Meeting on Spirulina Project

Statement
by
Mr. Layashi Yaker
United Nations Under-Secretary-General
and Executive Secretary of the
United Nations Economic Commission for Africa

Addis Ababa, Ethiopia
2 - 3 September 1994

Eminent Prof.Madame Mann Borgese,
Chairman, IOI,

Dr. K. Saigal
Executive Director, IOI,

Expert Guests,

Distinguished Representatives of Ethiopia

Dear Colleagues,

Ladies and Gentlemen,

It is my pleasure to welcome you all to the Headquarters of the United Nations Economic Commission for Africa and would like to express my good wishes for a pleasant stay at Addis Ababa for our distinguished guests who have travelled from outside Ethiopia.

As you are all aware, our main focus for the coming two days will be on how the proposed spirulina project would take off the ground. "Spirulina" - which is a microscopic blue-green algae - is known to have a high food value that could feed millions of people, thus reducing the risks of natural disasters for people who are exposed to unfavourable climatic conditions.

The project document before you provides a detailed account on spirulina, its growing environments, the ease with which it can be cultivated as well as its rich and nutritional values. There is indeed much that could be said about all the useful features of this algae but I would probably not tell you much that you did not know already since most of you have read literatures or even conducted research work on this plant. It is, therefore, my view that our common knowledge would lead to a conclusion that the production of spirulina would go a long way to alleviate

consequences of food shortage arising from the conjugated effects of drought and chronic rainfall deficit and contribute significantly to the improvement of life and health conditions of the large majority of the population in Ethiopia. This, I say, because spirulina is not only appreciated for its nutritional value by providing substitution for a wide variety of component vegetable and crop constituents, but also because of its use to prevent or cure chronic pernicious anaemia.

The meeting today and tomorrow involves three parties, namely the Ethiopian group composed of various interested institutions, experts from France with technology for spirulina production for domestic consumption and the third party being the International Ocean Institute and the Economic Commission for Africa who are interested to see development take place in this sector.

As can be learnt from the project document, the conception for spirulina production was envisioned in 1967. Sosa Texeoco Company in 1976 became the first and the most important producer of spirulina and therefore we see that the technological know-how will not be a constraint as we have the experts for the test case. In Ethiopia, there are many known lakes like Abijata, Shala, and Chiltu in which Spirulina thrives naturally and this provides the required environment for breeding the algae.

In view of previous knowledge gathered and on the basis of field visits made in Ethiopia, a two-phased project proposal for production of spirulina is drawn up for consideration and discussion. The first phase will be a semi-industrial facility to

serve as a demonstration or a pilot project and will be linked with a training programme. Naturally, this phase would only require a modest financial investment. This pilot scheme is to be followed by phase two which is of an industrial and commercial scale. At this stage, the involvement or attraction of other African countries is foreseen. The development in this stage constitutes of distribution and marketing of the product. The natural corollary is that not only social benefits accrue, but also job creation and income generation from sale of the product would provide a new ground to dynamize economic activity.

The Economic Commission for Africa as the regional arm of the United Nations has been playing a significant role in promoting the economic and social development of the African region. It has been assisting member States of the region, among other things, in: (i) the improvement of regional and sub-regional cooperation and coordination; (ii) strengthening of regional and subregional training programmes; (iii) assisting with strategic planing and policy formulation; (iv)drought alleviation and disaster preparedness; (v) providing advisory technical services to member States and organizations in the region; and (vi) promoting exchange of information and experiences. I may also add that the UNECA has since many years been called upon to exercise team leadership and for executing projects within Africa. UNECA has made every effort to stand to the call for assistance from its African member countries. Similarly, today we are eager to support in whatever way we can so that this project becomes successful and assist our

host member country Ethiopia in solving one of its chronic socio-economic problems, namely the food shortages and poverty alleviation. We have noticed that there have been many kinds of research activities carried out in Africa in various fields. At the same time, I do not wish to refrain from asserting that Africa did not venture in translating its research findings into development programmes. It has, as a result, been the unfortunate continent that is left behind. We recall the dismal picture of under-development that has made our region a victim of every undesirable incident such that it has literally been quoted as an example of poverty, malnutrition and ill-health.

It is my hope that at its conclusion, this meeting comes up with an approach that would culminate in a development activity. May I wish you success in your endeavour during the coming two days, leading to the fruitful implementation of this much desired project.

I thank you for your kind attention.

United Nations
Economic Commission for Africa

SPIRULINA MEETING, 2 - 3 September 1994

Committee Room 1

Draft Provisional Agenda

1. Opening of the meeting
2. Adoption of the Agenda and Programme of Work.
3. Project Proposal: "Local, Drought resistant food production in Africa- Development of Micro-Algae (Spirulina) in Ethiopia".
4. Technology Transfer Agreement
5. Any other business
6. Field visit

Draft Provisional Annotated Agenda

Opening of the meeting:

The Executive Secretary of the United Nations Economic Commission for Africa will make an opening statement.

Adoption of the Agenda and Programme of Work

The Executive Secretary will introduce the Provisional Agenda, the Provisional Annotated Agenda and Provisional Programme of Work for adoption by the meeting

Project Proposal: Local, drought resistant food production in Africa - Development of Micro-Algae (Spirulina) in Ethiopia:

A representative of the International Ocean Institute (IOI) will introduce the project proposal. The meeting will then consider the general project concept, the specific elements of the project including the annexes, and the arrangements for its financing and management. The conclusions reached on the various proposals and the amendments adopted by the meeting will be noted for the subsequent project revision.

Technology Transfer Agreement

A representative of BECCMA will introduce the document after which participants will make their observations on its provisions. The meeting will recommend a new text and any other actions as deemed necessary.

Any other business

The meeting will take up any other business

Field visit

Announcement will be made on arrangements for the field visit

Provisional Programme of Work

Friday, September 2, 1994

09:30 - 10:00 Opening of the meeting

Adoption of agenda, and programme of work

10:00 - 13:00 Project Proposal

13:00 - 15:00 Lunch Break

15:00 - 17:00 Technology Transfer Agreement

Saturday, September 3, 1994

09:30 - 10:30 Conclusions and follow-up action

10:30 - 11:30 Any other business

11:30 - 12:00 Closure of the meeting

14.00 - 17:00 Visit to Debre Zeit

MEMORANDUM OF UNDERSTANDING

The United Nations Economic Commission for Africa (UNECA), the Ethiopian Science and Technology Commission (ESTC), and the International Ocean Institute (IOI)

Aware of critical problems, identified in Ethiopia by the Ethiopian Nutrition Institute and others, of protein deficiency, the high prevalence of diseases caused by deficiencies in vitamin A and iodine, and nutritional anaemia;

Deeply concerned by recurrent droughts which might entail other devastating famines and untold suffering;

Desirous to supplement and complement traditional relief activities through the utilisation of a still unutilized local resource, viz the blue-green alga *spirulina*;

Aspiring, at the same time, to contribute to the establishment of a new industry, in Ethiopia and other African countries, that is sustainable, of special benefit to the health of children, and generating employment, especially among women;

Cognizant that *spirulina* contains practically all proteins, vitamins, and minerals a human being needs for survival; that it grows at a very rapid rate, doubling its volume every third day; and that, above all, growing in saline/alkaline waters, its production is not affected by the occurrence of drought;

Conscious that *spirulina* cultures have been and are being successfully carried out in many countries, e.g., in Mexico, Bangla Desh, India, Thailand, USA, Japan, France; that, in particular, the native Ethiopian *spirulina* is being most successfully cultured in Thailand; that the technology for growing and processing the algae has been tested and is available; and that numerous studies are on hand documenting the nutritional and medical benefits of *spirulina*, especially on children, to prevent and/or cure the effects of malnutrition.

Informed that the natural conditions for the culture of spirulina in Ethiopia are ideal; and that the Government of Ethiopia has already established a task force to study the feasibility of *spirulina* culture in Ethiopia; and

Hopeful that a *spirulina* culture project, starting with a pilot installation in Ethiopia, may contribute to saving a great number of lives in Ethiopia and in other African countries during the forthcoming drought;

NOW THEN HAVE AGREED AS FOLLOWS:

1. The ESTC, the UNECA, and IOI are convinced that the establishment of a facility for the production of dried spirulina, based on an appropriate feasibility study, at a suitable location in Ethiopia is desirable and therefore they welcome it.

2. The ESTC, the UNECA, and the IOI are further of the view that, parallel with the feasibility study, a pilot project for testing and establishing the acceptability of dried spirulina as a nutritious food supplement in Ethiopia.

3. The three parties also agree to collaborate in the preparation of documents and reports establishing technical and financial feasibility of the proposed production facility in line with the attached terms of reference, which, upon the approval of the Government of Ethiopia, should be presented to funding agencies and/or other donors as well as relief agencies to whom the product could be sold at cost.

4. As part of the feasibility study, The ESTC, in consultation and collaboration with other concerned Ethiopian institutions, will be responsible for carrying out local investigations and studies for establishing an efficient and effective management structure for implementing the project.

5. The UNECA will examine, in consultation with concerned States parties, and regional and subregional bodies, the prospects of regionalizing and/or extending dry spirulina production facilities in other parts of the continent.

6. The IOI will be responsible for coordinating and preparing, in close consultation with ESTC, UNECA, and the technology and equipment suppliers, the documents and reports necessary for enabling decisions by all concerned, including the funding and relief institutions, for the establishment of the production facility. IOI will also be responsible for securing the necessary funds and preparing the project proposal by the end of November, 1994.

For the ESTC	for UNECA	for the IOI

List of Participants

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Separation Date: June 15, 2016

Fonds Title: Elisabeth Mann Borgese
Fonds #: MS-2-744
Box-Folder Number: Box 259, Folder 4
Series: United Nations
Sub-Series: Administrative Records
File: Meeting on spirulina project - United Nations Economic Commission for Africa (UNECA)

Description of item:

File contains a copy of a technology transfer agreement between the Bureau d'Études et de Conseil en Culture de Micro-Algues (BECCMA) and the Ethiopian Mineral Resources Development Corporation (EMRDC), as well as correspondence between the BECCMA and Elisabeth Mann Borgese.

Reason for separation:

Pages have been removed from digital copy due to privacy concerns.

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Dalhousie University

International Ocean Institute

PROJECT PROPOSAL

LOCAL, DDROUGHT-RESISTANT FOOD PRODUCTION IN AFRICA

DEVELOPMENT OF MICR-ALGAE (SPIRULINA) IN ETHIOPIA

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CONTENTS

EXECUTIVE SUMMARY

The purpose of the project is to illustrate the potential represented by the local production of a still unexploited high value food crop, the microscopic blue-green alga *Spirulina* and to show how the efficient management of local natural resources may contribute to sustaining a healthy human population in apparently unfavourable climatic conditions. The project should be a demonstration of sustainable development in the face of climate change. It also exemplifies a "no-regrets" policy: for no matter what happens to climate change, the culture of Spirulina reduces the risks of damage from natural droughts; it could save hundreds of thousands of lives and offer new possibilities for job creation and foreign exchange earnings.

While contributing to the alleviation of the nutritional problems till facing the population of, among others, the countries located along the eastern part of the African continent, the materials and technologies proposed may also find application in other developing countries.

The project is organised in two phases

The first phase should be a joint venture between the Bureau d'Etudes et de Conseil en Culture de Micro-Algues (B.E.C.C.M.A.) of Nantes and Monpellier, the Ethiopian Mineral Resources Development Corporation (E.M.R.D.C.) and the International Ocean Institute (I.O.I.), to install a semi-industrial Spirulina production facility on a small part of B.E.C.M.A.'s evaporation lagoons. This would be a demonstration plant. Production should be linked with a *training programme*. The product would be used to show the spectacular results which may be obtained with this alga for renutrition. Five hectares would provide a daily ten-gram dosis to 62,500 children during the drought forecast in 1994.

This first phase would be considered as a not-for-profit humanitarian emergency action. The E.M.R.D.C. should provide the ponds, some of the labour, and one third of the cost which could be covered by an interest-free or low interest loan from the World Bank.

B.E.C.C.M.A. would provide the Technology. I.O.I. would manage the Training

Programme and co-ordinate the expansion of the programme. I.O.I. would also be responsible for raising the remaining two-thirds of the costs from donor agencies or other interested parties.

Phase 2 would see the commercialisation and expansion of the project, both locally and in other developing countries.

Ony Phase 1 requires funding from international funding sources. It is expected that Phase 2 will be profit making.

The total cost for Phase 1, including nonrecurrent, recurrent, and training cost, would amount to US$ 1,283.028

Dalhousie University

International Ocean Institute

PROJECT PROPOSAL

Local, Drought-Resistant Emergency Food Production in Africa

Development of Micro-Algae (Spirulina) in Ethiopia

1. Introduction

The case of Ethiopia is chosen to illustrate the potential represented by the local production of a still unexploited high value food crop, the microscopic blue-green alga *Spirulina* and to show how the efficient management of local natural resources may contribute to sustaining a healthy human population in apparently unfavourable climatic conditions. The project should be a demonstration of sustainable development in the face of climate change. It also exemplifies a "no-regrets" policy: for no matter what happens to climate change, the culture of Spirulina reduces the risks of damage from natural droughts; it could save hundreds of thousands of lives, and offer new possibilities for job creation and foreign exchange earnings.

While contributing to the alleviation of the nutritional problems till facing the population of, among others, the countries located along the eastern part of the African continent, the materials and technologies proposed may also find application in other developing countries.

2. What is Spirulina

Spirulina is a blue-green alga (Cyanophyte) of the order Notocales, family Oscillatoriaceae; it is an ubiquitous organism, preferring tropical and sub-tropical climate, and most often growing in alkaline soda lakes. Under the microscope, it appears as a blue-green filament, helicoidal in shape, about 250 in length, and 10 in diameter.

- It can be grown on pieces of land unsuitable for other agricultural uses, such a shores of alkaline soda lakes;
- it allows the best water utilization ratio (2 to 3 ton water per kg of protein);

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it offers a very high yield in suitably controlled conditions: 12,500 ten-gram doses (edible weight) per hectare per day.

From the nutritional point of view, the following table shows the percentages of the US RDA (Required Daily Amount) for adults of various nutrients which are provided by one of thee ten-gram doses (1 heaping tablespoon):

Protein	6.5 gm	10 %
Vitamin A	25,000 IU	500 %
Vitamin B12	20 µg	330 %
Iron	6 to 18 mg	30 to 100 %
Riboflavin	322 to 460 µg	21 to 30 %
Thiamin	311 to 370 µg	21 to 25 %

Spirulina improves the protein value of the millet ration as efficiently as the same amount of powdered skimmed milk. Ten grams of product daily are enough to prevent or cure protein deficiency diseases and balance the most inappropriate diet (EnsEte, et.).

A ten-gram dose of Spirulina provides as much beta-carotene a 43 eggs, 250 g carrots, or 15.5 l cow milk. The dried alga thus can be utilized to prevent or cure vitamin A deficiency diseases.

Dried Spirulina contains 4 times more vitamin B12 than crude liver, wrongly considered by nutrition experts as the best source, and 10 grams of dried product provide as much iron as 545 gram whole wheat, 450 gram spinach, or 330 g veal liver, Spirulina can thus be used efficiently to prevent or cure chronic or pernicious anaemia.

3. Precedents

a) A little bit of history

The first reports on the utilization of Spirulina as human food are to be found in the chronicles of the conquest of the New World by the Spanish invaders. The algae were consumed by the Aztec Indians. Harvested with nets in Lake Texcoco,

recuperate the sodium carbonates and bicarbonates from the underground water resulting from the disappearance of the greatest part of the lake. The water is pumped and brought to the external part of the spiral, and evaporated along its course to the centre. The concentrated brines are then pumped from the centre of the spiral to a processing plant for crystallisation and transformation into soda ash.

Problems were arising from the fact that Spirulina, still present, was developing in the external part of the evaporator, where the conditions for its growth were optimal, and the presence of the algae and of their excreted products complicated the process.

The French Director of the company met in 1967 French research scientists working on a process for the industrial production of Spirulina, and, after a fruitful discussion, the decision was taken to start growing the alga, in lieu of endeavouring to destroy it. In 1976, Sosa Texcoco became the first, and still is the most important, Spirulina producer in the world. Spirulina is cultivated on 20 hectares of semi-natural ponds located in the outermost part of the evaporator, utilizing a portion of the brines extracted from the underground; the salinity is about 12.5 g/l, of which 8.5 of sodium carbonates and bicarbonates. Sources of nitrogen, phosphorus, sulphur and iron are added at regular intervals of time. The daily production is about 2 tons per day. Harvesting is done by pumping, filtration, washing, disintegration, pasteurization (optional) and spray-drying.

4. Spirulina development potential in Ethiopia

a) The need

In a "steady state" pattern, some of the critical problems identified in Ethiopia by the Ethiopian Nutrition Institute and others, are protein deficiency, the high prevalence of diseases caused by deficiencies in vitamin A and iodine, and nutritional anaemia, either due to iron or vitamin B12 (cyanocobalamin) deficiencies. As is well known, furthermore, Ethiopia is exposed to increasingly severe and frequent droughts. It is thus essential to find ways both to alleviate the malnutrition problems afflicting the population all year round, and to prevent the eventuality of high death tolls during occasional drought periods.

a PVC liner. They are in fact almost identical to industrial Spirulina production ponds. As was to be expected, the alga is already growing in the evaporation lagoon and is killed by the factory staff with copper sulphate.

If that factory could be converted into a Spirulina production facility, *the production would be enough to provide a 10-gram daily dosis of dried product to 9.09 million Ethiopian children under nine!*

5. Proposal

Meteorologists are predicting the beginning of a new period of drought and famine before the end of 1994. The death toll may be as high as the highest in the past.

We propose a *two-phase project:*

The first phase should be a joint venture between the Bureau d'Etudes et de Conseil en Culture de Micro-Algues (B.E.C.C.M.A.) of Nantes and Monpellier, the Ethiopian Mineral Resources Development Corporation (E.M.R.D.C.) and the International Ocean Institute (I.O.I.), to install a semi-industrial Spirulina production facility on a small part of these evaporation lagoons. This would be a demonstration plant. Production should be linked with a *training programme* (see Annex 2). The product would be used to show the spectacular results which may be obtained with this alga for renutrition. Five hectares would provide a daily ten-gram dosis to 62,500 children.

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B.E.C.C.M.A. would provide the Technology. I.O.I. would manage the Training Programme and co-ordinate the expansion of the programme. I.O.I. would also be responsible for raising the remaining two-thirds of the costs from donor agencies or other interested parties.

7. Budget

The *Budget for Phase I* is as follows (in US$; $1 = FF6.1):

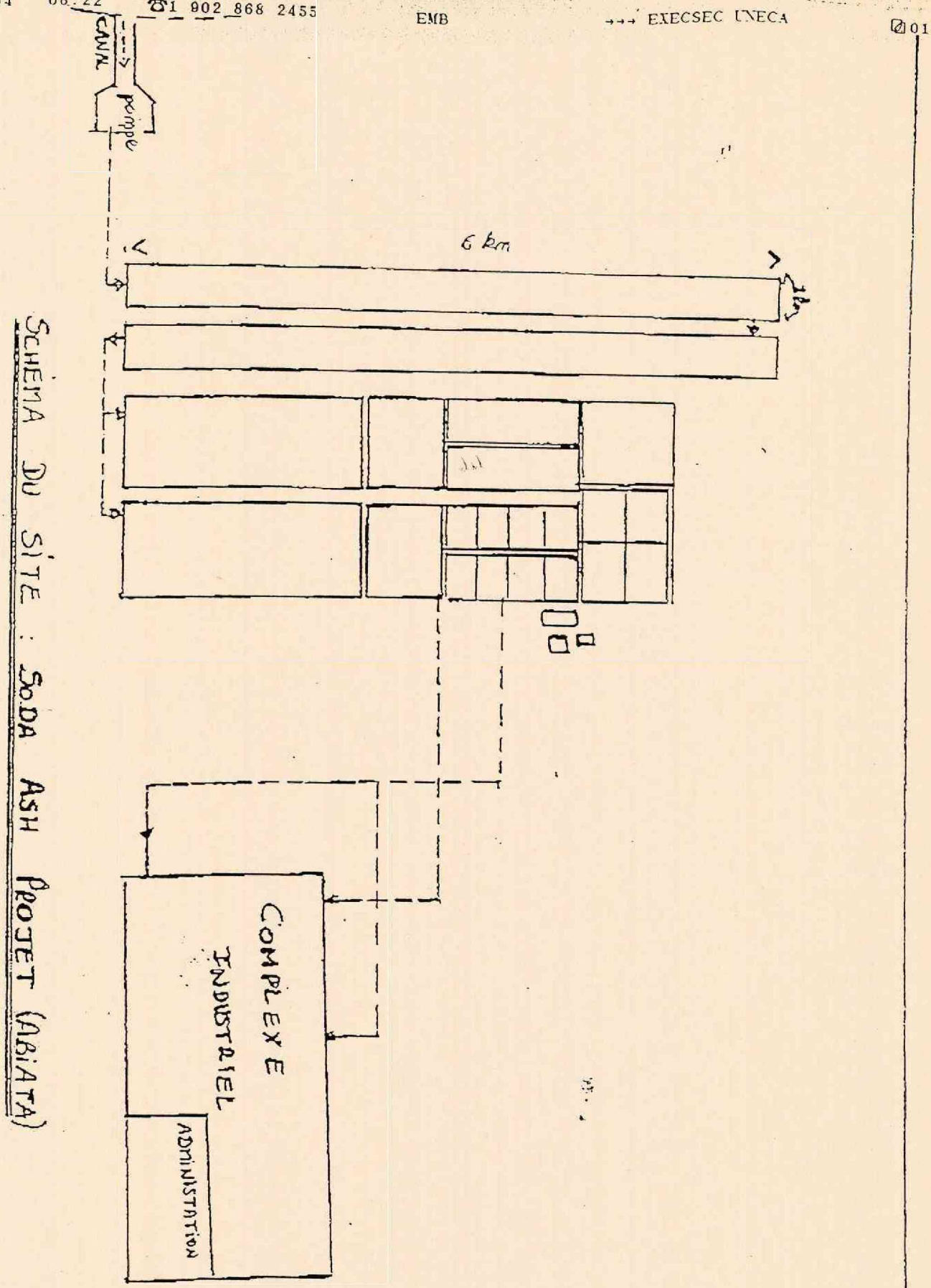
A. *Nonrecurrent costs*		
Land, landscaping, ponds (already in place)	0	
Building (around processing machinery)	66,000	
Machinery (stirring device, filters spray drier, etc.)	701,820	
Piping, electrical connections, etc.	89,000	
Starting cost (preparation of culture medium	65,000	
Subtotal		921,820
B. *Recurrent costs* (six months)		
Personnel (factory staff and volunteers)	0	
Chemicals	85,000	
Fuel (drying)	55,000	
Depreciation (only items shown above; 10 years life-span	92,182	
Subtotal		312,182
C. *Training costs*		

Annex 1

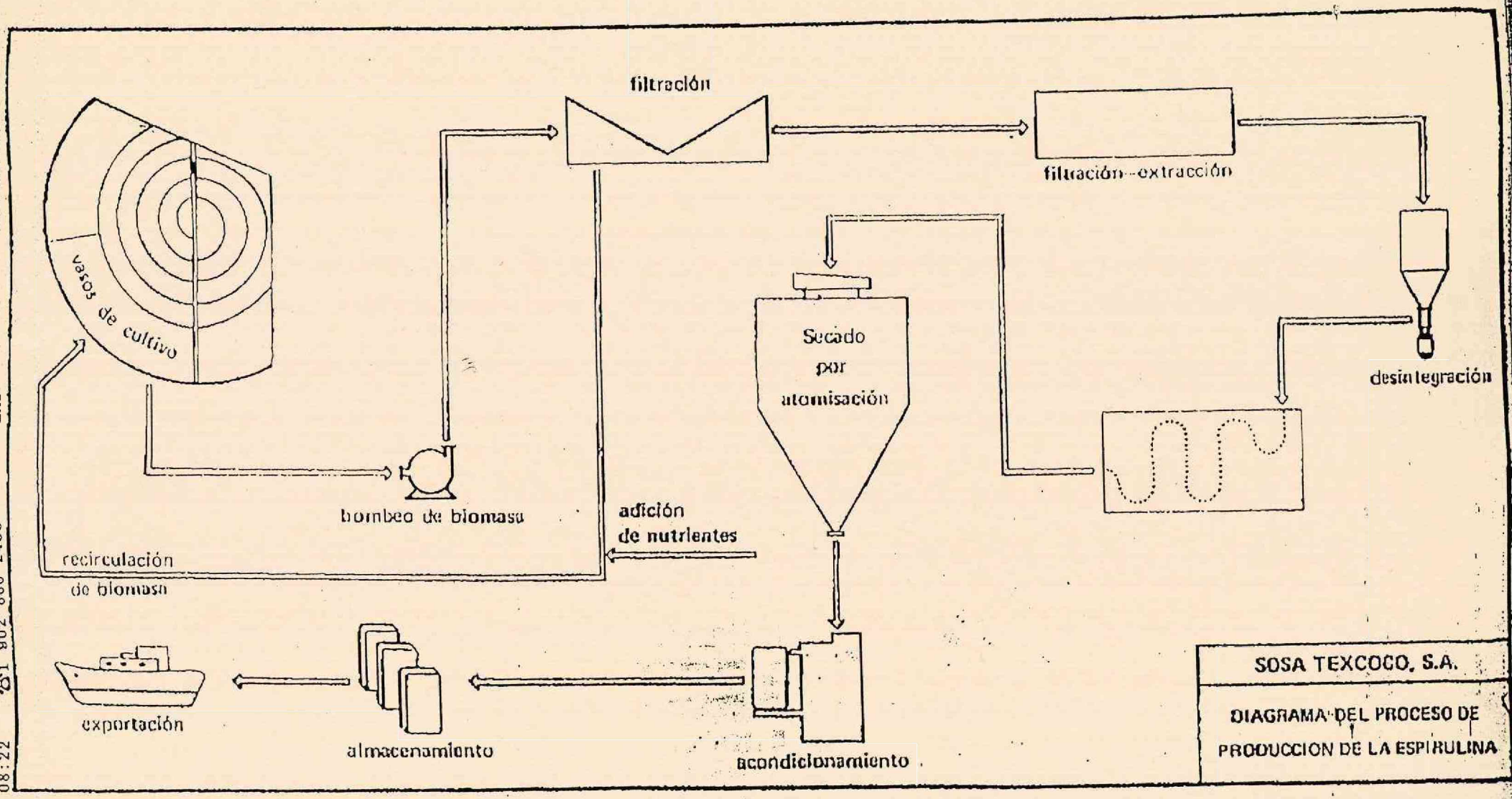
Lake Abijata Soda Ash Factory

Sosa Texcoco, SSA, Spirulina Production Plant

Principal Lakes of Ethiopia



SCHEMA DU SITE : SODA ASH PROJET (ABIATA)



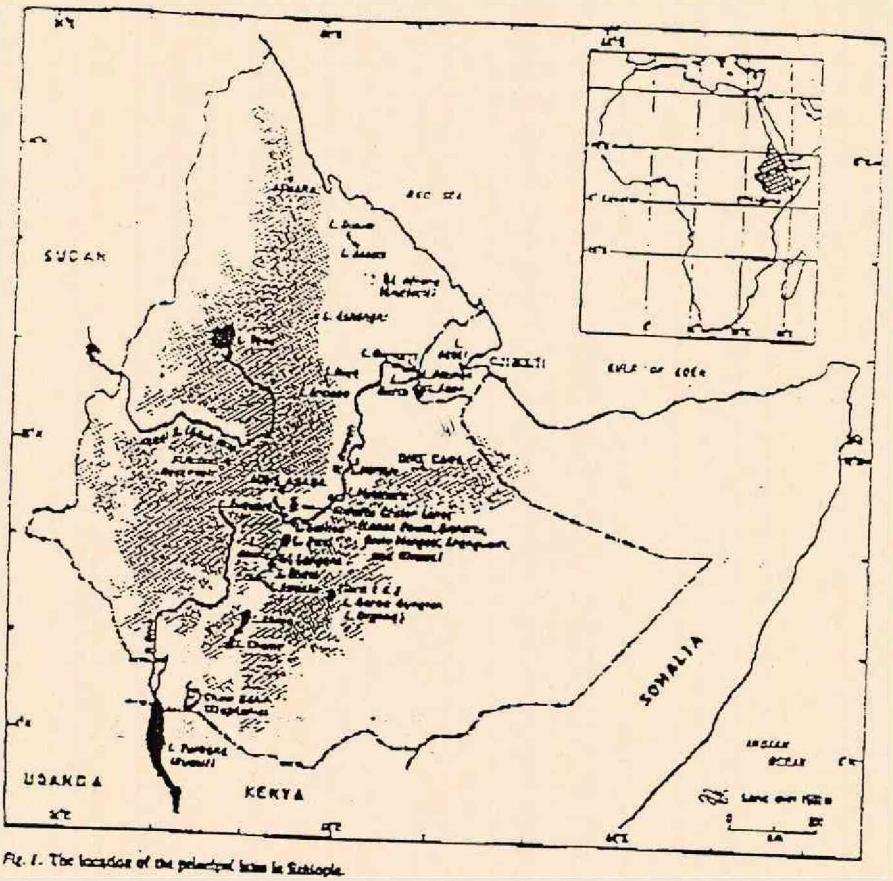


Fig. 1. The location of the principal lakes in Ethiopia.

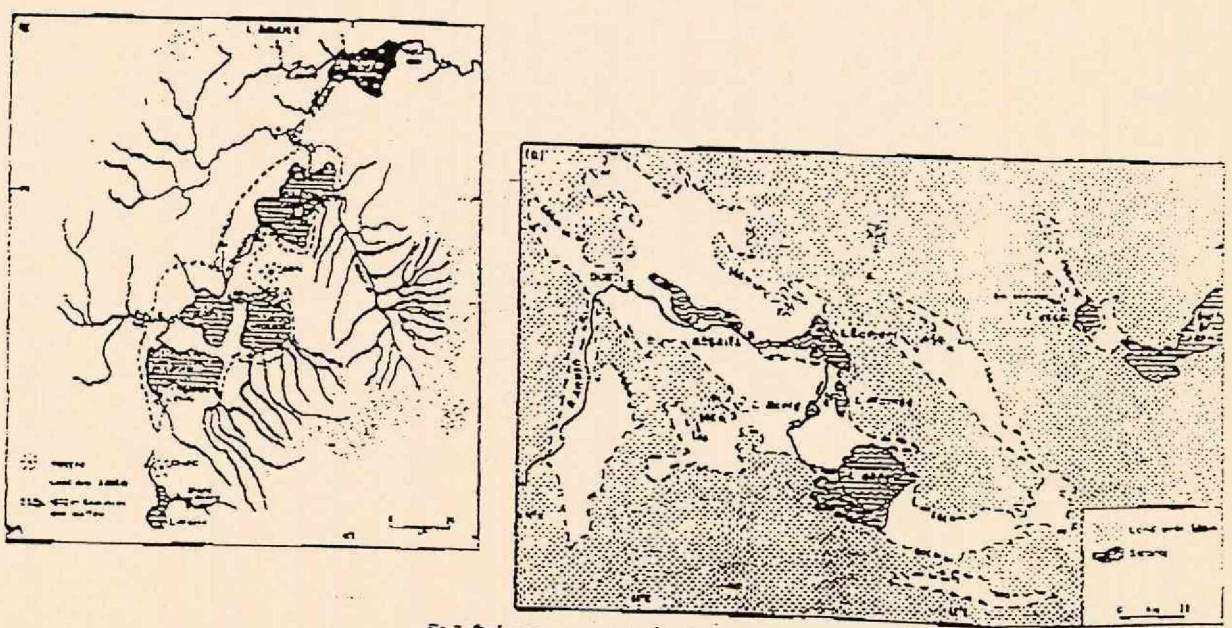


Fig. 2. Drainage systems associated with (a) the Galla lakes of the northern Rift valley (b) lakes of the central R. Awash system in Central Afar region. In (a) the maximum level at 1670 m altitude of a large closed lake, and its outflow channel, are indic

Post-Harvest Operations

Storage

Microbiological Control of the Product

Biochemical Control of the Product

Utilizations and Further Transformations

Health Food Products

Food Products

Pharmaceutical Products

Extraction of Pigments

Example of Application

Flow Sheets

Dimensioning & Engineering

Case Studies Including Your Future Plant

Financial & Economic Studies

Elements for Financial Analysis of *Spirulina* Factories

Case Studies Including Your Future Plant

Distribution in Crisis Conditions

Coordination with Aid Agenies

Priority Setting

Cooperating with Nongovernmental Organisations

Annex 2

Training Programme

TRAINING PROGRAMME

SPIRULINA PRODUCTION

Duration: 2 Weeks

Venue: Lake Abijata, Ethiopia

Programme Synopsis

Spirulina sp.
History
Taxonomy and Description
Cytology
Biochemistry, Physiology, Compoition

Traditional Harvesting
Mexico and Chad

Algae Production
Cultivation of Algae
Laboratory Culture
Ponds Design and Construction
Stirring Systems
Culture Media & Algal Nutrition
Ponds Inoculation
Culture Control
Control of the Culture Medium
Pest Control
Deficiency symptoms
Harvesting Strategies
Mathematical Laws of Harvesting
Pumping and Removal of Alien Particles
Concentration
Filtration and Washing of Algal Slurry
Drying

TRAINING PROGRAMME

SPIRULINA PRODUCTION

Duration: 2 Weeks

Venue: Lake Abijata, Ethiopia

Programme Synopsis

Spirulina sp.
History
Taxonomy and Description
Cytology
Biochemistry, Physiology, Compoition

Traditional Harvesting
Mexico and Chad

Algae Production
Cultivation of Algae
Laboratory Culture
Ponds Design and Construction
Stirring Systems
Culture Media & Algal Nutrition
Ponds Inoculation
Culture Control
Control of the Culture Medium
Pest Control
Deficiency symptoms
Harvesting Strategies
Mathematical Laws of Harvesting
Pumping and Removal of Alien Particles
Concentration
Filtration and Washing of Algal Slurry
Drying

Annex 3

Selective Bibliography

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