR ......................................158

Performance of a New Synthetic Sunflower Stock Developed From Local and Introduced Germplasm and Further Improvement Via Population Improvement Method.
R. SHABANA ............................................163

Response of Sunflower and Associated Weeds to Some single and Tank Mixed Herbicides.
A.F. IBRAHIM, Z.R. YAHIA, H.R. EL-WEKIL AND E.D. ABUSTEIT ........................................167

Report on Sunflower Production In Dakahlia Governorate, Egypt.
S.E. EL-KALLA ...........................................168

Studies of Diallel Cross in Sunflower (Helianthus annuus L).
KHALED HAMMAD ........................................171

Effect of Some Intercropping Patterns of Sunflower/Soybean on Yield, Yield Components and Land Usage in Egypt.
M.A. MADKOUR ...........................................175

Sunflower Diseases in Egypt.
ARAF A. HILAL ...........................................180

Part 3. GENERAL

The Vegetable Oil/Protein System Program: The Kenyan Experience.
CARLOS ZULBERTI ......................................184

Microbial Control of Lepidopterous Pests of Oilseed Crops.
H.S. SALAMA ............................................203

Sunflower and Sesame Research in the Philippines.
NENITA M. TEPORA .....................................206

Part 4. DISCUSSIONS AND RECOMMENDATIONS

Discussions and Recommendations ..................213

I. Sesame ..............................................213

II. Sunflower ..........................................218

III. General ............................................223
THE VEGETABLE OIL/PROTEIN SYSTEM PROGRAM:
THE KENYAN EXPERIENCE
Carlos Zulberti

The purpose of this paper is to report the various steps undertaken, the different actors participating and some of the results being obtained in the process of developing and implementing the Vegetable Oil/Protein System (VOPS) program in Kenya. The description of the integrated approach being followed to characterize, analyze and generate research and policy interventions of the oil/protein Production, Processing, Marketing and Utilization (PPMU) system has as its main objective, the generation of awareness on the work being done, the appraisal of its usefulness, and the assessment of its potential for implementation in other countries of the region. It is expected that at the end of the meeting the participants will evaluate the possibilities following a similar approach in their respective countries and estimate the interest that their colleagues at home will have in carrying out this kind of work in the future.

Background

The International Development Research Centre (IDRC) is a Canadian public corporation established in 1970 by the Parliament of Canada to support research designed to adapt science and technology to the needs of developing countries. As part of its mandate, IDRC began to fund oilcrops research projects in East Africa, the Middle East and South Asia in the late 70's. After few years, the need to promote and facilitate contacts between research workers investigating similar subjects but in relatively isolated places was identified. To ameliorate the problem, partially, due to the lack of an international agricultural research centre responsible for most of the important oilseed crops, the Oil Crops Network was established with a permanent Technical Advisor to coordinate its activities. The first meeting of the Network took place in Cairo six years ago (3-8 September, 1983). Several other gatherings have taken place since then and four Subnetowrks have emerged, two of which are meeting here today.

In 1986, while the Network was strengthened by having more participants and expanding its activities, the world prices for oils and fats were following a downward trend reaching the lowest levels in 14 years. The decline in prices was mostly caused by accumulation of stocks due to the supply growing faster than the demand. It can be seen in Figure 1 that using palm oil as an example, the prices were below 300US$/MT in the years before 1972 and 1986.

Those low levels were not attained during 1973-1985 period. As a consequence of the significant price-drop, the possibility of continuous over production and the collapse of the market was felt as a real threat. As someone quite eloquently put it at that time "The rivers of palm oil from the Far East will flood the mountains of butter in Europe".

Figure 1 also shows that substantially different conclusions could be drawn depending on which length of time is used to analyze past prices. If the last 20 years are taken into consideration, the general tendency is for the price of palm oil to increase. While if the last 15, 10 or 5 years are used, the tendency is decreasing, at a rate given by the slope of the regression line; increasing as the period of analysis shortened. In other words, it was during the last few years, immediately before 1987, that the
Figure 1: PALM OIL PRICES
Sum/Mal, cif N.W. Eur.

Legend

□ = 1 year
× = 5 years
Δ = 10 years
◊ = 15 years
+ = 20 years
prices really decreased, reversing the previous growing tendency and significantly changing the future outlook of the sector.

Figure 2 shows that what has been said for palm oil closely applies to sunflower oil which has a very similar price change pattern while enjoying a premium due to its relatively better quality*.

A similar situation also existed for cakes. Using soybean meal prices as an example, Figure 3 shows that the tendencies were alike but gradient of the slope for soybean meal was substantially smaller than for oil's. While the price of palm oils decreased at an average yearly rate of US$ 18.01, 31.87 or 79.70 per MT depending if 15, 10 or 5 years were taken into consideration, the prices of soybean meal decreased US$2.28, 2.85 and 8.20/MT/year during the same periods. In other words, the relative importance of oil, as one of the products obtained from oilseeds, was diminishing in comparison with the cake. And, both commodities were showing the same downward trend observed in many other agricultural and non agricultural commodities.

Under these circumstances, IDRC professionals began to query if it was still justifiable to allocate limited research funds to oilcrops research when its future looks so bleak. They started to speculate to what extent the decline of fats and oil prices in the international markets would negatively affect the cultivation of oilcrops at the local level to the point of making irrelevant the generation of more productive technologies through agricultural research.

Or even under decreasing oil prices to what extent the demand for protein cake for animal production could help justify the continuous cultivation of oilseeds, especially in those countries where oilcrop research has been funded or being considered for support.

A meeting to discuss the subject between the Associate Director (Agricultural Economics) and the Program Officers (Crops and Animal Production Systems and Postproduction Systems) from the Agriculture, Food and Nutrition Science (AFNS) Division and the Program Officer (Economics) of the Social Science Division took place in the East African Regional Office (Nairobi) in October 1987.

Based on the discussions held with a number of informed Kenyans from Government, research institutes, and industry and a potential international consultant, the need for a four-stage investigation aimed at establishing the economic as well as technical feasibility of oilseed production and processing with particular reference to the marketing of the meal for animal feed was identified.

The four stages were**:

a) A consultancy to formulate a project that would investigate the principal economic, technical and institutional factors determining the economic and technical feasibility of oilseed production and processing (3 months).

b) Locally based research into the principal economic, technical and institutional factors affecting the economic and technical

---

* Unfortunately, international price data for sesame is not available for the same periods of time but it could be expected that, if available, will show very similar tendencies.

** The description of the four presented in its original form as they appear in the earlier document. Later on it was slightly modified to improve their presentation and understanding.
Figure 2: SUNFLOWER OIL PRICES
any orig, ex-tank Rott
Figure 3: SOYBEAN MEAL PRICES
44% U.S., CIF Rott
feasibility of oilseed production and processing in Kenya (8-9 months).

c) Based on the results of the above mentioned study, a series of field trials related to selective aspects of oilseed production and processing, and further investigation of the marketing of oilseed cake and vegetable oil (2 years).

d) On the basis of the above mentioned research, and in conjunction with Government authorities, farmers organizations, enterprises in the food industry, and other donor agencies, specification and implementation of a program to expand Kenyan production and processing of oilseeds (2+ years).

System Approach

The oil/protein sub-sector was conceptualized as a system with several interacting components which has to be analyzed as a whole to be able to properly describe and understand it. It was envisaged that by following a system approach it will be possible to identify those research and policy interventions required to modify it to better satisfy national objectives without unexpected and undesirable effects.

Incremental Process to Research Support

From the start, the VOPS program was conceived as to follow an incremental process by which each step of the investigation is predicted on prior demonstration, from the results of the previous stage, that oilseed production and processing can not be ruled out on economic grounds. This original notion was somehow made more embracing by promoting the continuation of research based on previous satisfactory performance demonstrated by the economic criterion, the quality and relevance of the results being obtained and the commitment of the researchers involved in the exercise.

The concept of incremental process also connotes the notion that knowledge and understanding of systems, the social, economical and political environment in which they evolve must be generated sequentially, step by step, because tomorrow's research can not be properly defined until today's results are out. In other words, the investigations required to generate meaningful results and improved recommendations must be based on previously accumulated experience and the continuous assessment and improved understanding of the over changing reality.

The first step to follow the incremental process was taken, in November, 1987 by retaining the services of a consultant, through a Divisional Activity Project (DAP*), to prepare a report leading to the identification and development of a possible research project on the feasibility of oilseed production and processing for edible oils and protein cake in Kenya.

Table 1, represents the various steps followed initially and how the program and its financing has developed since then.

<table>
<thead>
<tr>
<th>Stage I DAP 1</th>
</tr>
</thead>
</table>

The consultancy was carried out as expected and the report was discussed.

*The Divisional Activity Project (DAP) is an IDRC internal mechanism for the speedy financing of relatively low cost activities leading, in most cases, to the identification and development of full fledged projects.
Table 1. The incremental process applied to the financing of the vegetable oil/protein system program in Kenya.

<table>
<thead>
<tr>
<th>VOPS program terminology</th>
<th>IDRC Amount</th>
<th>Effective approved CAD $</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAP 1</td>
<td>16,400</td>
<td>November, 1987</td>
<td></td>
</tr>
<tr>
<td>DAP 2</td>
<td>26,060</td>
<td>February, 1988</td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>9,555</td>
<td>April, 1988</td>
<td></td>
</tr>
<tr>
<td>Stage II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase I</td>
<td>234,100</td>
<td>May, 1988</td>
<td></td>
</tr>
<tr>
<td>Phase 2</td>
<td>223,100</td>
<td>February, 1989</td>
<td></td>
</tr>
<tr>
<td>Stage III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core</td>
<td>Phase 3</td>
<td>641,000</td>
<td>September, 1989</td>
</tr>
<tr>
<td>Satellites</td>
<td>DAP 3</td>
<td>6,000</td>
<td>September, 1988</td>
</tr>
<tr>
<td></td>
<td>DAP 4</td>
<td>8,000</td>
<td>January, 1989</td>
</tr>
</tbody>
</table>

on the 24 of January, 1989 and a presentation made at the Fourth Oil Crops Network Workshop at Njoro, Kenya, 25-29 January, 1988. The main output from this initial exercise was the general characterization of the oil/protein system which was represented by a diagram (Figure 4) showing seven major interrelated components, including the policy environment.

The main conclusions were:

"The importation of palm oil at bargain prices has allowed high levels of profitability of the refining and packing activities in spite of relatively low price to consumers. The fats and oil industry has no economic encouragement to pay the prices required by the domestic producers to make a profit."

"... the production of oilseed in Kenya does not appear to be economically feasible and the importation of oil/protein related products will continue until the existing circumstances are deliberately modified, shifted by outside forces without local control or unexpectedly changed by unforeseen events."

"Unfortunately, not enough is known about the oil and fat industry, its backward and forward linkages and the direct and derived demands for its products, which will enable us to make conclusive recommendations. A better understanding of the complex interrelationships... is required to determine where interventions are needed by identifying and predicting their outcome."

The gathering at Njoro was attended by several Kenyan professionals from Universities, Ministries, Research Institutes and the Private Sector plus a sizable representation of IDRC staff including the Deputy Director, two Associate Directors and several Program Officers of AFNS and the Regional Director for East Africa. The interest demonstrated by the Kenyan professionals in the subject made IDRC confident of the need for the continuation of the investigation, following the previously described incremental process by carrying out a comprehensive study of the various components of the system.

DAP 2 and Extension

Egerton University, through its recently created Division of Research and Extension, showed the interest and willingness to assume the leadership and coordination responsibility and became the recipient of the second DAP and its extension aimed at the generation of a project proposal for those studies.

The Deputy Vice-Chancellor for Research and Extension assumed the responsibilities of Principal Investigator and, from then on, a very close and participatory professional relationship was developed between him representing the recipient organization, the Postproduction Systems Program Officer at the IDRC Regional
Figure 4: THE VEGETABLE OIL/PROTEIN SYSTEM IN KENYA PRODUCTIVE, INDUSTRIAL AND CONSUMPTION ACTIVITIES.
Office in Nairobi as the Officer Responsible representing the Donor Agency and the consultant. The three of them acted as partners in a team from their own institutional perspective pursuing the objectives of the program by identifying common grounds in which to operate together. That basic team actively interacted with and had the support of the Program Officers for Crops, Animal Production and Economics at the East Africa Regional Office and the Associate Director of the Agricultural Economics Program in Vancouver, Canada.

To develop the proposal for the comprehensive study of the sub-sector, two workshops were organized with the participation of about 50 Kenyan professionals. They were held on February 16 and March 15, 1988.

In the first meeting, after general presentations about oilcrops production and processing in Kenya and their relationship with the international market, the consultant presented a challenging null hypothesis:

"Due to the importation of cheap palm oil to satisfy local demand it is not worthwhile for the country to pursue the expansion of oilseed production and, as a consequence, no more genetic, agronomic or socio-economic research on the subject is required".

Several participants, mainly the plant breeders and agronomists refused to accept that conclusion but they had a difficult time trying to justify their rejection. It became evident that not enough information was available and the system was not properly understood to arrive to meaningful conclusions. The whole assembly concluded that a much better grasp of the various components and their interactions was required.

The participants then organized in seven groups following the characterization of the sub-sector, Figure 5, under the leadership of carefully selected by the Principal Investigator, group team leaders representing a wide spectrum of institutions and professional expertises.

Each group generated a plan of work for the next month having as the main objective the preparation of a proposal and a budget to carry out the investigations related to their main area of interest.

The Principal Investigator and/or the Consultant met with every group during that month to participate and advice on the preparation of the individual proposals. They also hosted a meeting for all the team leaders to ensure consistency in the presentations.

In the second general meeting, each team leader made a presentation of his group proposal and how they were planning to execute the study. They received comments and suggestions from other participants on how to clarify the objectives being pursued and suggestion to improve the methodology to be utilized.

The draft proposals prepared by the groups were used to develop a unified and definitive proposal which was presented to IDRC for consideration on 15 April, 1988. That proposal had the benefit of the discussions that the Principal Investigator and the Consultant had with AFNS Director who visited Nairobi in March to attend the IDRC Board of Governors' meeting which took place during that period.

The objectives of the research project which became known as Vegetable Oil/Protein System (Kenya) (VOPS) Phase 1 were to:

a) specify the structural characteristics of the oil/protein production system in Kenya, the linkages between the
Figure 5: STUDIES OF THE VEGETABLE OIL/PROTEIN SYSTEM IN KENYA PRODUCTIVE, INDUSTRIAL AND CONSUMPTION ACTIVITIES.
various components and the quantitative flows between them;

b) determine the farming production systems which include oilseeds, and how they are influenced by the socio-economic environments;

c) describe the technological characteristics of each component in particular, its use of the factors of production and its contribution to value added;

d) find out the present level of consumption and estimate the future demand of vegetable oils, fats and protein cake as derived from dairy, poultry and pig industries;

e) define the policy instruments which influence the oil/protein system, determine their setting mechanisms and estimate their quantitative impact;

f) identify, assess and assign priorities to specific areas of research leading to the removal of constraints to local oilseed production and processing into edible oils and protein cake; and

g) prepare a project proposal for a subsequent phase which includes those areas of research with the highest priority and expected pay-off to be presented to IDRC for financing.

Stage II

Phase 1

The second stage was started by requesting each group to prepare a definitive plan of work within the budget approved for them and to develop the questionnaires that they were going to use for the collection of primary data. Those questionnaires and the methodology of data gathering would be discussed in a workshop with the participation of all team members. The third general gathering was valuable for the professionals from different backgrounds to familiarize themselves with, and comment on, the work to be done to characterize the various components of the system. It was also useful to coordinate the work of the groups dealing with related industries and to rationalize the use of resources and avoid duplications.

The various groups visited farmers, extension agents, local authorities, managers of crushing plants and refineries, feed millers, government officials, etc. They gathered primary and secondary information and by October 29, 1988 presented their preliminary results in the fourth seminar which was held in Nairobi with the participation of special guests, mostly from Government Agencies.

Those preliminary results were compiled and put together in a report which was first presented in the meetings of the Oilseeds Inter-ministerial Committee (see below) and later delivered at the International Oil Crops Workshop held at Hyderabad, India in January 1989.

The major findings included issues such as:

- the secondary data being used, and available, is apparently not consistent, and needs to be improved for planning and research;

- past attempts to increase the production of sunflower through large- and small-scale farmers indicated that the comparative advantage was with the small holders;

- for the majority of small farmers, oilseeds are of secondary importance, behind the main food and cash crops. The average smallholder plants less than 2 ha. of oilcrops together in an intercropping arrangement
mostly in marginal areas and often late in the season, after labor is released from other major crops. Almost all small farmers do not use chemical fertilizers on oilcrops and only a few use manure. At present, thousands of small holders are planting sunflower and simsim (sesame) under the above circumstances with the potential for increased production not being investigated because no station or on-farm research is being carried out under those farmers' conditions. This situation partially explains why yields of oilseeds are slow. This means that scientists working at present on sunflower and those who would get involved in simsim and other oilcrops in the future would have to design their experiments to match farmers' circumstances and provide recommendation which are suitable to their environment, production system and economic situation;

- another possibility to be explored is the opportunity for some oilseeds to be a low-input, high-risk crop for the short rains in areas with bi-modal rainfall;

- the drop in world prices of vegetable oils which took place in 1986 led the major promoter of sunflower and other oilseeds to reduce its prices to the farmers. As a result many farmers have discontinued growing oilcrops;

- until recently, cotton and maize constituted the major source of raw material for domestic oil production. The fact that these oils were by-products of other primary commodities had a major effect on the oil processing industry which has not developed procurement mechanisms to be obtain raw materials directly from farmers. The significant reduction in cotton production, due mostly to lack of prompt payment to producers, has been detrimental to the smaller members of the oil expressing industry who were using cottonseed as their sole source of raw material. It has reduced their plant capacity utilization to about 50%. The smaller processors have also had difficulty in obtaining foreign exchange allocation for the import of spares to maintain equipment and/or to import raw materials. It seems expertise is lacking in fine tuning existing equipment so as to obtain optimal performance on the raw materials available to them. The solution to these problems could enhance their profitability.

- the studies of the fats and oils processing industry have put together the expelling enterprises, the refining ones and the packers, assuming that all of them have the same objectives. This is far from reality. While the expelling business wants to promote local production or be authorized to import seeds and it is supportive of levies on imported crude and refined oil, the refineries want only levies on refined oil (many times impossible to identify from the crude one), while the packers aspiration is an unregulated market free for all regardless of its effects on foreign exchange use, local resource utilization, employment generation, etc.

- similar findings were made in other components of the total system which could be found in the reports of the groups which will be made available in the immediate future.
The key policy and research interventions identified are:

- the need to charge variable levies to the importation of oils and fats to stabilize prices and eliminate the negative effects of the volatile international markets. The prices will have to be set at such levels that will induce industrialists to avoid imports and pay higher and steady prices to farmers in order to promote local production. It is expected that those more remunerative prices will encourage farmers to increase the production of oilcrops;

- another important interrelated intervention will be the execution of agronomic and plant improvement research to increase the yields of oilcrops to further raise the income of the farmers. Simsim and sunflower are considered as the crops with greatest potential. Simsim (sesame) originated in the region, is already being cultivated by small holders in the coastal and western areas of the country and not enough investigation has been carried out to improve its performance. Sunflower is the oilseed most widely cultivated at present by thousands of small farmers in many areas of the country, including some marginal ones;

- to make local oils competitive with foreign ones through import price stabilization, it requires de-regulation of the price to consumers or increase of the prices at present under control. To avoid the negative effects of that measure in the most vulnerable sector of the population, small farmers in the marginal areas, rural processing of oilseeds would have to be experimentally introduced;

- the generation of rural processing technological packages adjusted to local conditions will require the participation of professionals in various subject matters i.e., agricultural engineering, agriculture, animal production, home economics, agricultural economics, etc. to insure that the dissemination process is properly designed, taking into consideration the production of the oilseeds easy to crush the rural level, the economics of processing, the utilization of the oil and cake obtained by humans and animals, respectively, the marketing of surpluses, etc.;

- industrial economics, industrial engineering and economics will be required to better describe, analyze and appraise the existing and future potential of the oil and fats, and soaps and detergents industries and how they can be encouraged and convinced to use local raw materials permanently;

- the whole VOPS should continue to be more precisely described, the data being used should be verified and improved, and the effects of various interventions assessed, monitored and evaluated;

- research planning, management and execution capacity have to be strengthened and enhanced by short- and long-term on-the-job and academic training.

Some of the interventions that have already been taken place are:

- as a consequence of the increase in price of vegetable oils in the international market during late 1987 and the beginning of 1988, the Government increased the consumer price of margarine by 17% in June 1988 and in mid-November 1988 the consumer
prices for all vegetable fats and oils products were increased by 10% including margarine whose price increased by 29% during 1988.

- also in November 1988, the Government announced the formation of a senior level inter-ministerial working group, with significant participation by the fats and oils industry, to develop a strategy for strengthening national production of oilseeds. The Government took note of the research work of Phase I of VOPS project and hence invited the participation of the Principal Investigator in the working group as a full member, on the strength of potential contributions. He was requested to submit a working paper, and he did so on 13 December, 1988. The information presented has been used by the working group to generate a set of recommendations for Government consideration.

- the Government has signed an agreement with the World Bank for the implementation of the Rural Service Design Project which will be co-financed by the International Development Association and the United Nation Development Program in March 1989. One of the components of the project deals with the production and processing of oilseeds. It is intended to finance agricultural research in the major oilcrops mainly sunflower and the dissemination of rural processing technology. No implementation reports are available yet, but it is expected that the Ministry of Agriculture will subcontract with KARI; the agricultural research activities and will work together with Egerton University in the development of the dissemination process for the rural processing technology.

Phase 1 generated more interest and enthusiasm among Kenyan scientists, administrators and policy makers than expected pulling the project along faster than anticipated path. To meet this high level of interest a "bridging" phase to consolidate the achievements made and complete Stage II was conceived until Phase III was approved and fully operational.

Phase 2

Its general objective was to develop the institutional base and coordination capacity of Egerton University to ensure that the on-going oil/protein systems research in Kenya meets national needs in an efficient and sustainable manner. Specifically, it was devised to:

a) coordinate with the recently formed Vegetable Oils and Protein Development Committee to resolve information reliability and consistency concerns,

b) promote enhanced understanding of the oil/protein system among public and private interest groups,

c) refine proposed research intervention points and encourage the development of research proposals on the intervention point, and

d) define the structure required for the generation and implementation of an on-going research and extension program on the oil/protein system in Kenya.

Phase 2 has been able to consolidate the research results of Phase I, hire and familiarize permanent research staff with the VOPS program and formulate the detailed work plan
for the third phase which is expected to last in three years.

To achieve those objectives:

- one day workshop meetings have been held with the seven working groups of Phase I to review their draft documents, discuss ways to handle data inconsistencies and agree on their final presentation. The seven reports from the groups plus the description of the phase I project, the original paper presented by the consultant and the summary of Phase I report are all being published as part of VOPS Working Papers Series which was specially created to disseminate the results of investigations related to VOPS program;

- the project team has began to familiarize itself with the method for assessing, programing and managing integrated production/consumption system (MEPS) and its adaptation to the Kenyan conditions. Discussions have been held with UNIDO personnel (the co-developers of MEPS) to identify their possible assistance in training project staff.

- consultations between the researchers in charge of preparing the satellite project proposals (see below) and the staff members of the core project have been taking place to ensure that those proposals are closely linked to the objectives of the VOPS program and their quantifiable goals and methodology are clearly described to facilitate implementation and follow up.

**Stage III**

**Phase 3**

A Phase 3 proposal was prepared and presented to IDRC for financing on April 1989. It was approved by the Board of Governors in June and became effective on 7th of September, 1989.

Based on the experience of the previous research stages, a two tier approach was proposed for Phase 3 for the future research process to be consistent with the Governmental objectives:

- the first tier is a core unit which includes an adequately staffed analytical group, which will facilitate the integration and co-ordination of an evolving research program, and support a continued systematic sharing of research results with policy and decision makers, researchers, and other main actors in the oil/protein system;

- the second tier consists of a collection of satellite projects which will comprise the execution of distinct, though linked, in-depth applied research each addressing itself to the intervention points identified within the seven components of the system. These projects will be separately funded and implemented under the co-ordination of Egerton University as part of an integrated national research network.

The general objective of this phase of the program is:

To develop an integrated research and development program on the vegetable oil/protein system (VOPS) in Kenya aimed at the removal of constraints to domestic oilseed production, processing and utilization of edible oils and protein cakes.

The specific objectives for the Core Unit are to:

a) characterize the VOPS model for Kenya in greater depth in order to assess, monitor and evaluate its reactions to policy land research interventions;
b) communicate VOPS's changing state to improve the understanding of the system by all concerned and, to enrich the decision making process related to it;

c) evaluate and synthesize the results of the interventions in the system in order to update the long-term integrated research, policy and extension agenda on the national oil/protein system;

d) promote, coordinate and appraise research on knowledge gaps detected as VOPS evolves;

e) establish and sustain a research management structure capable of supporting and monitoring an integrated cluster of research activities within the vegetable oil/protein system, aim at the establishment of a national VOPS research unit within the University;

f) strengthen the capacity of researchers in conducting applied research on VOPS through short and long term academic and on the job training, and

g) evaluate the usefulness of the systems approach used in this project, as a contribution to planning and execution of research.

The specific objectives for the Satellite Projects are to:

a) describe and analyze the oil and fats, and soaps and detergents industries to determine all their components and effective capacities, cost of operation and present flows so as to estimate which changes will take place, and when and by how much the crushing capacity will have to be expanded to absorb the expected increase in local oilseed production;

b) test and select for introduction small scale rural processing equipment, develop the technological packages for their local utilization and identify the dissemination mechanisms with the greatest potential of being accepted by the rural communities;

c) collect, classify and select simsim germplasm and identify by surveying growers, the most productive agronomic practices suited to the needs and abilities of small holders with the purpose of enhancing their income.

The long-term direct beneficiaries of the program in general and of this specific phase in particular, are foreseen to be the Kenyan small holders by bringing about opportunities to increase production and utilization of oilseeds based on technology generated under their own conditions and in close collaboration with them.

The expected increase in local oilseed production, its processing and the utilization of edible oils and protein cake will benefit the Kenyan economy as a whole through a stabilization initially and later a reduction in the use of scarce foreign exchange for the importation of oil/protein products. The resources so saved could be used in other areas for development. Another potential country-wide benefit will be the strengthening of the research capacity of several professionals and the establishment of a research management capability to execute applied research of relevance to national objectives, within one of the institutions of higher learning which could well be replicated elsewhere.

Egerton University will benefit internally by establishing a knowledgeable and authoritative analytical unit of the oil/protein system and by suing the results from this research and extension program
to enrich curricula and provide study opportunities for post-graduate research.

The anticipated methodological and institutional building results include:

- an effective research support program to meet the needs of researchers, policy-makers, and the extension cadre, all of whom are seeking to respond to the problems of the producers, processors, and consumers of edible oil and protein cake;

- the construction of a useful model of the interrelationships among the components of a national oil/protein system, capable of predicting changes in the system's output in response to changes in factors such as policy, technology, demand, weather, and the international market; the critical parameters in the model will be updated annually, using data gathered and validated through strengthened national data collection mechanisms;

- an enhanced decision making by the public and private sector as a consequence of greater data availability and better understanding of VOPS. Sharing of results will provide a service to government and industry for planning and policy formulation;

- a regular publication of findings by applied researchers working on the Kenyan vegetable oil/protein system;

- a collection of formal and informal literature i.e., a library about the oil/protein food/feed system and their components, focussing particularly on Kenya, Africa and South Asia;

- a sustainable mechanism capable of contributing to national setting of research priorities, stimulating proposals and attracting research funding;

- an experience in utilizing an incremental and systems approach for goal-directed application of research resources to solving development problems relating to food/feed self-sufficiency;

It is foreseen that the previously mentioned achievements will lead to the following concrete results:

- a generation of farm income due to intensification of production;

- a creation of employment at the rural level by the introduction of local processing;

- an increased availability of animal products as a consequence of improved feeding based in locally produced protein cakes;

- an improvement in the nutritional status of the rural communities due to higher energy intake through oils and greater accessibility to protein of animal origin;

- an overall positive change in income distribution because increased oilseed cultivation and animal production will take place at the small holders level mostly in marginal areas and rural processing will be run by small operators employing landless rural population, and

- an improved capacity in utilization of existing processing plants.

**DAPs 3 and 4**

The first of these two DAPs was generated to finance the purchasing of a manually operated ram press and an engine driven expeller for lab.
experimentation. The second one financed the field experimentation required to start the process of designing methodology for the diffusion of the oil extraction technology at the rural level. These efforts are related to the preparation of one of the satellite projects previously mentioned as part of Phase 3.

**Implementations for other countries**

Table 2 shows the supply and demand situation of several of the countries represented in the workshop. Unfortunately, data is not available for all of them, but for all of those for which some information is available (with the only exception of Philippines) they are net importers of vegetable oils.

While the situation is expected to be somehow different in each country, the experience being obtained in Kenya could be of use in some of them. It is important to emphasize that what is being pursued in Kenya is a system approach and an incremental process, not a fix method. This is so because each country requires the flexibility to develop the kind of information which suits its needs. Nonetheless, as it has already happened with the Oilcrops Network, the interchange of information and the sharing of results have been proven useful and beneficial for the generation of scientific knowledge. The same appears to be true for the understanding of the system and the elimination of constraints for the development of the oil/protein sub-sector.

**Conclusions**

The key policy and research interventions required to remove constraints to the local production and consumption of oils and fats identified in Phase 1 of Stage 2 clearly show that the problems are not limited to one area, component or subject matter.

Nonetheless, it has become evident that without Government intervention and/or the introduction of rural processing in some of those areas the probability of increasing local production and reducing imports is low. The present structure of the internal production, processing, marketing and utilization system and the international market is still such that the most profitable enterprise within the sector is to import palm oil, pack and sell it to consumers.

At present, the policy of remitting (not charging) any duty to the importation of crude or refined palm oil contradicts the Governmental objectives of reduction of the importation bill, generation of income and employment at the rural level and food security. But, which are the more appropriate measures to reverse the present situation in pursuit of those objectives, are not yet properly defined. Until those answers are found and made widely known to researchers, administrators and policy makers for them to support and take action, the potential to modify the existing situation is low.
Table 2. Supply and demand of oils and fats in selected 17 countries, 1987 (000 MT).

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (July 1987)</th>
<th>Opening Stocks</th>
<th>Production</th>
<th>Imports</th>
<th>Exports</th>
<th>Disappear</th>
<th>Ending Stocks</th>
<th>Balance</th>
<th>Exp-Imp</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1,065.4</td>
<td>757</td>
<td>7,426</td>
<td>955</td>
<td>117</td>
<td>8,298</td>
<td>734</td>
<td>1,848</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>786.4</td>
<td>312</td>
<td>3,860</td>
<td>1,622</td>
<td>40</td>
<td>5,435</td>
<td>519</td>
<td>1,783</td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>102.6</td>
<td>25</td>
<td>56</td>
<td>346</td>
<td>367</td>
<td>49</td>
<td>(346)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pakistan</td>
<td>102.2</td>
<td>224</td>
<td>566</td>
<td>769</td>
<td></td>
<td>1,478</td>
<td>102</td>
<td>(769)</td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>57.4</td>
<td>135</td>
<td>1,523</td>
<td>28</td>
<td>1,075</td>
<td>447</td>
<td>171</td>
<td>1,047</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>50.8</td>
<td>120</td>
<td>194</td>
<td>603</td>
<td></td>
<td>865</td>
<td>51</td>
<td>(603)</td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td>45.2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>23.1</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td>22.3</td>
<td>6</td>
<td>213</td>
<td>44</td>
<td>13</td>
<td>249</td>
<td>5</td>
<td>(34)</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>21.9</td>
<td>5</td>
<td>157</td>
<td>38</td>
<td></td>
<td>115</td>
<td>19</td>
<td>(129)</td>
<td></td>
</tr>
<tr>
<td>Nepal</td>
<td>17.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>16.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>16.4</td>
<td>16</td>
<td>52</td>
<td>21</td>
<td>17</td>
<td>68</td>
<td>5</td>
<td>(4)</td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td>14.5</td>
<td></td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(47)</td>
<td></td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>8.7</td>
<td></td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(19)</td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(9)</td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td>7.1</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rwanda</td>
<td>6.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burundi</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Somalia</td>
<td>4.9</td>
<td></td>
<td>27</td>
<td></td>
<td>27</td>
<td></td>
<td></td>
<td>(27)</td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>4.4</td>
<td></td>
<td>17</td>
<td>5</td>
<td></td>
<td>103</td>
<td></td>
<td>(12)</td>
<td></td>
</tr>
<tr>
<td>Bhutan</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>