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FACT-FINDING AND PREPARATORY ASSISTANCE FOR THE INDUSTRIAL UTILIZATION OF MEDICINAL AND AROMATIC PLANTS IN SUDAN

XA/SUD/95/613

SUDAN

Technical report: Findings, work performed and recommendations*

Prepared for the Government of Sudan
by the United Nations Industrial Development Organization

Based on the work of K. Husnu Can Baser,
chemical technologist/team leader,
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LIST OF ANNEXURES

ACRONYMS USED

UNIDO	United Nations Industrial Development Organization
UNDP	United Nations Development Program
WHO	World Health Organization
FAO	Food & Agriculture Organization
CNS	Comprehensive National Strategy of Sudan, 1992-2002
NCR	National Centre for Research of Sudan
IRCC	Industrial Research & Consultancy Center, Sudan.
MAPRI	Medical & Aromatic Plants Research Institute, Sudan.
TRUMAP	Training in the Utilization of Medicinal & Aromatic Plants in Pharmaceutical & Related Industries, UNIDO in-plant group training program in Turkey.
SSMO	Sudanese Standards & Metrological Organization
IPC	Investment Public Corporation of Sudan
NIDB	El-Nilein Industrial Development Bank, Sudan

ABSTRACT

A UNIDO team, comprising K. Husnu Can Baser and Kenneth Abeywickrama, visited Sudan 3-31.12.95 December 1995 on a fact-finding and preparatory assistance mission for the industrial utilization of medicinal and aromatic plants of Sudan. The job descriptions of the experts are given in Annexes 1 & 2. The team was assisted by the national consultant Prof. Sami A. Khalid, whose job description is in Annex 7. Annex 3 gives a list of persons contacted during the mission. Sudan has a wide range of medicinal and aromatic plants and a long tradition of using some of these in folk medicine and cultural practices. Four of these plant products are presently important export items: gum arabic, karkadeh, senna pods and henna leaves. The competitive strength of these exports has declined. But there is potential for expansion of the volume, value and range of these commodity exports. There is also an opportunity for increased local utilization through local production of non-prescription drugs, toiletries, perfumes, essential oils and cosmetics from these plant materials, both for local use and export to neighboring countries and, in some cases, to the Middle East.

The country has extensive unutilized agricultural land suitable for increased production of these plant materials to support these potential new industries. The government offers an array of very attractive fiscal incentives for these new business ventures as well as for supporting agriculture. It also leases land at nominal rates and provides irrigation in several areas of the Blue Nile State. Private sector business operations have improved as a result of the liberalization and privatization programs since 1990.

The mission found a favorable local situation for these developments. The local pharmaceutical and perfumery manufacturing industries are small but well-organized, profitable and expanding faster than other industrial sectors. They are interested new product development based on medicinal/aromatic plants, and willing to invest in production facilities and supporting agriculture, and several have already commenced preliminary work. The major commodity export companies are well organized and interested in expansion of exports through value-addition and the standardization of product quality. The major areas of product development are in basic industries: essential oils and perfumes, medicated toothpastes, beverages and extracts, toiletries, semi-processed gums, non-prescription drugs for common ailments.

The mission recommends technical support for the development of two types of projects by the interested businesses in Sudan: (1) large-scale cultivation and oil distillation of lemon-grass and other essential oils and (2) developing and testing new products using the local medicinal/aromatic plant material. These will provide rural employment, supply local industry and generate export revenues. The private sector will pay for such assistance. The institutional framework for UNIDO assistance will be MAPRI, which will be restructured by the government and supported by UNIDO to make it a commercially-oriented research institute effectively serving the businesses developing these projects.

BACKSTOPPING OFFICER'S COMMENTS

The report contains a comprehensive account of the work carried out by the consultants with recommendations for the development of medicinal and aromatic plant based industries at SME level including activities in rural areas. An assessment of the present status of activities has been done and discussions have been held with Government institutions and the private sector. Private sector participation has been sought for the proposed technical assistance project where in the outputs to be achieved at village level are to be funded by the private sector. A draft project document was also prepared by the consultants in which strengthening of the Medicinal and Aromatic Plant Research Institute (MAPRI) is envisaged in order to develop agronomical and industrial packages to the private sector and to conduct the quality control activities. Funding for such a project may be considered through the African Development Bank contribution to the development of the pharmaceutical sector. It is hoped that the Ministry of Industry will consider the project for funding through IPF or the ADB.

The consultants have successfully carried out their duties in accordance with the Job Descriptions assigned to them.

1. INTRODUCTION

1.1 Country profile

With a land area of 2.5 million sq km, Sudan is the largest country in Africa (Annex 7). It has three major climatic zones: the northern deserts covering about 30% of the land, the semi-arid central region, and the tropical swamp and rain-forest region of the south. The Nile and its tributaries run through the country, providing the water that sustains the best agriculture and hydro-power for electricity. The current population is estimated at 25-26 million, giving it a population density of 10 people per sq. km. Annual population growth is around 2.6% and 45% of the population is under 15 years of age. With large areas of desert, half the population is concentrated in 15% of the land area. The adjacent cities of Khartoum, North Khartoum and Omdurman have the highest concentration of people with about 1.34 million persons. Arabic is the language used by about 60% of the population but there are over 115 other languages used by the country's diverse tribal groups.

Sudan has an adult literacy rate of only 28%, with 45% for men and 13% for women. School enrolment for those in the 6-23 year age group was only 27%, though public spending on education is 4% of GNP. Life expectancy at birth in 1992 is estimated at 51.9 years. Infant mortality is calculated at 98.7 per thousand. With 160 hospitals and a total of 17,300 hospital beds, there is an average ratio of one bed per 1,110 of the population. The country has about 2,100 qualified physicians. Public spending on health is about 1.3% of the national budget or US$ 1.0 per capita. Only 46% of the population has access to clean drinking water. **Only 11% of the population has access to health care in the formal sector.** Sudan ranked 151st out of 173 in the UN Human Development Report for 1994.

Sudan is among the least developed countries in the world with a GNP of US$ 10.1 billion (1990) and a per capita GNP of US$ 401 (1991). The economy is weighed down by an external debt of over US$ 20 billion requiring a debt service of US$ 21 million per annum at present and arrears of US$ 1.7 billion to the IMF alone. Government measures to liberalize the currency exchange rates to allow free-floating exchange rates and reduce government spending, coupled with increased food production in the last year, reduced inflation from highs of over 100% per annum to a current rate of around 65-70%. The government budget for 1995 also reduced corporate taxes, land purchase taxes and some import duties. However, Sudan's inability to meet the IMF demands for loan repayments led to a suspension of the Structural Adjustment Facility which the IMF has again refused to reinstate this year. The withdrawal of IMF assistance also means that Sudan has lost the support of other bi-lateral aid donors that now follow the IMF lead.

The origin of the GDP in 1992 was as follows: agriculture 33.8%, industry 16.7% (of which manufacturing 9.1%) and services 49.5%. Agriculture employs about 69% of the working population, employment in services occupies 23%, and industry and mining only 8%. Small-scale farming is the main economic activity in agriculture, though there are larger mechanized farms for cotton, sugar cane and wheat. Pastoral activities support a large livestock population: 23 million cattle, 18 million sheep, 13 million goats, 3 million camels. Livestock is of poor quality and is often regarded as a currency for social transactions and a status symbol rather than a commercial venture. The forestry sector is the source of gum arabic, of which Sudan is the leading international supplier. It also provides timber and medicinal and aromatic plants. The rivers and the eastern seaboard provide fishing, but the annual fish harvest is only about 24,000 tons.

With a recurring trade imbalance and net outflows exceeding inflows, the country had an average current account deficit of around US$ 500 million over the last 4 years. But with an increase in gum arabic and cotton exports, the current annual deficit is expected to be reduced to around US$ 355 million. Exports in 1993/94 amounted to US$ 438 million, imports amounted to US$ 618 million (in 1990). The principal

exports in US$ millions were as follows: cattle and beef 77, gum arabic 72, cotton 53, oilseeds 30, others 206. The main export destinations were Saudi Arabia 19.4%, Italy 14%, Thailand 10.3%, Japan 9.1%, Germany 6.6%, Egypt 6.6%. The main imports in 1990 in US$ millions were petroleum products 315, manufactured goods 69, machinery and equipment 63, chemicals 51, transport equipment 43, wheat and flour 22 and others 55. The principal origins of imports were Libya 17.9%, France 7.5%, UK 6.6%, Italy 5.9%, Egypt 5.2% and Saudi Arabia 5.2%. [1]

Sudan is rich in natural resources. Only about 15% of the potentially arable land is cultivated. There are substantial resources of petroleum, gas, gold, chromate, silver, iron ore, etc. awaiting commercial exploitation. It has substantially more capacity for irrigation and hydro-electricity generation.

Despite some gloomy forecasts and a somewhat hostile external environment, Sudan has good potential for economic growth and some steps taken by the government this year could result in major economic developments. These are the most important achievements in this regard.

(1) Agreement with the Chinese International Hong Kong Company to prospect for gold in south-east Sudan.
(2) Agreement with a Syrian-Jordanian group for mineral exploitation in southern Darfur.
(3) Kajbar dam project with Hydroprojekt of Russia for power generation.
(4) The US$ 750 million contract with May Petroleum Company of Canada (a subsidiary of Arakis Energy of the USA) for exploitation of the Greater Heglig oil-field with an estimated initial production of 85,000 b/d.
(5) Agreement for oil exploration with a Chinese company in west Sudan.
(6) Financing agreement with the Paribas bank of France for US$ 27 million for rehabilitation of the Port Sudan oil refinery.
(7) Additional financing agreements with the African Development Bank totalling US$ 140 million.

The prospect of oil revenues within two years should improve Sudan's financial standing with lenders and new investors.

A major constraint to economic development is the poor state of infrastructure services, particularly transport, telecommunications and electricity. The outdated railway system has 3,420 miles of track. Most of the 31,000 miles of road are dirt tracks. The present installed electricity generation capacity is about 500 megawatts or 4380 million kw/hour while actual production was 1329 million kw/hour (1990). Of this 29.4% is generated from fossil fuel and 70.6% from hydro-power. There are frequent power outages which disrupt work in the existing industrial sector.

The Sudanese pound (SP) is being gradually replaced by the dinar (SD): Dinar 1.0 = SP 10. Due to devaluation and inflation, the current exchange rate is US$ 1.0 = SP 825 or SD 82.5.

1.2 Background, Goals and Objectives of Mission

The government priorities and concerns are clearly spelt out in its **Comprehensive National Strategy, 1992-2002** (CNS) and are in accord with the objectives of this mission. The CNS states in the opening pages that "Raising the volume of investment in the agricultural and the agro-industries to the highest possible level is the first step in the one thousand miles journey of this strategy". The section of the CNS dealing with "The Strategy of Industry" opens as follows: "The nature of the country's resources, its social realities, and the level of its economic and technological development make the huge agricultural sector ..... the leading sector and the prime mover for economic and social development in the country.

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[1] All data from latest Economist Intelligence Unit reports.

The industrial sector gets its importance from its developmental role and its strategic importance in its contribution to the huge agricultural renaissance". The continuing balance of trade deficit and the need to increase exports to earn foreign exchange is a major concern of the CNS. This is to be achieved through increased exports and import substitution.

The Investment Encouragement Act of 1990 was established for this purpose. Approved investments for rehabilitation, expansion, modernization or for new business ventures will be exempt from corporate taxes and import duties on raw materials for periods ranging up to five years. Exporters are also eligible for a duty drawback on raw materials imported for export production.

The budgetary constraints and the inadequacy of foreign exchange for the import of pharmaceuticals places a burden on the government which is committed to supplying practically free medical services to the population. Since Sudan is rich in medicinal and aromatic plants and has an ancient history of traditional medicine, the Ministry of Finance and the Ministry of Industry considered that the extension of the use of these plants in industry for value added products for the local market and exports will be beneficial. A project to encourage the development of products based on medicinal and aromatic plants would have the following advantages.

1. Save foreign exchange on some essential oils, imported drugs and toiletries through availability of local products based on local raw materials.

2. Increase export earnings through production of essential oils and adding value to current commodity exports of medicinal and aromatic plants.

3. Generate rural employment by creating through plantations which will cultivate these medicinal and aromatic plants.

4. Provide a service to the local population through the provision of cheaper (and safer) non-prescription remedies, cosmetics and toilet preparations.

5. Generate employment through new industries in this category.

6. Generate employment in depressed rural areas by increasing the demand for medicinal and aromatic plants that are obtained from these localities.

7. Increase government revenue through the expansion of economic activity.

It is envisaged that the project will be implemented by the business sectors that are already engaged in the export of medicinal and aromatic plants or those engaged in the manufacture of pharmaceuticals. Indeed, sections of this business community have already communicated their interest in such projects to the concerned ministries, persuading the government to make a request to UNIDO for assistance in implementing these. The focus of such a project is seen as follows:

1. Assisting the development of an essential oil industry based on the substantial availability of land suitable for cultivation of aromatic plants and cheap rural labor.

2. Facilitating the production and commercial marketing of non-prescription drugs, cosmetic and toilet preparations that could be made from locally available plant materials that have traditional usage in Sudan and the neighboring countries.

3. Adding value to unprocessed medicinal and aromatic plants that are now exported bulk in raw form by introducing basic processing, quality standards and quality certification in order to obtain higher

value and become more competitive in the export markets.

This report deals with the following, as per UNIDO project document xx/SUD/94/x06 of August 1995, which states as follows:

1. The availability of raw materials to further develop the traditional medicine and a plant-based pharmaceutical and essential oils industry.
2. Assessment of the existing manufacturing facilities and the available infrastructure for production, quality control laboratories, human resource development as well as information on regulatory arrangements for plant-based medicines, if any.
3. Prospects of improving production of existing plant-based medicament and aroma chemicals, development of entrepreneurship and possible cooperation between existing and potential enterprises operating in the sector and scope of setting up of joint venture.
4. Market potential for medicinal and aromatic plants as well as product, based on both for domestic consumption and for export.
5. Laying down of standards for the raw materials and products and setting up of institutions to control these aspects.

1.3 Medicinal and aromatic plants of Sudan

The flora of Sudan consists of 3137 species of flowering plants belonging to 170 families and 1280 genera. An estimated 15 percent of the plants are endemic to Sudan. Although much of Sudan is desert and semi-desert, the occurrence of two main branches of the River Nile, namely the White Nile and the Blue Nile, makes a considerable proportion of the country irrigable. The southern parts of Sudan enjoy a tropical flora. Traditionally, Sudan has been a major exporter of several important plant drugs such as gum arabic (Acacia senegal), gum talha (Acacia seyal), senna pods (Cassia acutifolia), karkadeh (Hibiscus sabdariffa), etc. These will be dealt with separately below.

There is a rich culture of traditional medicine in Sudan since only about 11% of the population have access to formal medical care and several plants are used as household medicines. As in many Arab countries, arak, also called miswak (Salvadora persica), is used to clean teeth by brushing with the fibrous texture of pieces of the stem. Due to the cleansing and antibacterial properties of saponins and other chemicals contained in the stems, some companies have indicated a desire to develop a toothpaste using its extract. Senna or Cassia acoutifolia pods and leaves are commonly boiled and used as a laxative. El-hargel or Solenostemma argel leaves are traditionally boiled and drunk by women for menstrual problems. Henna or Lawsonia alba leaves are crushed and mixed with an oil to create a dye which is used to make decorative patterns on the palms, hands and feet of women. It is widely used as a beauty cosmetic by women throughout the Arab world.

Medicinal and aromatic plants are on sale in special shops called "attareen". These shops sell Sudanese as well as imported plant materials and special incense mixtures called "bakhour" which is composed of dried aromatic plant materials, gums, balsams, etc. When burnt in the traditional clay incense burner, bakhour gives off a fragrant smoke which is believed to clean the air, ward insects off and make the environment smell nice.

According to information given by the national consultant, Prof. Dr. Sami A. Khalid, the University of Khartoum, Sudan has a unique tradition of preparing local perfumes. These are a myriad of different preparations, each one adapted slightly to make a personal blend. They all are derived from the basic "khumra". In the old days, the khumra was prepared from mahaleb seeds (Prunus mahaleb), sandalwood powder (Santalum album) and different brands of known perfumes, lotions and eau de colognes. It has been developed, over the years, to become "khumra 'ajina" which is the basis of all khumras of the present day. The word "'ajina" refers to a mixture of paste made of various powders. The khumra consists of sixteen

ingredients. During the preparation of this sophisticated perfumed product, the 'ajina is smoked on a charcoal fire with pieces of sandalwood mixed with gum olibanum. The complete process of preparation for this fragrance takes over ten hours during which the products are ground, cleaned, smoked and finally bottled. The mixture is left to stand for some time to mature. The composition of khumra can be varied by the addition of lemon, sandalwood oil or a ready-made perfume, according to personal taste. There are several khumras, such as khumra zait (oil based), khumra dufra (includes shells), khumra misk (containing extracts of crocodile's sweat glands), etc.

Dilka (massage) is a universal custom amongst the Arabs in health and disease. The massage is usually carried out after anointing the body with oil which is scented (karkar). Dukhan (fumigation) is another popular custom especially favored by Arab women who are usually indulged in this practice for sexual enhancement, cleanliness and also for medical purposes. The smoke from the wood of habil (Combretum ghasalense), subakh (C.undulatum) and taleh (Acacia seyal) are used by Sudanese women and men to fumigate their naked body while covering it within a sheet of cloth in the form of a tent. The main purpose of this exercise is to impart fragrance to the skin by long exposure to the smoke of fragrant woods on hot charcoal.

During a visit to the famous attareen (traditional medicine store) in the Omdurman bazaar called "El Teiman", the mission recorded the following thirteen Sudanese drugs: 1) Shaw makkada (fruits of Perpomia sp.), 2) Karmadoda (fruit paste of Nauclea latifolia), 3) Hazaa (stems of Haplophyllum tuberculatum), 4) Sanamaka (fruits and leaves of Cassia acutifolia), 5) Sheeh (herb of Artemisia herba-alba), 6) Garad (fruits of Acacia nilotica subsp. nilotica), 7) Damsisa (herb of Ambrosia maritima), 8) Karkadeh (calyces of Hibiscus sabdariffa), 9) Fakahat (roots), 10) Karawya (fruits of Carum carvi), 11) Rashaad (seeds of Lepidium sativum), 12) Bakhur (gum of Boswellia carterii), 13) Hargal (leaves + stems of Solenostemma argel).

A student dissertation submitted to the University of Khartoum identified 30 plant drugs sold in attareen shops in Sudan as the following (excluding the above mentioned and the imported drugs): 1) Habat al arous (seeds of Abrus precatorius), 2) Bizr khilla (seeds of Ammi visnaga), 3) Laloob (fruits of Balanites aegyptiaca), 4) Bizr al kattan (seeds of Linum usitatissimum), 5) Turmus (seeds of Lupinus termis), 6) Aradaib (fruit pulp of Tamarindus indica), 7) Kazbarah (fruits of Coriandrum sativum), 8) Kamoon akhdar (fruits of Foeniculum vulgare), 9) Kamoon aswad (seeds of Nigella sativa), 10) Yansoon (fruits of Pimpinella anisum), 11) Hilba (seeds of Trigonella foenum-graecum).

Fifty plant drugs were recorded during a visit to the office of the export company, Concord Medical Enterprises Co., Ltd., in Khartoum. Apart from the above-named, the following Sudanese plant drugs were seen: 1) mahareb (leaves of Cymbopogon proximus), 2) al reihan (herb of Ocimum basilicum), 3) herb of Artemisia maritima, 4) seeds of Cassia tora, 5) herb or leaves of Mentha spicata, 6) seeds of Cassia occidentalis, 7) fruits of Capsicum frutescens, 8) seeds of Azadirachta indica, 9) leaves of Indigofera arrecta (Monkey's henna), 10) seeds of Cicer aretinum, 11) herb of Artemisia absinthium, 12) fruits of dwarf palm, 13) umgligla seeds, 14) wood of Khaya senegalensis, 15) watermellon seeds, 16) corn grains, 17) grapefruit peel, 18) orange peel, 19) guar seeds (Cyamopsis tetragonolobus), 20) mahaleb seeds, 21) fruits of Ziziphus spina-christi, 22) gum olibanum (Boswellia carterii), 23) fruits of Grewia tenax, 24) stigma and seeds of Carthamus tinctorius, 25) seeds of Brassica nigra, 26) ades (seeds of Lens esculentus), 27) seeds of Triticum sativum, 28) seeds of Phaseolus vulgaris, 29) fruits of Cassia fistula, 30) flowers of Matricaria chamomilla, 31) fruits of Anethum graveolens, 32) seeds of Sesamum indicum, 33) Al henna (leaves of Lawsonia inermis), 34) branches and leaves of Tamarix aphylla, 35) stems of Salvadora persica.

The same company had, in 1982, published a book titled "Medicinal and Aromatic Plants of Sudan" containing brief information on forty plant drugs also containing the following: 1) Catharanthus roseus, 2) Commiphora pedunculata, 3) Helianthus annuus, 4) Citrullus colocynthis, 5) Cyperus rotundus, 6) Croton tiglium, 7) Cymbopogon citratus, 8) Allium sativum, 9) Viscum album, 10) Eucalyptus sp., 11) Phoenix

dactylifera, 12) Argemone mexicana, 13) Hyoscyamus muticus, 14) Solanum sp., 15) Cuminum cyminum, 16) Peganum harmala, 17) Cissus quadrangularis. 118 medicinal plants are described with line drawings in three books of the series titled "Medicinal Plants of Sudan" published by the Medicinal and Aromatic Plants Research Institute (MAPRI).

The Investment Public Corporation of Sudan (IPC) recently compiled monographs of 62 medicinal and aromatic plants for the publication of an investor's guide. Apart from the these plants, the guide includes the following additional plants: 1) Baobab, gongolaise (Adansonia digitata), 2) Glycyrrhiza glabra, 3) Alalia (Securidaca longepedunculata), 4) Datura sp., 5) Allium cepa, 6) Ananas comosus, 7) Kurmut (Cadaba sp.), 8) Luffa cylindrica, 9) Momordica charantia, 10) Jatropha curcas, 11) Ricinus communis, 12) Albizzia lebbeck, 13) Dolichos lablab, 14) Medicago sativa, 15) Aloe sp., 16) Citrus limon.

The national consultant, Prof. Dr. Sami A. Khalid produced the following list as the most important Sudanese medicinal and aromatic plants: 1) Acacia nilotica, 2) Acacia senegal, 3) Acacia seyal, 4) Adansonia digitata, 5) Ammi majus, 6) Ammi visnaga, 7) Anethum graveolens, 8) Artemisia absinthium, 9) Artemisia maritima, 10) Balanites aegyptiaca, 11) Boswellia carterii, 12) Carum carvi, 13) Capsicum frutescens, 14) Cassia acutifolia, 15) Catharanthus roseus, 16) Citrullus colocynthis, 17) Commiphora myrrha, 18) Coriandrum sativum, 19) Cucurbita pepo, 20) Cuminum cyminum, 21) Cymbopogon citratus, 22) Cymbopogon nervatus, 23) Cymbopogon proximus, 24) Cyperus rotundus, 25) Foeniculum vulgare, 26) Haplophyllum tuberculatum, 27) Hibiscus sabdariffa, 28) Lawsonia inermis, 29) Lupinus termis, 30) Peganum harmala, 31) Pimpinella anisum, 32) Ricinus communis, 33) Salvadora persica, 34) Solenostemma argel, 35) Tamarindus indica, 36) Trigonella foenum-graecum.

Three plant products have well established distribution channels and are export commodities bringing in substantial foreign currency earnings to Sudan. These are gum arabic, karkadeh and senna pods. Gum arabic is a gummy exudate which is obtained by tapping branches of the Acacia senegal tree and its closely related species. The gum (hashab in Arabic), is highly demanded by food, pharmaceutical, textile, and related chemical industries for its favourable emulsifying and film forming properties. It has been traded for the last 4000 years. It is produced by villagers both from the wild and cultivated trees between November and June, and sold in one of the twenty five auction markets in the so-called "gum belt" of Sudan cutting across the country from east to west. A tree can be tapped twice a year from the age of 3 to 20. After 20 years, the trees are cut down and used to make charcoal.

Karkadeh is the dried dark red coloured calyces of Hibiscus sabdariffa. It is a native plant and is widely cultivated and consumed in Sudan as cold or hot beverage. The drink so prepared is also regarded as a remedy for cough. Total production of karkadeh in Sudan is around 12,000 tons per year and about 8,000 tons are exported, mainly to western Europe including Germany. It is mainly cultivated in Kordofan State. Karkadeh is used in Europe as an ingredient of herbal teas and the spray-dried karkadeh powder is used as a food-grade dye. Recently, UNIDO sponsored a project which dealt with the problems of converting a run-down milk powder factory at Babanousa into a karkadeh powder factory. The study, conducted by the NATEC Institute of Germany, recommended the setting up of a smaller spray drying plant for karkadeh powder production as heavy mechanical damages inflicted on the inner surface of the 700 kg powder per hour spray drying tower made efficient production of the powder impossible. Local business people expressed interest in making beverages and tea bags with karkadeh.

Senna pods are dried fruits of Cassia acutifolia which are collected while green and dried preferably in the shade. Due to high sennoside content (2-4%) the pods are used as the source of these laxative principles for formulation into ethical medicines. The pods are harvested by peasants principally from wild growing plants and bought by collector traders who, then, sell them to exporting companies. Sudan exports about 1500-2000 tons of senna pods a year to industrialized countries. The leaves which also contain sennosides are not exported any more due to their brittleness and smaller size than senna leaves of Indian origin (Cassia angustifolia) which dominate the world market for senna leaves. There is no pharmaceutical

company in Sudan currently using indigenous senna pods or leaves for laxative formulations: instead sennoside containing laxatives are imported. One newly established pharmaceutical company has recently filed an application for registration of a laxative tablet containing standardized senna pod powder.

1.4 Previous studies

"Mobile Unit of Pharmaceutical and Essential Oils Industry to the Least Developed Countries in Africa, Sudan, 3 November-3 December 1979, Terminal Report, RF/RAF/79/005. UNIDO Document DP/ID/SER/ B.241". Prepared by I.Minea, A.Iugau, E. Paun and L. Negut.

The report and the draft project document were prepared by a group of Romanian experts who travelled in Sudan for several weeks in November 1979 with a mobile unit equipped with laboratory equipment and materials to collect materials and data on medicinal and aromatic plants and to assess their potential for industrial development. The group of experts who were assigned by UNIDO worked in close collaboration with the Medicinal and Aromatic Plants Research Unit of the National Council of Research, the Industrial Research and Consultancy Centre (IRCC) and the Faculty of Pharmacy of the University of Khartoum. The experts identified twelve wild growing medicinal and aromatic plants, namely, Cassia acutifolia, Ricinus communis, Capsicum frutescens, Datura stramonium, D.innoxia, Rauvolfia vomitoria, Catharanthus roseus, Carica papaya, Cucurbita maxima, C.pepo, Foeniculum vulgare, Anethum graveolens and Citrullus colocynthis. They recommended that research be conducted on a further twelve plant species growing abundantly in Sudan, namely, Hibiscus sabdariffa, Tamarindus indica, Acacia nilotica, Solenostema argel, Mentha viridis, Cymbopogon proximus, Lupinus termis, Balanites aegyptiaca, Cuminum cyminum, Lawsonia alba and Salvadora persica. They further recommended the cultivation of twelve more plant species, namely, Pimpinella anisum, Mentha piperita, Mentha crispa, Matricaria chamomilla, Carum carvi, Cinchona sp., Strychnos nux-vomica, Strophanthus sp., Saponaria officinalis, Coriandrum sativum, Tussilago farfara and Rosa canina. Finally, they advised the introduction of twenty European medicinal and aromatic plants into cultivation in Sudan from seeds brought in by the experts from Romania. These plants are the following: Atropa belladonna, Calendula officinalis, Carum carvi, Coriandrum sativum, Cynara scolymus, Datura innoxia, Digitalis lanata, Foeniculum vulgare, Lavandula angustifolia, Matricaria chamomilla, Ocimum basilicum, Pimpinella anisum, Plantago lanceolata, Salvia officinalis, Saponaria officinalis, Sinapis alba, Solanum laciniatum, Tagetes patula, Thymus vulgaris and Valeriana officinalis. The report contained prescriptions using medicinal and aromatic plant products based on the above listed plants for various ailments. The project proposal annexed to the report was to the value of US$ 127,500. The main objective of the project was to strengthen the Medicinal and Aromatic Plants Research Unit to enable it to cultivate, process and analyze medicinal and aromatic plants of Sudan and the introduced species.

The report and the project proposal had several shortcomings. The experts recommended the introduction of twenty European species into Sudan for cultivation. Most of these plants are not included in the flora of Sudan and such costly and unnecessary introduction of temperate species into tropical areas would not facilitate or expedite the development of Sudan. The diseases for which remedies were suggested are not the priority diseases of Sudan. Therefore, if implemented, the project would not solve the health problems in the country. The equipments suggested were defined with vague descriptions and ambiguous costs. The project was costed at an impossible figure of US$ 127,500,000.

2. THE PHARMACEUTICAL INDUSTRY

2.1 Current situation

The total value of the pharmaceutical market in Sudan is estimated at around US$ 70 million, of which around 50% is imported and the balance is produced locally[2]. In terms of volume of production by packs, it is estimated that imports constitute 33% and local manufacturing provides the balance 67%. Importation for the public sector health services is through the Central Medical Stores of the Ministry of Health. The Ministry of Defence also makes some imports for the armed services and also has its own small manufacturing unit. Private sector importers supply the requirements of the estimated 600 private sector pharmacies in the country.

The market and the industry are expanding, as the following table relating to imports illustrates. Accurate figures regarding local production are not available.

Imports of pharmaceutical items, 1991-1994, (US$ million)

Year	Human use	Veterinary use	Raw material	Total Value
1991	4.5	1.5	2.7	8.6
1992	18.3	2.9	5.3	26.5
1993	14.9	0.6	7.9	23.5
1994	23.7	11.9	8.7	44.3

Source: Statistics Section, Ministry of Industry.

Local production value is now estimated at about US$ 35 million equivalent and, as the raw material imports suggest, is increasing.

The local manufacturing sector is in a healthy state and is expanding very fast. The main pharmaceutical manufacturers, in ranking according to production volumes, are these.

(1) Amipharma Laboratories Co.
(2) Sudanese Chemical Industries
(3) Humavet Drugs International Ltd.
(4) Sigma-Tau Sudan Ltd.
(5) CIMA
(6) Balsam Medical Industries Ltd.
(7) Pharmaceutical Industries Laboratories Ltd.
(8) Abdel Moneim Medical Industries Co.
(9) Wafrapharma Laboratories
(10) General Medicines Co.
(11) Medical & Sanitary Products Ltd.

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[2] A figure as low as US$ 13.9 million for the total value of the pharmaceutical industry was given in another report on Sudanese industry. The figures quoted in this report are drawn from the Pharmaceutical Manufacturers' Group, a trade association of the pharmaceutical industry, and statistics obtained from the Ministry of Industry.

The local manufacturers supply about 60 types of basic drugs in the following categories: anti-infectives such as anti-bacterials, anti-malarials and anti-amaeobics; analgesics, anti-pyretics, non steroidal anti-inflammatories; miscellaneous over-the-counter drugs. These are made in the form of tablets, capsules, syrups, parentherals (injection & I/v fluids), powders and semi-solids (ointments, creams, pastes). Some products are manufactured under license from foreign drug manufacturers but most of the products have been locally formulated to meet international standards. All raw materials are imported and are stated to be from reliable foreign suppliers.

Locally manufactured products are of good quality and are accepted by the market and the medical profession. The factories are modern and the technical staff are adequately qualified. Laboratory facilities in the bigger companies are superior to those in government research institutes and are professionally manned. The companies are able to compete on equal terms with equivalent imported products. The quality control laboratories seen by the mission were of a good standard and the manufacturers adhered to GMP[3]. There is excess capacity in the production of tablets, capsules and powders for oral suspension, where production capacity utilization is about 40%, but there are many new product areas that are attractive to local manufacturers who are seeking to expand product lines. As the economy improves, the demand from the government hospital sector and private sector hospitals and pharmacies will increase much further.

The pharmaceutical manufacturing industry did not expand during the nineteen eighties because of excessive government regulation of business and the lack of access to foreign exchange for the import of raw materials, machinery and equipment. After the Comprehensive National Strategy, 1992-2002, and the liberalization and the privatization programs that followed after 1991, the pharmaceutical manufacturing industry has seen very healthy growth and the four companies visited by the mission were implementing very substantial factory expansion plans. The manufacturers are now able to obtain foreign exchange for the import of raw materials and machinery from the foreign exchange bureaux in exchange for local currency. The industry is exempt from excise duty and sales tax. And some companies have obtained 2-5 year exemptions from corporate tax and import duty concessions through the Investment Public Corporation for these new investments as approved industries.

The present market for locally produced pharmaceuticals is buoyant and the demand is steady. While pharmaceutical importers have medical and sales representatives to sell their products aggressively, the local manufacturers visited had made minimal investments in marketing and had small sales teams. Government regulations do not permit pharmaceutical manufacturers to sell their products direct to pharmacies. They obtain their sales through wholesale distribution points in Khartoum or Omdurman from where other wholesalers collect and distribute their products around the country, indicating that there is a steady market demand which is pulling sales without much effort by manufacturers to push their products. The wholesale distributing companies are invariably linked to the manufacturing companies through family connections or joint shareholding.

The import or local manufacture of pharmaceuticals is controlled by the Ministry of Health and the Ministry of Commerce. The Ministry of Health maintains a list of approved drugs and specifications. Importers must pay a registration fee and become registered as pharmaceutical importers with the Ministry of Commerce. Approval is given for each import on the basis of the pro-forma invoice submitted by an importer for approval. If the product is an approved drug and the C&F price is within the range that is considered acceptable, approval is granted. The importer must then find the foreign exchange for the import, as the banking system will not usually fund such imports. The importer may buy foreign currency from the exchange bureaux (current rate of US$ 1.0 = SP 900-950) or purchase currency through the foreign exchange account of an exporter who has accumulated foreign exchange. Once the imports arrive in the country, the importer must get the pricing approved by the Ministry of Commerce before the product

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[3] Acronym in industry for Good Manufacturing Practice.

is released into the market. The ministry has a formula where retail prices are approved on the basis of C&F cost plus local handling/transport/ storage expenses plus importer and retailer margins. The importer's margin is fixed at 16.5% and the retail margin at 20%. Importers then distribute the product to local pharmacies through their sales representatives. They also employ marketing representatives for detailing medical practitioners.

Government imports through the Central Medical Stores are done on the basis of public tender. At present there are separate tenders for the purchase of imported products and locally manufactured products to prevent very cheap imports from Asian and Middle Eastern countries out-bidding local producers. Imports are mainly from India, China, Malaysia and the countries with which Sudan has trade protocols such as Egypt, Syria and Jordan. Jordanian products enjoy a good reputation in the market.

Medical Development Enterprises Ltd. of Khartoum, which is an importer of pharmaceuticals and local agent for several foreign principals, provided the mission with information about the import of pharmaceuticals into the country. The company maintains medical detailmen to support the main principals and a sales force to distribute its products but faces increasing competition from local manufacturing companies.

As in other countries, the international pharmaceutical companies have their local agents in the country. Imports are done only through local agents. These local agents employ marketing and sales representatives who work for the brands of different manufacturers, visiting the doctors to obtain support for these brands and selling into pharmacies. There are about 300 pharmacies in the main adjacent cities of Khartoum, North Khartoum and Omdurman and about 600 in the whole country. Importers' salesmen sell the drugs directly into the pharmacies in the three main cities. Larger pharmacies act as wholesalers of drugs and supply pharmacies in the provincial towns who come to these cities to buy their supplies. Importers must sell drugs with a shelf-life of about two years as movement is slow and withdrawals from the market are difficult.

The local pharmaceutical manufacturing companies are very profitable and the industry has generated funds for expansion. During the meetings the mission had with the four companies visited, the managements expressed interest in expanding into new product lines based on the use of locally available medicinal plants. The main areas of interest were these: (1) extracts from senna for laxatives (2) extracts from miswak for dental hygiene, (3) anti-spasmodic drugs from Datura innoxia and Datura metel. Some of these expressions of interest are contained in letters addressed to the mission (Annex 6).

The main constraints faced by the companies were stated to be (1) technical know-how for new product development and (2) specifications and drawings for new plant for manufacturing these new products. The local companies interested in these projects expressed an interest in obtaining technical assistance from UNIDO on a cost-sharing basis. There were no requests for investment funds from the manufacturers as they seemed to have adequate resources of their own or access to funds through foreign partners. With the shortage of foreign currency in the banking system for investment funds, and the high cost of local credit which amounts to about 36% per annum, manufacturers would prefer to invest their own profits.

It was noted with concern that expansion plans and new investments were being undertaken or planned by the pharmaceutical industry with minimal information on markets and marketing practices. None of the companies visited had accurate information on market volumes, competition, pricing, the number of wholesalers and pharmacies, number of doctors, etc. Not a single public servant or pharmaceutical company manager interviewed by the mission knew the real size of the total market, the number of medical practitioners in the country and the number of pharmacies. Since manufacturers are able to sell their products without much difficulty, they assume that they can continue to expand the market with new products. The mission saw a project proposal for funding to the extent of about US$ 0.5 million from a

leading pharmaceutical company at the El-Nilein Industrial Development Bank which carried the same inadequacies. While this may be considered a characteristic shortcoming of newly developing countries, it is quite possible that some of these new investors may come to grief in the near future through inadequately planned investments.

2.2. Elie Pharmaceuticals Ltd.

Elie Pharmaceuticals Ltd. is one of the companies in the group of companies owned by G.M. Haddad & Sons Ltd. and is in the business of importing pharmaceuticals. The main company, G.M. Haddad & Co. Ltd., exports medicinal and aromatic plants. It is a leading exporter of senna pods and karkadeh from Sudan (Chapt. 3, Sec. 3.3). Another subsidiary, Sudanese Cosmetics & Household Products Ltd., imports and distributes household and grocery products and also packs detergents and perfumery products in a small but modern plant in Khartoum. It has a marketing organization with 13 sales representatives. The local packing of detergents and cosmetics is not doing well: the plant was operating at about 5% capacity. The company stated that demand for higher priced consumer products was poor due to the low purchasing power and the high excise duty of 75% on luxury items. A subsidiary company located in Port Sudan is the local agent for the French shipping line, Compaigne Maritime A'ffretment, which carries cargo between Sudan and most of the west European ports. Another subsidiary named EGH Commercial Company will establish new business.

EGH Commercial Company is presently building a new manufacturing plant to produce solid and liquid pharmaceutical preparations on 40 ha of land in the industrial estate in Gezira province. The mission visited the premises where the construction work on the buildings was in progress. The buildings under construction will cover 35,000 sq mt and is to be centrally air-conditioned.

Since the company expects to have sufficient factory space and tabletting capacity, it is interested in expanding its proposed production lines by entering the area of non-prescription drugs based on local medicinal plants. It is initially interested in producing a laxative in tablet form based on senna to match international brands like Senekot. The company has the funds for this project and requires the technical expertise for product formulation and the subsequent designing of the requisite manufacturing equipment. It is willing to obtain expertise from UNIDO on a cost-sharing basis.

The company, being a leading exporter of senna pods, does not foresee a problem of obtaining raw materials locally.

2.3 Sigma-Tau Sudan Ltd.

This company, the fourth largest in volume in pharmaceutical production in the country, is a joint-venture with the Sigma-Tau Company of Italy and was set up in 1982 with production commencing in 1984. The foreign partner holds 49% share and the local partners have 51%. The factory is equipped to produce hard gelatine capsules, tablets, dry powder for oral suspensions, pastes, creams, ointments and surgical dressings. The company manufactures 22 product lines and has applied for the registration of 6 other lines. The company is associated with the Blue Nile Textile Co., the largest textile manufacturer in Sudan, for the manufacture of surgical dressings using Sudanese cotton. There are plans to expand into absorbent cotton bandages, expandable bandages, wound dressings and sanitary towels, and also enter the export markets in neighboring PTA[4] countries with these.

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[4] Preferential Trade Area covering east and central Africa.

The company developed its own packaging industry and manufactures blow-molded plastic bottles, polycelene and pvc.

The company employs 130 personnel, including 30 university graduates. The sales distribution is done through an associated company, Sharif Pharmaceutical & Chemical Co., which is an authorized drug distributor with its own pharmacists and a fleet of sales vans for sales distribution.

Within the local pharmaceutical industry, Sigma-Tau pioneered the idea of developing preparations based on Sudanese medicinal plants and established its own phyto-pharmaceutical division for this purpose. It applied to the government to seek international expertise for the development of this new business which later led to the government's request to UNIDO for assistance in this area. The company has established a pilot farm where about a dozen species of the selected botanicals are grown. The company has initially identified three prospective product areas.

(1) A toothpaste incorporating miswak, a plant widely used in Arab countries for dental hygiene. Stems from this plant are now popularly used to brush the teeth.
(2) Senna based laxative tablets, similar to the product manufactured by some international pharmaceutical companies.
(3) An anti-spasmodic based on the local available plants, Hyoscyamus muticus, Datura innoxia, Datura metel, similar to the brand Buscopan which is manufactured by foreign pharmaceutical companies using Hyoscine Butylbromide.

The company requires foreign technical expertise for product formulation and the design of the necessary additional equipment. It is prepared to enter into cost-sharing agreements for the hire of UNIDO experts specializing in this area. The company has already entered into a contract with its joint-venture partner in Italy to set up a plant to obtain an extract from senna. The foreign partner will provide the technology and equipment for repayment over 10 years, with an undertaking to buy the product.

The company does not foresee a problem in obtaining raw materials from the local trade for these projects. However, it is prepared to go into cultivation at a later stage if the business develops. It has some tentative plans to use Al Raja Agricultural Project for pilot farming if the need arises.

2.4 Amipharma Laboratories Ltd.

Amipharma Laboratories is the largest manufacturer of pharmaceuticals in Sudan, claiming an annual sales turnover equivalent to about US$ 6.0-7.0 million. It estimates it has about 10% share of the total market in Sudan and about 20% of the local pharmaceutical production. The company is a family-owned business which commenced in 1983 with two production lines for capsules and tablets. Over the next 7 years the company experienced difficulties because of government over-regulation and exchange control restrictions on foreign currency. With liberalization after 1990, the company expanded. Subsequently, two additional production lines were set up for liquid syrups and lozenges. The company employs 120 personnel, including a number of qualified staff. The current factory production area covers about 5,000 sq mt and is clean and air-conditioned. The company manufactures anti-bacterials, anti-malarials, anti-amaeobics, analgesics and anti-pyretics. It manufactures some of these under license from Beecham Products of UK and the others are under their own brand name. It feels that foreign licensing agreements are not very helpful as the multinational companies offer only restricted assistance and demand high royalty fees.

The company is at present expanding its factory production area by another 1,500 sq mt. It states that though it made an application for tax exemption from the Investment Public Corporation, it did not receive its approval because the investment was considered an expansion of capacity and not a new business. They have nevertheless gone into the expansion program. The company is expanding its present

product lines and has also obtained new machinery for the manufacture of medicated creams and ointments. The company claims a capacity utilization of about 70% at present. It is very confident about the future of the industry.

The company distributes its products through an associated company, Amipharma Drug Stores, in Khartoum. This company employs 2 medical representatives and 3 sales representatives.

The main competition comes from international pharmaceutical companies in Jordan, Syria, Egypt and India. Jordanian brands are regarded by the market as premium products. Multinational companies send only generic products to this price-sensitive market. Competition in the local market is mainly on the basis of price, not brand names. The distributing company has to give wholesalers 4-6 weeks credit on purchases.

Quality control was observed to be of a high standard. The company has modern and well-equipped microbiology laboratory facilities and a qualified staff manning these. The laboratory was initially established with some assistance from Prof. Hendricks who was in Sudan as a UNIDO consultant. The clean and efficient laboratories with all equipment working was in contrast with the public sector laboratories. The company also has a pilot production line for product development.

According to the company, except for a government quality audit about once in two years, the ministries and government research institutes have no communication with the companies. At one time the company tried to link with the University of Khartoum for product development but this project failed. The company opines that the university staff are not geared to develop product formulation as they have no experience in industry. The company needed expertise in the areas of product formulation and air-conditioning and is willing to pay for these consulting services.

The company has not considered the development of non-prescription drugs based on local medicinal plants. It will be interested in considering this business if it has more information about the prospects.

2.5 Climax for Drugs

Climax for Drugs is a recently established pharmaceutical company with immediate plans to start production of phyto-pharmaceuticals in Sudan. The production manager, Dr.A.Karim, a former TRUMAP trainee, has recently left his job at the Faculty of Pharmacy as Professor of Pharmaceutical Technology to join this newly established company. The major objective of this company is the production of non-prescription drugs based on locally available plant material to serve the local market and markets in neighboring countries. It is working concurrently on a number of new projects which are noted below:

(1) The company has already filed an application with the Ministry of Health for the registration of its senna tablets, using standardized senna pod powder for laxative tablets. It reckons the local production of senna tablets will save hard currency and provide a good import substitute. It will also provide a better alternative to the traditional use of senna pods.

(2) It is developing coloring and flavoring agents for pharmaceuticals and beverages based on karkadeh. Karkadeh is also being used to formulate powder and effervescent tablets containing vitamin C.

(3) It is studying the composition and anti-microbial effect of Nigella sativa oil for its possible formulation into pharmaceuticals.

(4) It is working on the formulation of an emulsion containing methoxalen ex Ammi majus to cure vitiligo (discoloration of skin). The results are said to be encouraging, with decreased side effects and increased rate of pigmentation.

(5) It is trying to develop extracts from the fruit of Azadirachta indica (Neem) to formulate anti-malarial, anti-inflammatory and anti-rheumatic drugs.

2.6 Evaluation

The local pharmaceutical manufacturing industry is well organized, profitable and expanding. Since the local market is under-supplied due to foreign exchange shortages for imports, it sees room for market expansion. It is the most active industrial sector in the country. On account of its existing manufacturing organization, it sees opportunities in the manufacture of non-prescription drugs based on local medicinal plants. This is a large market in any country, as the majority of consumers resort to such over-the-counter drugs for common ailments. The main product areas of interest were laxatives and cough medicines, but some other areas are also being tested.

The pharmaceutical industry is interested in the development of value-added products and new pharmaceutical, cosmetic and household products based on local medicinal and aromatic plants. The proposed new ventures represent a logical expansion of the present industrial base and do not involve very sophisticated technology or production processes. They are within the capacity of the local industry. The interested companies are seeking markets only locally and in the neighboring countries or Middle East, except in the case of Sigma-Tau which plans to export senna extract to its partner in Italy. Some letters of intent from companies are given in Annex 6.

The industry is attracted by the fiscal incentives offered by the government for most of the planned projects and encouraged by the economic liberalization measures. High profits generated by the pharmaceutical industry provide finance for investment. In the present inflationary situation in the country, companies would invest in factories and machinery rather than retain money which is depreciating in value.

The companies requested external consulting support in the areas of product development, product testing and the designing of machinery and equipment for processing ingredients from the local raw materials. These are not facilities that will be found in the quality control laboratories of these companies and would be too expensive for individual companies. These services can be provided through UNIDO consultants who are assigned to work with MAPRI, if the project proposal of this mission is implemented.

Even the hire of external consulting services will represent an investment in research which will benefit the country. To encourage this activity, the mission recommends that investment in research should be deductible from profits for tax purposes, rather than be deducted only as a normal business expense. This will encourage companies to seek the services of MAPRI in future.

Though the industry is not aware of it, it also needs support in the areas of feasibility studies, project formulation and marketing. It may otherwise face a situation where its new investments in this area may not be profitable. This failure would result in foreign exchange losses and discourage further investments. The government investment promotion agency, the Investment Public Corporation, and the government development bank, the El-Nilein Industrial Development Bank, can help to avert this by insisting on more professionally prepared investment proposals as a condition for approvals.

3. MARKETING OF MEDICINAL AND AROMATIC PLANT PRODUCTS

3.1 Traditional medicine and practices

Sudan, like many other developing countries, has a long tradition of folk medicine. Indigenous remedies are often the only form of therapy available to the large majority of poor people living both in rural areas and the cities. In Sudan, it is assessed that only 11% of the population has access to the formal health sector. Government medical services which were available free of charge are now available at a nominal charge. But poor recipients are unable to afford the cost of medicines which they have to buy in the market and opt out of the system. At the same time, government medical services are quite inadequate due to government budgetary constraints. The country had over 4,000 medical doctors at one time but the figure today is around two thousand. The medical college graduates about 200 doctors a year but many of them leave for employment abroad. The monthly salary of a government medical practitioner is about US$ 30-75 equivalent at current exchange rates. Since medical services are not available or are too costly in cash terms for the majority of people, they have to continue with traditional home remedies or local remedies prescribed by unregistered traditional healers.

Medicinal and aromatic plants and their derivatives are an integral part of the life and culture of the people of Sudan, not just items used for therapeutic or cosmetic purposes. They are relevant even today not merely because western medicinal services, toiletries and cosmetics are too expensive for the majority of the people, but because much of it is a part of a way of life. As Sudanese society becomes more affluent and sophisticated with economic progress, some of these useful practices could be continued with the conversion of the crude raw materials now used into more sophisticated products instead of being totally replaced by foreign product concepts and practices.

The mission visited a well-known traditional medical practitioner in a suburb south of Khartoum, Sheikh Balla A. Ghayeb, who had a flourishing medical practice and was wealthy by local standards. He claimed that he catered to over a thousand patients monthly, working 4 days a week. He belonged to the Tijania religious sect and was a follower of Imam Al-Akhadery. Advertising boards in his clinic claimed that he cured sexual impotence, bronchial asthma, hemorrhoids, gout, high blood pressure, renal failure, slipped disc, eczema, gonorrhea, syphilis, rheumatism, dysentery, liver inflammation, tuberculosis, hemophilia and mental disorders, among others. Brochures and leaflets with religious quotations were available to patients to testify to his abilities. He claimed that he gained his skills as an apprentice to Sheikh Khalifa Abdul Wahab and Sheikh Al-Tayeb in southern Sudan while he was employed as a soldier in the Sudanese army and later under Imam Al-Tukhi in Cairo.

Patients of this traditional medical practitioner included the rich and poor, who paid him after treatment according to their wishes. He dispensed his own medicines (secret and unregistered) which were in the form of powders and powders mixed with honey. He claimed that he had his own farm of 80 hectares extent where 16 species of medicinal plants were cultivated, while 7 other species were collected from the wild and 8 species were imported. It was noted that patients could pay him in goods instead of cash (eg. cattle or goats or other products), depending on their financial capacity, making his treatment available to those who were less affluent financially.

The proposals by the Ministry of Health to regulate these traditional medicinal practitioners and their practices are valid. The traditional medical practitioners in Sudan have no formal training and their knowledge is based on acquired folklore. It is not a medical system. This is not to be equated with the Ayurvedic medical system of South Asia or the Chinese traditional medical system. In the absence of any formal training and the lack of a pharmacopeia of traditional medicine (as in the case of ayurveda in South Asia), some of the traditional medical practitioners are charlatans claiming near magical powers to attract patients. There is an opportunity for local and foreign pharmaceutical companies to investigate some of the known local plant remedies to develop new products.

3.2 Local marketing

The local trade in medicinal and aromatic plant products that caters to local consumers is carried in Sudan by the informal trading sector, as in many other developing countries. The formal business sector enters this area only for the export of some of these products. Plant products are mainly collected from the wild by villagers and brought to local collectors in the provincial regions. These collectors have established small enclosed compounds where the only equipment is a weighing scale and the only facility is a shed. Their business assets are usually a small truck for transport and some ready cash to pay for purchases. The small quantities of product brought by villagers are weighed and examined and are paid for on the spot. The villagers usually receive a very small payment. The collectors aggregate the products and bring them to wholesale traders in the city.

From that point, there are different systems for the two types of products: those purchased by exporters and those purchased by traders for consumption by the local population. Most of the products consumed locally are obtained directly by the rural people from the wild, as many of them are presently living at subsistence level. But different plant products come from different parts of the country and some products have to be imported. This need is catered to by the local trading sector in the bazaars found in all the towns through the attareen shops (traditional medicine stores). The main wholesale trading centers for these products are in Omdurman, around El-Mourada Street, and in the western Sudanese towns such as Tendalty, Ummrowaba, Marraway and Al-Obeid. Small traders carry these products from the wholesalers in these bazaars for sale in all parts of the country.

The consultants visited a leading wholesale trading shop operating in El-Mourada Street in Omdurman that caters to traditional medicinal and household products used by local consumers. The shop was called El-Teiman Shop. The shop contained about 50 different types of local woods, sticks, dried gums, leaves, dried flowers, bees' honey and bees' wax arranged on shelves or tables. It also had imported perfumes and flavors which are used in combination with some of the local products. The shop sold to retail customers but would also supply small traders from the stores in a separate warehouse. The trader stated that it was not possible to legally import some of the required products as there were import difficulties and these stocks were obtained from small traders who smuggled items from Egypt and Saudi Arabia in small lots. Conditions in the shop and stores were very primitive and unhygienic, with dirt and rat droppings on the counters and containers.

The local trade in the main export products is more organized. The main export items in their order of importance are gum arabic, karkadeh, senna and henna. There are collectors in the provincial areas who specialize in each of these products who bring it to specialized wholesalers in Omdurman or Port Sudan. There are also produce auctions for these products in 25 provincial towns organized by the local authorities; a practice dating back to British colonial times. The export of gum arabic is a government monopoly and the collection system for this is more organized. For the other products, exporters either rely on the bigger wholesalers in Omdurman or have their own collection points which resemble those of the wholesalers: ie. an enclosed yard with a weighing scale in the center and sheds where the purchases can be stored. Wholesalers and exporters are increasingly going direct to provincial collection centers and auctions in order to by-pass middlemen to obtain better prices and larger volumes.

The consultants visited a major wholesaler serving exporters of senna pods in North Khartoum, Mr. Mohamed Ibrahim. This trader operates a complex consisting of an open yard surrounded by a number of locked store rooms. During a visit by the mission, provincial collectors were bringing bagged senna pods in small donkey carts as well as in 5 ton lorries. These stocks are examined, weighed, paid for and then unloaded into the store rooms. Stocks are drawn from the store rooms daily, dried on matting and cleaned for removal of foreign matter in the open space, and packed into large jute bags to make packs of two

kantar[5] in weight. He claimed that waste could amount to 20%. Cleaning is done by sifting and a scale is used for weighing the correct quantities in bags. About 50 workers were employed in the premises. Though grading into three categories was said to have been done in former times, this practice has been discontinued. Cleaning is the only value addition at this stage. His purchase price per kantar was stated to be SP 15,000-17,000 and his selling price SP 23,000. Jute bags are obtained from a local supplier who stitches the bags. As in the case of most informal traders, there was hardly any record keeping of stocks or accounts. It was stated that the demand from exporters and wholesalers was very good and the product could be sold without grading.

The informal trading system operates and also provides a substantial level of employment to people. But it is also very primitive and unhygienic and not entirely reliable as it depends on the actions of thousands of collectors and traders who are not always acting in concert.

The consultants visited a similar wholesale collection point operated by a large exporter, G.M. Haddad & Sons. The collection point and the operations were similar. The same system was observed in the karkadeh collection points in this area.

In the case of senna exports, no value addition is done at this stage except for cleaning and bagging. These are then transported to packing plants in Khartoum or Port Sudan where the product is compressed by machine and baled for export. Exporters could also hire the baling facilities of the Agricultural Development Corporation (the cotton export corporation) or those of Usuf Shabor. Karkadeh wholesalers also clean the product by sifting before it is sold to exporters. The product is strewn on the ground on coarse matting in open sheds and ladies with 6' x 4' sifters made of a sheet of wire mesh and wood walk over the piles of product sifting out the sand and stalks. Larger exporters may then do another cleaning in their warehouses before packing for export.

3.3 Export marketing

Gum arabic, of which Sudan is the main international producer, karkadeh, senna, henna and hargel are the most important medicinal or aromatic plant export products. Statistics are hard to come by in Sudan but the following export value figures were compiled by the Statistics Section of the Ministry of Industries. The accuracy of these figures was not verified and there were contradictions in the information supplied.

Export values of major products, 1992 - 1995

(US$ million)

Product	Jan. 92 Dec. 92	July 93 June 94	July 94 June 95
Gum Arabic	NA*	99.3	64.6
Karkadeh	74.1	13.7	48.5
Senna	13.4	1.3	1.4
Gum Olibanum	11.7	1.4	1.0

Source: Statistics Section, MOI. * NA = Not available

[5] 1 kantar (small) = 44.93 kg.

Gum oilbanum sales declined over the last few years due to the export of low quality product. Sudan's current volume share of the world market in its three main exports in this category are estimated as follows.

Sudan's export volume share of approximate world market total

Product	World Market (tons)	Sudan's share (%)
Gum arabic	40,000	50%
Karkadeh	12,000	35%
Senna	5,000	40%

Source: Local exporter's estimates

The government regularly establishes floor prices for the export of these three products. The current floor prices per ton of product are as follows.

Gum arabic	- US$ 3,500
Karkadeh	- US$ 1,200
Senna	- US$ 350

Floor prices are not the subject of criticism from the larger exporters now, though some complained of inefficiencies in the administration in the past. For example, senna is now sold by the big exporters at US$ 500-750 per ton, US$ 150-400 per ton over the floor price. It is clearly helpful to ensure that new exporters do not depress the world market prices too much. It may also force small exporters to improve quality to some extent to get better prices.

The consultants visited a few major exporters to study the export operations and related issues. The major exporters like G.M. Haddad & Sons, Agriproducts (Holdings) Ltd., Union Trading Co., Herbs & Spices Ltd. and Tag Cosmetics & Toiletries are well organized for export and are competent businesses. Many of the larger companies have been in the export trade for three or four decades and export direct through their own branches in the UK from where the export marketing is conducted. They are not looking for new buyers.

As the competition in the international markets for these commodity exports is increasing and prices are being depressed, the larger exporters, quite rightly, are looking for new products to export. Sudan is rich in a wide variety of medicinal and aromatic plants that can be developed for export, offering better prospects of profit. There is also potential for the development of an essential oil industry based on the substantial agricultural resources that are presently under-utilized. This will bring in higher profits than current exports, and also serve the local industry in soaps and cosmetics, replacing the cheap perfumes imported from abroad. Lemon grass has been identified as the best prospective essential oil product. Land is plentifully available, irrigation of these lands using artesian wells is not difficult, and the technology for oil extraction is basic. Crude oil extraction is usually done for these products in distillation plants that are manufactured in developing countries and operated within the farms. Cultivation trials by the Horticulture Department have been successful.

It will be necessary to remove essential oils and extracts from aromatic plants from the current classification as luxury products, which carries a prohibitive excise duty of 75%, if the industry is to be developed.

There are also a number of gums from the acacia species that can be developed for export. Additionally, the quality of the present export products can be improved by standardizing grades and all the main exporters that the mission met expressed an interest in developing Sudanese standards for the main commodity exports. Only gum arabic, among these export products, has standards at present.

3.4 Visits to exporters

G.M. Haddad & Sons Ltd., are the principal exporters of senna pods and karkadeh from Sudan. The company currently exports about 900-1,200 tons of senna pods a year, out of an estimated total annual country export of 2,000 tons. The current export price per kilo is around US$ 0.75 FOB. It was stated that the company formerly exported around 5,000-6,000 tons but that export volumes had fallen. This was attributed to two reasons.

(1) Exports from India are considered more reliable by international buyers as India has a better infrastructure for export.
(2) Government policies had been erratic. Floor prices in the past prevented exporters from meeting export orders on time. Government mandated floor prices could not keep up with fluctuations in commodity prices that traders must live with.

The company buys senna from wholesalers and auctions and is also setting up collection points in the provinces. The pods are sorted in company premises and compacted into bales in a factory in Port Sudan to reduce volume. The principal buyers are the international pharmaceutical companies or their buying agents in Europe and America. The company ships its products through a UK office.

The company exports about 1,500-2,000 tons of karkadeh out of an estimated total national export of 4,000-5,000 tons. There is growing competition from China and Thailand but the Sudanese variety is considered to taste better. The current export price is US$ 1,200-1,500 per ton FOB.

The company has a small but modern factory for the production of good quality detergents and perfumes. However, with the price increases resulting from the 75% excise duty on luxury items (all perfumes are considered luxury items) and the 20% defence tax, sales have dropped drastically and the plant is operating at 5% of capacity. The company claims that products smuggled from neighboring countries have taken over this market. With the very low consumer purchasing power in the country, this is not presently a market for higher-priced products.

The company is interested in the prospect of growing camomile for export. A pilot plot cultivated by the Horticulture Department of the Ministry of Agriculture has given a good quality product with a yield of 7-8 tons per acre.

The company is interested in value addition and the following new products.

(1) Grading systems for senna pods.
(2) Production of senna tablets locally.
(3) Marketing of camomile teas in consumer packs.
(4) Distillation of oils from local aromatic plants.
(5) Production of bottled beverages from tamarind and gongolaise (baobab fruit).
(6) Karkadeh powder to be marketed as an instant drink.

Tag Cosmetics and Toiletries Ltd., the main exporter of henna from Sudan, was visited by the consultants. The company claims an annual export turnover of US$ 1.0 million. Henna leaves are bought by the company from traders in northern Sudan and then cleaned and ground into a powder in the factory at Omdurman. The product is then packed for export in 100 gram consumer packs. The packing is a thick

paper sachet. The pack carries the brand name "Crown" and has good quality printing. It is exported to the Arabian Gulf states. The current export price per carton of 100 x 100 g packs is US$ 16.50.

The company packs bakhour incense for the local market and export. The incense is a combination of small pieces of the shaf tree wood and pieces of imported sandalwood packed in small polythene packs each adequate for one brazier load. A dozen such packs are bagged in a larger polythene pack.

The company is preparing for work on a joint-venture project for the cultivation of aromatic plants and the distillation of lemon grass oil for export in collaboration with a Kuwaiti company. The company has applied for one thousand acres of land in the Waha region to grow lemon grass, mahareb and henna. The company requires an expert in lemon grass cultivation and distillation for a period of 6-12 months to develop this project. The company hired the services of IRCC to distill small samples of lemon grass oil from locally cultivated plants and thinks that the product is satisfactory.

The company is the largest producer of perfumery for the lower end of the Sudanese perfumery market.

Agriproducts (Holdings) Ltd. is another major exporter of karkadeh and senna from Sudan. The company is a breakaway group of the original G.M. Haddad & Co. The company has been in this export business since 1962. The company claims to export about 700-800 tons of senna and 2-3,000 tons of karkadeh. It has its own office in the UK which handles its exports. The company has been trying to develop the cultivation of camomile for export.

The company believes that Sudan is losing out in the export markets for karkadeh and senna because Sudanese quality standards have declined. Senna is exported to the USA and several west European destinations. Germany and Japan have stopped buying on the basis of a German report of carcinogenic properties in the product. India, which exports most of its senna in the form of leaves and not pods, is becoming a strong competitor. Karkadeh is exported mainly to Germany and Switzerland where it is blended with rose hips and sold as a herbal tea. Though Sudanese karkadeh is supposed to have a superior flavor to hibiscus from elsewhere, Thailand and China now supply about 65% of the total world market of 12,000 tons.

The company opines that the main problem is the entry of too many small exporters who have spoilt the market by offering lower grade products at lower prices, driving down export prices and spoiling the reputation of Sudanese exports.

The company was associated with the Khartoum Processing Co. which was set up to carry out preliminary processing of gum arabic in Sudan but this company failed due to internal problems.

Concord Medical Enterprises Co. Ltd. was established in 1981 and exports a range of medicinal and aromatic plant products to Germany and Syria where it has good relations with a number of importers of medicinal plants. The main exports are luban (Commiphora spp.), senna, camomile, karkadeh, red chillies, dried limes, guar, kamoon aswad (Nigella sativa L.), guar gum and visnaga (Ammi visnaga).

The company obtains supplies through the local trade but plans to set up its own farm for cultivation. It has obtained 307 feddans of land in Rammash in the Blue Nile State and has applied for credit from the Agricultural Development Bank to develop this. It has also obtained corporate tax and import duty exemption for this project for 5 years through the Investment Public Corporation. It has also obtained permission to retain 50% of its present export earnings to finance the investment in its agricultural project for medicinal plants.

Unlike other exporters of medicinal and aromatic plant products that export to their own offices in London on the basis of cash against documents (C/D), this company exports on letter of credit (L/C) terms to its foreign buyers. By using L/C terms, it is able to finance its local purchasing.

The company is interested in the local manufacture of a cough syrup using local medicinal plants which can be marketed locally and in the region as a non-prescription drug. It requires technical assistance to develop the project. It has no financing problems for such a project.

3.5 Gum Arabic Co. Ltd.

The Gum Arabic Co. Ltd. (GAC) was established in 1969 by a government decree which established the company as the sole monopoly exporter of gum arabic from Sudan. It is a private limited liability company with the government holding 30% of the shares, private business people holding 52% and 18% being held by 4 producer cooperatives. The board of directors consist of 11, 3 representing the government (the Under-Secretary of Commerce, Governor of the Bank of Sudan, and Conservator of Forests), 4 representing the producers, 3 representing the private business shareholders plus the General Manager of the company. Prior to that date, there were many competing private sector exporters. The company is involved in the development of the industry, together with the Gum Development Corporation of Sudan, which is an association of the gum industry.

The rationale for a monopoly exporter is clearly understood. Gum arabic, which is widely used in the industrial countries in the confectionery, beverage and pharmaceutical industries, is the main export in this product group from Sudan. Sudan is the leading world supplier of this crop mainly originating from the Sahelian belt of north Africa and is collected from the wild. Sudan produces about 80% of the world supply, and other Sahelian countries like Chad, Senegal and Mauritania are the other major suppliers. However, about 20-30% of the Sudanese crop is smuggled out and sold through neighboring countries and these are not registered as Sudanese exports.

The current world market demand for this product is about 40,000 tons, and Sudan is able to supply 25-40,000 tons, the crop availability depending both on weather and the capacity of rural collectors to harvest the product. In the nineteen fifties the world market was 60,000 tons. It dropped to around 25,000 tons in 1989. Although it is picking up in recent years, a major problem that Sudan has been facing is the smuggling of gum arabic to neighboring countries by traders wishing to avoid the government monopoly and make more profits for themselves.

Gum arabic revenues of Sudan amount to US$ 60 million a year. It has a social importance beyond export economics because it provides income support for about 5 million harvesters, who are among the poorest sections of the population, during seasons when agricultural returns are low. GAC and the government regulate the industry to avoid over-exploitation of resources and the rural harvesters, avoid export price fluctuations, ensure steady market demand and further develop the industry. The Gum Development Corporation is the industry organization which works with the government to achieve these goals.

Registered agents of the company buy the gum in the provinces, grade it and sell it to GAC which is the sole exporter of gum arabic from Sudan. Each year, the government, in consultation with GAC, establishes 3 floor prices for the gum: the producer price, the local market GAC purchase price, and the export price. Currently, the price to the producer is SP 25,000 per kantar, the GAC purchase price is SP 38,000 per kantar, and the export price is US$ 3,500 per ton. GAC maintains the objective of giving its shareholders an annual return of 5%. The floor prices ensure a fair return for the harvesters, the traders, the company and the governments which collects revenue in the form of corporate tax.

GAC needs to ensure a balance between a supply of product from the wild and a calculated annual export volume that will ensure that the international market is neither over or under-supplied. If under-supplied, the market turns to substitute products: when over-supplied, market prices fall. To do this, GAC needs to build a buffer stock. But collection from the wild depends on rainfall, as drought conditions reduce harvests by making it difficult for rural collectors to go deep into the bush for several weeks to gather the product. GAC officials said that only 1/3 of the Acacia senegal trees of Sudan were being tapped due to lack of roads and drinking water in some potential areas. Joint projects with FAO, UNSU, ITC, JICA, CARE, Save the Children Fund, Dutch, Finnish, Danish, British and French Governments are under way to encourage farmers to plant gum trees. The seedlings are distributed free of charge. The Danish Government is currently helping GAC to establish cleaning, grading and kibbling (cutting into small pieces) facilities at Port Sudan.

The government established an Equalization Fund to pay producers during lean times to ensure that they did not decimate the acacia trees. GAC officials also visit the 25 provincial gum auctions to buy the product if the demand from traders falls below the established floor price to producers.

The GAC also exports six other gums such as gum talha (Acacia seyal), gum olibanum (Boswellia carterii), gum guar (Cyamopsis tetragonoloba), gum karaya (Sterculia setigera), gum kakamut (Acacia polycantha) and gum combretum. No monopoly exists on these gums.

GAC has recently established a factory to produce gum guar in Sinngha city of the Sennar State. The gum is obtained from the seeds of Cyamosis tetragonoloba. The factory was said to be suffering from the lack of sufficient supply of raw material. Guar gum is used in Sudan as an essential ingredient in making bread from wheat and sorghum flour to render it soft and fresh. Exporters complained about the decline of gum olibanum exports in recent years due to lack of interest and demand for the Sudanese gum.

Though gum is exported for industries in developed countries, Sudanese industry does not use local gums in the pharmaceutical or food industry, relying on imports from developed countries.

3.6 Cultivation

There is very little cultivation of medicinal and aromatic plants in Sudan. Most of the product is collected from the wild by rural folk, posing the danger of environmental denudation and irregular supplies. The export of gum arabic, gum olibanum and all other gums, as well senna, is based entirely on collection from the wild. Karkadeh is cultivated on the periphery of small farms growing food crops. The development of this plant-based sector will require cultivation of the main crops.

Since only about 15% of the arable land is still under cultivation, there is good potential for the cultivation of selected medicinal and aromatic plants with high commercial potential. The Ministry of Agriculture is willing to lease land for cultivation at very nominal rates. Attractive fiscal incentives are provided by the government through Investment Public Corporation for commercial farmers investing in new crops. This will be of interest both to large farmers, as well as rural small farmers. Since these are new ventures, the impetus will come when a few large farmers demonstrate that these crops can be cultivated profitably. Four companies expressed an interest in cultivating some of these plants on a large scale: Tag Cosmetics & Toiletries Ltd., Al Rajah Agricultural Project of Al Geteina Province in White Nile State, G.M. Haddad & Sons Ltd. and Sigma-Tau (Sudan) Ltd. They only require technical support to develop the projects, which UNIDO could provide.

The mission visited the **Al Raja Agricultural Project** which has obtained 5,000 faddans of partly irrigated land and fiscal incentives from the government for the cultivation of medicinal and aromatic plants and other commercial crops. It is run by an organization associated with the Coptic Christian Church. The project needs professional technical advise on crops and planting techniques. Though it has access to

irrigation from the Nile as well as 9 artesian wells which provide more than adequate water, plus an abundance of local labor, the land is under-utilized due to the lack of technical skills by the management. The President of the company, Rev. Father Filotheos Faraj, stated that he planned to cultivate 500 hectares with lemon-grass oil, but lacked the expertise. He gave the mission a letter requesting UNIDO technical assistance for this project (see Annex 6).

The mission identified 14 plants which could be cultivated initially, if technical assistance was available. These are noted here: (1) Cymbopogon citratus (lemon-grass), (2) Hibiscus sabdariffa (karkadeh), (3) Cassia acutifolia (senna), (4) Matricaria chamomilla (chamomile), (5) Cymbopogon proximus (al-maharieb), (6) Capsicum frutescens (capsicum chillie), (7) Coriandrum sativum (coriander), (8) Hyoscyamus muticus (Egyptian henbane), (9) Ammi visnaga (visnaga), (10) Nigella sativa (black cumin), (11) Trigonellafoenum graecum (fenugreek), (12) Ocimum basilicum (basil), (13) Carum carvi (caraway), (14) Pimpinella anisum (anis).

3.7 Evaluation

The problems faced by commodity exporters in Sudan are typical of the problems faced by exporters of commodity products from developing countries to developed countries.

(1) Increasing competition from other developing countries fighting for more commodity exports saturate international markets and drive down prices. Gum arabic exports are facing increased exports from Chad, Mauritania, Senegal and Ethiopia. Karkadeh is facing strong competition from Thailand and China which have been developed as new supply sources by European import houses. Senna pods are facing strong competition from Indian exports, mainly of cheaper senna leaves. Henna is also competing with India.

(2) Substitute products for natural products decrease market demand. Gum arabic is facing competition from cheaper modified starches. Karkadeh is one among a number of natural products used in herbal teas and food coloring. Several other forms of laxatives are competing with senna. Only henna, which is a traditional Arab cosmetic, appears safe at the moment, though even this practice will decline with the marketing of western fashions for women which will erode traditional cultures. Industries in developed countries are constantly researching cheaper substitutes for imported raw materials.

The terms of trade show a progressive decline, as the export commodities decline in price and imports from developed countries derived from these products increase in cost. In this situation, increasing export volumes of a limited number of completely unprocessed commodities, as in this case, may further contribute to a decline in prices.

A major problem facing exporters from developing countries, such as Sudan, is the lack of the local infrastructure and the financial, technical and marketing resources to develop value-added products for export. Local exporters are experienced and skilled in commodity trading and they do not need help in this area. But they will have difficulties in entering into competition with established suppliers in Europe and America for finished consumer products, even in areas such as herbal teas. The marketing resources required are beyond the capacity of local manufacturers and exporters. Their skill is in trading and not in product or consumer marketing. They are also operating in a local environment where support infrastructure is inadequate in many areas: telecommunications, roads, railways, electricity, gasoline availability, banking and foreign exchange, etc.

Manufacturers in developed countries are generally not interested in setting up manufacturing facilities for such products in countries like Sudan, where manufacturing support services and the infrastructure for industry are inadequate. Henna, has been the exception, where Tag Cosmetics and Toiletries is exporting a consumer product to the Middle East. A Kuwaiti company is also working on a joint-

venture with the company to develop this business. The best prospect for Sudan at present is to concentrate on selling finished products in the local market, the neighboring PTA countries, and also seek markets in the Middle East where some traditional products have acceptance.

In this situation, exporters, and the country as a whole, have to set long-term objectives and develop strategies that will result in sustained economic development in the context of a liberalized Sudanese economy operating in a competitive international market. To merely aim for increased production and export is quite insufficient. The present operation of the Sudanese medicinal and aromatic plant sector can be described as being in its elementary stage. Collection of plant material from the wild and its distribution through the informal trading sector within the country will not develop the sector and make the country internationally competitive. They provide employment at present but unless the local production and the marketing of raw material is upgraded the system will not be able to support modern industries.

The national goal should be to make the transition from commodity trading based on primitive production and collection systems based on the informal sector to the marketing of value-added products that will be based on organized cultivation and collection systems. **The key transition should be from trading to marketing.** Trading characterizes the poorer developing country operations. Marketing is the distinguishing feature of economically developed countries.

These are the main areas for development which the mission discussed with pharmaceutical manufacturers and exporters. Many in these business sectors are interested in these developments. These developments are not too complex and are within the capacity of some local companies.

(1) Large-scale cultivation of the selected medicinal and aromatic plants that are to be used in value-added marketing or manufacturing industries in the country.

(2) Improving the quality and packing of export commodity products to obtain the best prices and fight competition. Some exporters are now exporting karkadeh and senna to Egypt from these commodity products are cleaned and repacked for export to Europe.

(3) Establishing Sudanese grade standards for these commodity exports.

(4) Diversifying the product range by developing some others among the large array of medicinal and aromatic plant products that are now available but not harvested and exported.

(5) Developing an essential oils industry based on the comparative advantage that Sudan has in the form of vast extents of cultivable land that are now not utilized.

(6) Developing semi-finished products for export from gums and medicinal plants, eg. purified spray-dried or liquid gum, tanning material from acacia, oil and animal feedstuff from acacia seed, etc.

(7) Consumer packaging and marketing of traditional Arab products such as henna, bakhour incense mixtures, miswak dental preparations, etc., in the local market and the Middle East.

(8) Developing beverages or concentrated ready-to-mix powders or syrups from karkadeh, tamarind and gongolaise for the local and regional export markets.

4. GOVERNMENT SUPPORT INSTITUTIONS

4.1 Government Concerns

The government has been providing free public health and medical services to the population but is presently severely hampered by budgetary constraints, the lack of qualified medical personnel and the rising cost of maintaining and equipping the existing inadequate facilities. About 200 graduates qualify from the medical colleges in Sudan but many of them leave for employment in the Middle East due the very low salaries received by government medical practitioners. The 160 hospitals and 17,300 hospital beds are inadequate but the government is hard pressed to maintain even these services. Due to the increasing cost of services and drugs, government hospitals and clinics now charge a nominal fee and prescribe some drugs which have to be purchased by patients from private pharmacies.

Almost 90% of the population use traditional medicines for even a part of their health and medical needs. The government recognizes this and follows the current WHO guidelines on the use of traditional medicine in developing countries. These recognize that traditional medicines which have been time-tested and proven in developing countries can be relevant to these societies. At the same time, there is a need to bring these traditional medical practices into the formal sector with regulations to safeguard the users.

The country is also rich in various medicinal and aromatic plants and has enough agricultural land for the cultivation of others which are commercially attractive. The most commercially important of these at present are gum arabic, karkadeh, henna and senna, while lemon grass is considered as being an attractive commercial possibility. There is potential for economic development and employment generation in economically depressed areas from the increased harvesting and cultivation of these crops. Agro-based industry is a government priority. **The National Drug Policy document of the Ministry of Health, 1994,** under the heading of "Traditional Herbal Drugs" (Section 4-9) states :

(1) Cultivation of medicinal and aromatic plants should be expanded and a factory established for the extraction of their active ingredients.
(2) The government should encourage establishment of a factory for the production of medicinal plant products and herbal medicines.

For these purposes, the government had set up two decades ago research and support centers for the development of traditional medicine and the development of work on the medicinal and aromatic plants of Sudan. These comprise the following: (1) Medicinal & Aromatic Plants Research Institute of the National Centre for Research, (2) Department of Medicinal Plants and Traditional Medicine in the Ministry of Health, (3) the Chemical Industries Department of the Industrial Research & Consultancy Centre. The departments of pharmacy in the universities also assist in this effort.

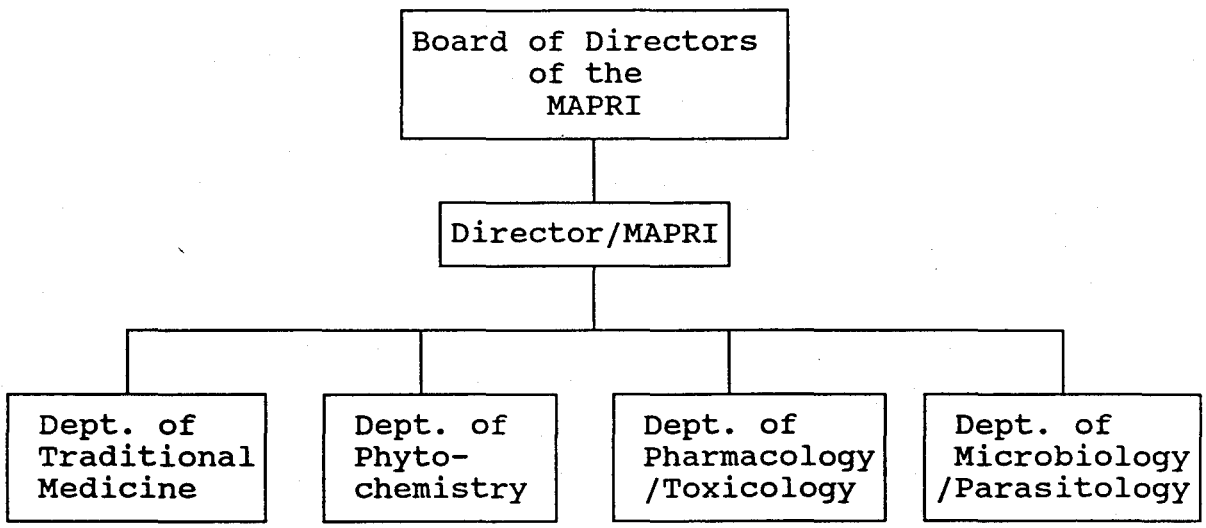
4.2 Medicinal and Aromatic Plants Research Institute (MAPRI)

The Medicinal & Aromatic Plants Institute (MAPRI) of the National Centre for Research (NCR) is the focal point for research into the development of medicinal and aromatic plants. The NCR was set up in 1970 by a presidential decree and was strengthened on the basis of an act of the National Assembly (parliament) in 1991. The NCR is governed by a body of eminent persons, the National Science Council, which makes policy. These policies are to be implemented by the NCR which is administered by a Director General and the Scientific Research Council which operates as its board of directors. The NCR comprises the following bodies.

(1) Energy Research Council
(2) Institute of Environmental and Natural Resources

(3) Technology Research Institute
(4) Economic & Social Studies Institute
(5) Institute of Tropical Medicine
(6) Medicinal & Aromatic Plants Research Institute.

The directors of these six bodies are represented on the Scientific Research Council. The organization chart of MAPRI is as follows.



MAPRI works on the basis of an Annual Program of Work approved by the NCR. It submits progress reports to the NCR every two months. The various departments of MAPRI also submit departmental reports to the NCR every six months.

MAPRI was initially a small unit located temporarily in the School of Pharmacy of the University of Khartoum. In 1976, the unit was moved to a separate building. It was given institute status in 1981. MAPRI moved in 1992 to its present new building which houses four laboratories, a herbarium, a store and administrative offices. MAPRI consists of four departments: (1) Phytochemistry, Processing and Taxonomy, (2) Pharmacology and Toxicology, (3) Microbiology and Parasitology, (4) Traditional Medicine. MAPRI has a staff of 42 including pharmacists (6), agronomists (4), chemists (3), toxicologist, zoologist, taxonomist and two social scientists. Nine researchers hold PhD and six researchers hold MSc degrees. Five staff members hold BSc degrees. One staff member of MAPRI was trained in 1992 in Turkey on the TRUMAP[6] in-plant group training program supported by UNIDO.

The objectives of MAPRI were laid down in the 1991 Act of the National Assembly as follows:

(1) Collection of data and plants, and documentation of traditional medical practices in the Sudan.
(2) Safeguarding the public from the abuse of traditional medicine by devising ways to control

[6] Training in the Utilization of Medicinal & Aromatic Plants in Pharmaceutical & Related Industries, a UNIDO training program.

its malpractices.

(3) Protecting medicinal and aromatic plants of Sudan from extinction by growing them in special areas and conserving their seeds.

(4) Establishment of a herbarium for Sudanese medicinal and aromatic plants.

(5) Conducting multi-disciplinary research in order to develop reliable plant-based medicines using active ingredients instead of crude drugs in formulations.

(6) Preparing feasibility studies on economic aspects, cultivation and industrial processing of medicinal and aromatic plants for related sectors.

(7) Creating awareness in public and private sectors on the value of medicinal and aromatic plants for industrial utilization and for primary health care.

(8) Introduction of economically important alien medicinal and aromatic plants into cultivation in Sudan.

(9) Establishment of contacts and cooperation with local, regional and international institutions concerned with medicinal and aromatic plants and traditional medicine.

The mission visited the institute and held discussions with its Director, Deputy-Director, heads of departments and researchers. The Phytochemistry Laboratory which is the core of all activities in an institute engaged in research into medicinal and aromatic plants lacks basic equipment to pursue phytochemical research work. Laboratory facilities include laboratory glassware, two rotary evaporators, TLC spreader, a range of Soxhlet apparata, a UV-lamp, chromatography columns, ovens. The only chromatographic equipment seen was a medium pressure liquid chromatography (MPLC) system. The institute has no other chromatographic or spectroscopic equipment. The laboratory does not possess a glass Clevenger-type apparatus necessary for the bench-scale water distillation of essential oils from aromatic plants. No extraction or distillation plant for scale-up work is available.

The Pharmacology and Toxicology Laboratory was said to test gastro-intestinal, cardiovascular and uterotonic activities using isolated organs. No work on intact animals was conducted. The Microbiology and Parasitology Laboratory is in the process of being established. The facilities include two incubators, an autoclave and a colony counter. The Traditional Medicine Department which made the centre recognized as a "WHO Collaborating Centre in Traditional Medicine" has an outdated computer which was not functional. The centre does not have a library and about 50 books donated several years ago are kept in the Traditional Medicine Department. The Documentation Centre of the National Centre for Research, which is next door to MAPRI, does not have necessary books and journals on medicinal and aromatic plants in its holdings. The herbarium has 500 mounted specimens of Sudanese plants. A collection of Sudanese plant drugs is kept in glass jars.

MAPRI has access to 16 faddans (6.7 ha) of land for the cultivation of medicinal and aromatic plants in Shambat and Soba regions of Khartoum. Four feddans of land have been cultivated with the following medicinal and aromatic plants in small experimental plots: Hibiscus sabdariffa, Brassica nigra, Trigonella foenum-graecum, Carum carvi, Citrullus colocynthis, Cyamopsis tetragonoloba (Guar gum plant), Matricaria chamomilla, Allium sativum, Lepidium sativum, Coriandrum sativum, Nigella sativa, Solenostemma argel, Hyoscyamus muticus, Ammi visnaga, Catharanthus roseus, Pimpinella anisum, Cassia acutifolia, Cymbopogon citratus, Mentha piperita.

MAPRI researchers have so far completed 30 theses and dissertations in various universities in and outside Sudan, and published 64 papers in international journals since its inception. The Director of MAPRI informed the mission that a patent application concerning a drug for jaundice had been submitted in August 1995 through WHO in Geneva, Switzerland. Research activities in MAPRI included collection of plant materials from the wild flora, and sporadic work on plants having molluscicidal, antimicrobial, anthelmintic, oxytocic, antidiarrheal, antispasmodic, anti-jaundice and anti-bilharzia activities.

MAPRI provides for post-graduate and under-graduate students from the universities to work on research projects. Its major achievement is the publication of three volumes on the medicinal and aromatic plants of Sudan and more publications are being prepared.

MAPRI is hampered by financial problems. It is sustained by the following financial provisions: (1) salaries of the staff and administration expenses paid by the government amounting to about SP 8.0 million, (2) about SP 4.0 million from government for research operations, and (3) an annual grant of US$ 20,000 from the WHO for equipment. The government component of SP 12.0 million amounts to about US$ 14,500 at current exchange rates. The institute received grants for equipment in former times from the Ford Foundation but these have ceased. It fears that the WHO grants may also cease.

The major shortcoming of the MAPRI is that it has failed to support commercial operations which will enable the practical implementation of its research activities. It has concentrated on pure research because the institute has no experience of working with the business sector to commercially develop the research it carries out. The management of MAPRI, consisting of academics and researchers without a commercial background, has not canvassed business enterprises with any success. They work on the assumption that businesses must come to MAPRI for support but this has not happened and is not likely to happen. Because of this frustration, and the increasing fears caused by diminishing financial allocations for the support of the institute, MAPRI considered direct entry into business operations on its own. It has made a request for some support to the Ministry of Industries which was conveyed to the mission both by the ministry and MAPRI. The ministry also feels that such commercial operations will enable MAPRI to be more financially stable, as the government is also facing severe budgetary constraints. It is regarded as the survival strategy for MAPRI.

MAPRI has two minor commercial efforts to its credit so far: (1) it carried out some chemical tests for the government currency printing organization for SP 300,000 and (2) it did some toxicological tests for the Arabian Company on vegetable oils for SP 150,000, both in 1994.

The first major project for which assistance is sought is an essential oil extraction/distillation pilot plant which MAPRI feels will enable it to enter business. MAPRI also seeks assistance for the export marketing of several other medicinal and aromatic plants direct to foreign customers in Europe. MAPRI has not done any feasibility studies on these ideas and there are also no specific project proposals.

The error in this line of thought is not uncommon. It is difficult for scientists and government officers to comprehend the nature of commercial operations of which they have no experience. It is assumed that if there is a manufacturing plant and a product there would be a market. The entirety of a business project encompassing the following is beyond the comprehension of a non-commercial enterprise: market research, identification of a viable market opportunity within the capacity of the supplier, identification of target customers, product development to match the customer needs in terms of product standard and pricing, production efficiencies, canvassing of potential customers through personal contacts, developing sales strategies, developing promotional strategies, etc. Investment in commercial ventures by a research institute with no commercial experience will be a failure.

The government is right in insisting that research institutes should earn a part of their keep through service to the business community. Developing countries cannot afford the luxury of pure research for its own sake. Research must be based on the prospect of some commercial exploitation of the work done. To do this, MAPRI will need to have a commercial department with personnel with business skills. Also, it should concentrate mainly on supporting the Sudanese business sector on commercial terms instead of getting into business on its own, which is not the role of a research institute. The commercial department will then guide the research work by establishing contact with business enterprises, entering into financially remunerative contracts for research into the development and testing of commercially viable products, and ensuring customer satisfaction with the research work being done. MAPRI will need to restructure its

management organization and its management methods to achieve this commercial focus.

4.3 Industrial Research & Consultancy Center (IRCC)

The Pharmaceutical Applied Research Laboratory of the Chemical Industries Department of the Industrial Research Consultancy Centre (IRCC) is the other government organization working on medicinal and aromatic plants.

IRCC was set up by the government around 1965 with UNIDO funding to provide a comprehensive service to industry covering the areas of laboratory research, product development and business management development services. A parallel institute for the leather industry, the National Center for Leather Technology, was amalgamated with this institute in 1993. This institute had been funded jointly by FAO, UNIDO and UNDP. IRCC is an independent agency within the Ministry of Industry. It is maintained partly by UNIDO grants, while the Ministry of Industry pays the salaries of the staff. IRCC is expected to earn its operating expenses through paid consulting services to industry and is stated to have carried out over 500 business studies, 670 laboratory tests and 10 training programs for the public and private sectors. But it does not presently attract a clientele that will keep it in business without government subsidies. The present staff is mostly under-employed and most of the laboratory equipment is out of order without funds for repairs, maintenance or replacement.

The government has had a number of strategic plans for the rehabilitation of industry, the last one being in 1992, and IRCC has figured in all these.

The institute is headed by a government appointed board of directors and a Director General who heads the management, currently Dr. M. El Amin A. Rahman. It is divided into two departments, each under a director: the Department of Research & Technology, and the National Center for Leather Technology. The Research and Technology Department has sections to cover the following sectors: food industries, textile industries, chemical industries, building materials and refractory industries, engineering industries, workshop maintenance plants, specifications and quality control, economic studies and industrial information. The Leather Technology department covers the following sectors: tanning, leather technology, training and laboratory work.

The institute is housed in a large building and employs a staff of around 250 persons, of whom 110 are professionals with qualifications. Very little work was being done at the time of the visit of the mission. The cost of rehabilitating IRCC would be substantial and the present prospects for earning adequate revenue through services to industry are not foreseen.

The Pharmaceuticals Applied Research Laboratory forms a small section in the Chemical Industries Department of IRCC. The laboratory has three staff members who have recently accomplished the distillation of lemon-grass and contributed to the UNIDO project aimed at turning a powdered milk production facility to a karkadeh powder production plant. Another ongoing project was concerned with the production of fixed oil from Nigella sativa seeds. The laboratory occupies a small space with a few pieces of glass equipment for bench-scale water distillation, volumetric moisture content determination, and equipment like freeze-dryer (Labconco), rotavapors (2), melting point apparatus (Electrothermal), bench centrifuge.

The mission was conducted to a moth-balled workshop belonging to IRCC in Mugran area of Khartoum. It was surprising to see some pilot plant scale chemical processing equipment such as a stainless steel vacuum tray dryer (Apex), a 100 L stainless steel stirred reactor with working pressure of 5 atm. (Kestner), a 20 L copper Soxhlet extraction cum distillation unit (Apex), a ca.100 L autoclave, a 7 kg/h operating cap. stainless steel spray dryer (Anhydro), a stainless steel vacuum filter, colloidal mill (Apex), three pieces of chemical pumps (Apex), 10 L stainless steel paste mixer (Apex), electrically heated

tray dryer (Apex) and a roller mill (Apex). These equipments are said to be operational and can be used for developmental work for pharmaceutical raw materials from medicinal and aromatic plants. According to the information given, these equipments had been supplied about 15 years ago and the extractor had been used only for the extraction of fixed oil from Balanites aegyptiaca seeds ten years ago. The spray drier was recently used for the trial production of spray dried powder of gum arabic. With the provision of a small steam generator and a 50 L stainless steel vacuum evaporator, the facility can easily be used for pilot plant scale extraction and distillation processes. The above mentioned equipment occupies only one part of the workshop which also houses some metal working equipment that can be used for fabrication of small process equipment and for maintenance of the existing equipment.

Food Industries Department of IRCC has two spacious laboratories to conduct chemical, physical and microbiological analyses of foodstuffs. The laboratories possess a variety of outdated or out of order equipment such as a TLC-densitometer (Chromoscan 200-Joyce Loebl), pH-meter, and equipment such as thermostatic water bath, autoclave (BTL), incubator (BTL), Lovibond tintometer, centrifuge (BTL), freeze dryer (Edwards), muffle furnace (Carbolite), melting point apparatus (Electrothermal), refractometer, vacuum oven, rotavapor and glass Soxhlet extractor.

The mission was then taken to a laboratory of the Analytical Chemistry Department which contained a range of very old, outdated and out of order equipment such as gas chromatograph (Beckman GC-2A), gas liquid chromatograph with recorder (Pye Unicam), ultraviolet spectrophotometer (Beckman DB), atomic absorption spectrometer (Pye Unicam), Karl-Fisher moisture determination apparatus, and functional equipment such as polarimeter (Bellingham & Stanley), adiabatic bomb calorimeter (2 pcs), elemental analysis apparatus and flame photometer.

4.4 Faculties of Pharmacy in universities

The university provides a 5-year course in pharmacy and an average of 28 pharmacists graduate annually from the Faculty of Pharmacy, University of Khartoum. To date, about 55 students have been awarded M. Pharm./M.Sc. and Ph.D. and currently two dozen students are reading for post-graduate degrees in various aspects of pharmacognosy/phytochemistry, pharmaceutical chemistry, pharmaceutics, microbiology and pharmacology. Due to a shortage of pharmacists in the country, partly caused by the migration of qualified personnel to the Middle East for more remunerative employment, the government has just established a faculty of pharmacy at the University of El Gezira (Wad Medani). However, due to inadequate funding, university laboratory and library facilities are presently inadequate for proper training in the universities. This will be a constraint at some point when the pharmaceutical industry expands.

4.5 Directorate of Pharmacy, Ministry of Health

The Directorate of Pharmacy in the Ministry of Health is the regulatory body for the industry. It comprises the following sections, each under a director.

1. Pharmaceutical Industry
2. Drug Statistics Research
3. Drug Control & Research
4. Information & Education
5. Medicinal Plants & Traditional Medicine
6. Drug Affairs Section.

The Drug Statistics and Research Section is concerned with the collection of industry data. The Information & Education Section is concerned with publicity of public health issues. **The Drug Affairs Section** is responsible for the registration of all pharmaceutical drugs imported or locally manufactured in Sudan for the market. There are about 5,000 drugs registered in the country. The registration comes under the

Poisons Act of Sudan of 1963, as amended in 1974.

The Medicinal Plants and Traditional Medicine Section was set up last year and the Director, Dr. Jamal Abdel Latif, was abroad at the time of the mission's visit. The mission met Mr. Mubarak Ahmet Adam Fudol who informed the mission that the main work of the section was the draft legislation for the regulation of traditional medicine. The government is mindful of the dangers of medicines and health practices that have not been subjected to the rigorous testing procedures used in the modern pharmaceutical industry. Traditional medicine is sanctioned on the basis of hundreds of years of practice with some proof of efficacy. If they are converted to drugs they will need to be subject to some regulation and testing. It is also proposed to register all traditional medical practitioners, as has been done in some other developing countries, to bring these practices closer to the formal system from the informal sector.

This section has drawn up the draft legislation for the Directorate of Pharmacy under the title **"Manufacturing and Circulation of Plants Preparations 1995"** which has been approved by a technical committee of the ministry. The committee comprised the following persons: the General Director of Pharmacy, a pharmacologist from the university, 3 senior government physicians, an expert on the essential drug program, the Director of Medicinal Plants/Traditional Medicine, the Director of Pharmaceutical Industry, the Director of Drug Control & Research, the Director of Drug Affairs. The proposed legislation has not been brought before the National Assembly for approval as yet. It would appear from the draft seen by the mission that the proposed act would over-regulate the practice of traditional medicine and cause difficulties in an area which now serves about 90% of the population. While regulations are required, these will need to be established progressively. These would also be meaningless unless the government established the necessary organisation for enforcement. The proposed legislation also consisted of a list of prohibited poisonous plants which included several plants used by the pharmaceutical industry abroad. It is hoped that the regulations will be discussed with representatives of traditional medicine practitioners, traders in medicinal plants and consumer groups using traditional medicine before finalization. A study of the regulations introduced in other African countries like Ghana would be helpful.

The Central Drug Control Laboratories analyses and studies products being submitted for registration and advises the Drug Registration Committee. The mission visited the laboratories. It is staffed by 9 pharmacists and a technician working under the supervision of the Director. The laboratory was in reasonably good working condition, considering that it is under-funded and under-equipped. The laboratory was partly equipped by WHO which gives a grant of US$ 50,000 every 3 years. The laboratory could improve its facilities if it charged a higher fee for testing products which were submitted for registration: its present charge per product is only about US$ 7.0. It could easily charge importers or local manufacturers about US$ 150 per product investigated and use the extra money for improved facilities. The Central Drug Control Laboratory is also responsible for quality control of drugs in the market and maintains a large stock of samples drawn from the trade for testing prior to completion of the stated shelf life of the products.

4.6 Sudanese Standards and Metrology Organization (SSMO)

The Sudanese Standards & Metrology Organization (SSMO) is a small unit within the Ministry of Industries with 3 laboratories in the following locations: Port Sudan, Khartoum and El-Obeid (seasonal). It is concerned with the testing of samples drawn from export consignments of oil seeds or oil-seed by-products to ensure accord with minimum standards. Tests are also done on gum olibanum (which has 4 grades) and on karkadeh.

SSMO was set up in 1969 and presently employs a staff of about 50: 35 in Port Sudan and balance 15 in Khartoum from where some are sent to El-Obeid during a season. Exporters may obtain certification of quality either from the Geneva-based SGS Company, which is represented in Sudan by the Gezira Trades & Services Co., or from SSMO. SSMO standards have not been published, according to the information provided to the mission by two senior quality controllers (the director was abroad). SSMO

charges SP 5,000 (US$ 6.0 equivalent) for certifying a shipment of 500 tons or over.

SSMO is presently not geared to establishing Sudanese standards for other commodity export products such as medicinal and aromatic plants. Standards for gum arabic have been set by the Gum Arabic Co.

4.7 Investment Public Corporation (IPC)

The Bureau of Investment (IPC), which functioned as the investment promotion arm of the government from 1980 to 1990, was developed into the Investment Public Corporation in 1990. The establishment of IPC was a part of the government's new open economic policy which emphasized private sector development and increased local and foreign investment in accordance with The Comprehensive National Strategy for development. IPC was set up and functions on the basis of the Encouragement of Investment Act, 1990 Act No. 64, amended in March 1991.

IPC evaluates proposals from local and foreign investors which are of adequate size and are considered new businesses (not expansion of existing ones) and determines the appropriate fiscal incentives to be offered. Proposals for investment in agriculture, industry and services have been approved. Incentives for these investments may cover exemption from corporate profit taxes and import duties on raw materials, machinery and vehicles, for periods ranging up to 5 years and even 10 years in special cases. Agricultural or agro-based industrial projects also receive extents of government land through the Ministry of Agriculture, ranging in size from 100 feddans to 5,000 feddans, at nominal lease rates, leases being renewable up to 99 years. IPC may also recommend a reduction of the sales tax on local sales of new businesses, export sales being tax-exempt. It was noted that several pharmaceutical and perfumery manufacturers had availed of these benefits for new investments, including Elie Phramaceuticals, Sigma-Tau (Sudan) Ltd., Balsam Pharmaceuticals Ltd. and Tag Cosmetics & Toiletries Ltd.

The incentives for new investments are substantial, even though the level of investment may not appear substantial as yet. For the moment, most of the new investment applications are from Arab countries and China. A hostile external political environment is a damper on investment in the country, which offers substantial advantages to investors, despite somewhat under-developed infrastructure services for business. However, there is the prospect of new investments in large oil exploration and mining projects which will have a substantial impact on the economy in future.

4.8 Development banks

The country has 25 commercial banks and 4 development banks, but the banking system is weak. It is inadequate for local investors in prospective new businesses and most investors contacted by the mission were investing their own resources for new business. High inflation in the country discourages savings and foreign currency resources are limited. Banks follow the Islamic banking system, not international banking practice. This offers three types of financial support for customers: Murabaha, Mudaraba and Musharaka. Mudaraba and Musharaka are profit sharing systems for short-term credit extending up to six months. Murabaha deals with development banking. Each of the 4 development banks specialize in one area: agriculture, livestock, real estate and industry. The industrial development bank is the El-Nilein Industrial Development Bank (NIDB) which was visited by the mission.

The origin of NIDB was in the Industrial Development Bank of Sudan founded in 1961. It operated as a purely development bank engaged in term-lending till 1986 when an amendment to banking laws enabled it to offer short-term credit and open branches in several towns. In 1993, it was integrated with the El-Nilein Commercial Bank, which had 40 branches, to become the NIDB. El-Nilein had been created in 1970 through the nationalization of the French bank, Credite Lyonaisse. NIDB is owned by the Bank of Sudan (central bank) and the Ministry of Finance.

Murabaha that is available to investors is usually based on a five-year credit. In the case of foreign currency credits, the customer will receive payment which is then repaid over 5 years, with the first year being a grace period. Payments are made bi-annually, in installments amounting to about one eighth of the total credit plus a profit share amounting to 7.5% of the total credit value (8 installments in all). With the addition of a service fee and legal fees, a customer would repay the credit plus an equivalent value of 75.5%, considered as profit share, over 5 years. This amounts to an interest rate of about 15% in standard banking terms. In the case of local currency credits, the average bi-annual repayment would be a portion of the capital plus a profit share calculated at 30% per annum during the period of repayment.

Development credit is presently restricted due to a shortage of foreign currency. The new concept of Islamic banking could work well, provided the bank has access to foreign exchange which is in short supply in the country. NIDB is seeking credit from the Islamic Development Bank in Jeddah and the African Development Bank (ADB). ADB currently has a consultant in place in NIDB to reorganize some of the banking systems in NIDB prior to grant of further funds.

4.9 Evaluation

MAPRI and IRCC are the key government support institutions for this sector, and these research institutes are presently facing a crisis. Concentrating mainly on theoretical research, they have become isolated from industry. To make a contribution to national economic development, these institutions need to be both restructured and re-organised to work on applied research as a service to industry.

The institutes are dependent on government budget allocations and funding from international aid agencies and both these sources of funds are drying up. With the increasing cuts in aid agency funding, these institutions may become moribund in the future. Already, they are unable to function effectively because the laboratories are in a state of disrepair and the staff are partly demoralized due to low salaries and poor working conditions. The best prospect for sustaining these two institutions would be through a restructuring of the managements so that they could operate as partially self-financing commercial organizations by effectively serving the business sector for fees. The pharmaceutical manufacturers and exporters have indicated that their main constraint is technical expertise for product development and for subsequent fabrication of plant and machinery. These research institutions are at present not geared for this role. If properly restructured, they have the potential to serve industry and become at least partially self-supporting.

The facilities and operations of the laboratories in the government research institutes and the private sector pharmaceutical companies stand in contrast to each other. The public sector laboratories are in a poor state and a lot of capital investment in equipment has been wasted. In contrast, the private sector laboratories are modern, clean and efficiently utilized. However, private sector laboratories are mainly intended for quality control and need to be supported by the government sector research institutes that can assist them with applied research for product development and testing.

In the context of the present situation, with a very active private sector operating in pharmaceutical manufacturing and plant exports, these government institutions could play an important role if they are restructured and given a commercial direction. The legal status of these institutions permit them to engage in commercial operations and the policy making National Scientific Council has in fact directed them to do so. The failure is the result of a lack of business management expertise within these institutions and the lack of incentives for the management.

For the purposes of this project, which is only concerned with the development of work relating to medicinal and aromatic plants, the mission recommends only the restructuring of MAPRI, which will be the focal point of industry research and support. When a restructured and strengthened MAPRI is reorganized to effectively serve the business sector, the Pharmaceutical Applied Research Laboratory of IRCC should

work in collaboration with MAPRI in this particular area of work.

The main recommendation of the mission is to restructure the organization of MAPRI so that it will have a Commercial Department in addition to the four research departments that now constitute it. The Commercial Department will be headed by a director who will report to the Director General of MAPRI. The management system of MAPRI will then be reorganized to ensure that no new major investment or work program commences without a professionally prepared project proposal which can justify the work on commercial grounds. The project proposals should be prepared by the Commercial Department with the research departments concerned and approved by the Board of Directors of MAPRI. The Commercial Department will have the following roles.

(1) Identify commercial opportunities in the business community relating to the cultivation or processing of medicinal and aromatic plants, or the manufacture of pharmaceutical, cosmetic, toiletry or other finished products from these. Carry out research into markets which seem attractive to identify potential customers.

(2) In association with the directors of the research departments, visit potential customers in the business community and actively canvass business by offering to carry out supporting research in this area of work. Customers may be found both locally and abroad for such projects. MAPRI will canvass these customers by preparing and presenting written proposals for work on commercially viable projects.

(3) Prepare legally binding commercial contracts with interested clients incorporating the work to be carried out by MAPRI and the fees to be charged for the work.

(4) Maintain regular communication with clients during work programs to ensure customer satisfaction.

(5) Persuade the research departments in MAPRI to carry out contracted jobs to the satisfaction of the clients.

(6) Ensure payment for the work carried out in accordance with the contracts.

The Director of the Commercial Department should be a qualified and experienced business person. Such persons are not found in the public sector and cannot be drawn in with the remuneration offered to public servants. It is therefore proposed that this director should be recruited on the basis of a two-year contract from the private sector at a very special salary which will be attractive enough for an experienced business development manager. At the end of two years, the under-study trained by this director in the department should be in a position to take over his/her role.

The establishment of the Commercial Department and the recruitment of the Commercial Director will be a pre-condition for the rest of the project assistance for MAPRI. This will be carried out initially with the assistance of an external Management/ Marketing consultant provided through UNIDO. UNIDO has considerable experience in this type of institutional restructuring.

The reorganization of the research departments through addition of new plant and equipment and the initial training of MAPRI personnel on the operation of these will be carried out with the assistance of an external consultant provided by UNIDO who is an expert in chemical engineering. UNIDO has considerable expertise in this area of work. Addition of plant and equipment will be based on some market research and identification of key areas of work which have commercial application (task of Commercial Department). The actual selection of relevant plant and equipment will be done on the advice of the short-term UNIDO consultant.

MAPRI assistance to the business sector will cover three major areas of research: (1) cultivation trials, (2) designing equipment for local fabrication, and (3) product development and testing. MAPRI will initially require UNIDO assistance to obtain technical support for this work through the provision of an agronomist, chemical technologist and an applied phytochemist.

Some additional training of personnel could be carried out abroad through UNIDO-sponsored training programs.

The Directorate of Pharmacy in the Ministry of Health is a regulatory institution. It also tends to work in isolation from the industry it is intended to serve. Pharmaceutical manufacturers complained that the ministry officials never visited the factories and were unaware of their concerns. This does not accord with government policy which is concerned with getting the participation of people into the development process.

The SSMO has to be improved to serve the export of Sudanese products. Exporters complained that the standards that existed in the past had now been abandoned and that Sudan was losing out in the export of medicinal and aromatic plants and their by-products as a result. To ensure recognition of value addition in the export markets for the major Sudanese export products, the SSMO should establish, publish and certify quality standards for these products: karkadeh, senna, henna, fenugreek, tamarind, argel, coriander, gum olibanum and chillies.

It is noted that **IPC** and the **NIDB** are doing good work to support agricultural and industrial development work despite the handicap of an unfavorable external environment for investment in the country.

5. SUMMARY OF CONCLUSIONS

5.1 Strengths

1. Small but efficient, modern and dynamic pharmaceutical manufacturing industry.

2. Interest by pharmaceutical industry and some exporters in new investments and in developing products based on locally produced medicinal and aromatic plants.

3. Plentiful availability of suitable land for large-scale cultivation for export and local manufacturing.

4. Successful cultivation on pilot-scale and small-scale of selected medicinal and aromatic plants in Blue Nile State.

5. Operating informal sector trading network for collecting medicinal and aromatic plant material from the wild which could be developed to expand availability of raw material.

6. Availability of substantial government incentives through IPC as well as government leases of land for development of both agriculture and industry.

7. Existence of some special government research facilities for medicinal and aromatic plants that are capable of further development.

8. Well established and competent export traders in the medicinal and aromatic plant commodity export sector.

9. Government commitment to agricultural and industrial development.

5.2 Weaknesses

1. Inadequate infrastructure for modern business operations, specially in these areas: electricity, telecommunications, roads, railways, local transport, irrigation, gasoline availability.

2. Inadequacy of banking sector and lack of foreign exchange for larger investments.

3. Lack of local support industries to provide adequate raw materials and packaging materials for industry: essential oils, chemicals, solvents, bottles, paper, board, polythene, polypropylene, etc.

4. Inadequate facilities in the public sector and public administration due to budgetary constraints.

5. Insufficiency of qualified personnel who are migrating for better remuneration to the Middle East and other countries.

6. Smuggling of plant materials to neighboring countries and smuggling of finished goods into the country from the same countries.

7. Lack of published data and statistical information for business.

8. Lack of established grading standards for plant products in this sector.

9. Crude collection and plant processing systems based on informal sector operations that result in low-grade commodity products which cannot compete in international markets against Chinese, Indian or Thai products.

10. Lack of technical expertise in processing plant-based products.

11. Foreign investor shyness.

12. Lack of coordination between government institutions and government and private sector business.

13. Lack of expertise in marketing (as opposed to commodity trading) and project formulation.

5.3 Opportunities

1. Strong local demand for cheaper-priced locally manufactured drugs within the country.

2. Demand for cheaper locally manufactured essential oils for local industry, eg. soaps and toiletries industries.

3. Strong international demand for many essential oils from aromatic plants grown in the country or which can be introduced and cultivated locally.

4. Local and Middle East market demand for better quality traditional products used in Arab countries, eg. miswak, bakhour, henna, karkadeh, senna, etc.

5. Growing demand in the developed countries, especially in the growing health food and natural products sectors, for plant-based consumer products as opposed to synthetic material-based products.

6. Potential local market for consumer products in the form of concentrated syrups or powders for beverages based on karkadeh, gongolaise, tamarind, etc.

7. Potential market for processed or semi-processed plant-based raw material for local industry, eg. gum arabic, gum olibanum, karkadeh powder, resin-free senna extracts, tamarind pulp, etc.

5.4 Threats

1. More sophisticated competition from better organized developing countries such as China, India and Thailand.

2. Uncertainties caused by unpredictable droughts.

3. Extension of war situation in raw material producing areas.

4. Brain drain of qualified persons to other countries.

5. Weakening of foreign exchange situation.

6. GOALS, OBJECTIVES AND RECOMMENDATIONS

6.1 Goals

1. To increase the agro-industrial production base in Sudan through the development of basic products based on the extended cultivation of medicinal and aromatic plants in the rural areas. A list of the selected useful plants from the flora of Sudan is given in Annex 5. This will result in increased employment opportunities for unemployed and under-employed rural families, provide raw material for the local industries, and generate exports.

2. To reverse the declining trend in the commodity export of medicinal and aromatic plant material by developing plant extracts that will have greater demand in export markets which are no longer interested in the bulk imports of raw products.

3. To improve the quality of commodity exports through improved cleaning, sorting and packing methods.

6.2 Objectives

1. Development of lemon-grass and other aromatic plant cultivation and oil distillation on 2,000 hectares of irrigable land within the first three years of the project. This will result in the annual production of 400 tons of lemon-grass and other essential oils, valued at about US$ 4.8 million. This will provide a perfumery base for the soap industry which has a production of about 50,000 tons per annum, and also for the large market for locally produced cheap perfumes. It is expected that this program will provide employment for 2,000 families. The initial program is expected to expand when the pioneering projects have demonstrated results.

2. Technical support for pharmaceutical, perfumery and beverage industries which have already commenced the development of simple value-added products based on the medicinal plant materials that are now used in the raw form, both by local consumers and exporters. Specifically, initial work is being done by local companies in the development of simple extracts and value added products from the following

materials: gum arabic, gum guar, gum olibanum, karkadeh, senna, henna, tamarind, gongolaise and camomile. Development of extracts from these products will create a demand for the cultivation of these plants materials which are now collected from the wild, resulting in increased rural employment as well as increased exports.

3. Technical support for the commodity export companies handling medicinal/aromatic plant products to improve cleaning, sorting and packing.

6.3 Available resources

1. Interest shown by pharmaceutical and perfumery industries, exporters and farmers to develop new products and also engage in large-scale cultivation to ensure reliable raw material resources.

2. Financially sound local companies which are capable of raising the required finances.

3. Availability of credit for proposed projects through African Development Bank or joint-venture partners.

4. Attractive incentives offered through Investment Public Corporation.

5. Government focus on agro-industrial projects and commitment to their development.

6.4 Proposed strategy

UNIDO will provide assistance in three areas, as follows:

1. Placement of UNIDO technical experts to support the cultivation and development of lemon-grass and other aromatic oils, and extracts or value-added products from medicinal and aromatic plants. These will require the services of three UNIDO experts during the project period: a chemical technologist, applied phytochemist and an agronomist.

2. Placement of management/marketing expert to develop management and marketing capability of MAPRI to work with industry, and also assist industry in obtaining funding and marketing skills to carry out the development programs.

3. Supply of some of the necessary laboratory equipment to up-grade MAPRI.

The project needs an institutional base, which will be provided by MAPRI. MAPRI needs to be restructured by Ministry of Industry to carry out this program of work. MAPRI will then offer the following services to industry on a commercial basis.

(1) Assistance in the preparation of project proposals for financing these projects.

(2) Assistance in identifying markets for the selected products that are to be developed.

(3) Assistance through pilot and small-scale cultivation of medicinal and aromatic plants.

(3) Assistance in product development and testing.

(4) Assistance in designing and sourcing equipment.

The project will be supported by the following government ministries and institutions:

(1) Ministry of Finance which will offer tax deduction incentive for product research costs incurred by manufacturing companies.

(2) Ministry of Finance which will approve fiscal incentives through IPC for viable investment projects under the program.

(3) Ministry of Agriculture which will provide land on concessionary lease basis for viable cultivation programs under this project.

(4) Ministry of Industry and the National Centre for Research which will direct the reorganization of MAPRI to establish its commercial focus.

(5) Ministry of Industry which will support an African Development Bank loan for MAPRI to establish the required additional facilities for its commercial operations.

(6) Horticulture Department of the Ministry of Agriculture which will conduct some of the cultivation trials for private sector investors under this project on a commercial basis.

6.5 Other recommendations

The following is a summary of the other recommendation for government ministries and institutions that impact on this business sector.

	Recommendation	Implementing agency
1.	Establishment of Sudanese grading standards for the following export products: karkadeh, senna, lemon-grass oil	SSMO of Ministry of Industry
2.	Removal of locally manufactured essential oils and aromatic extracts from category of luxury products to eliminate current 75% excise duty on this item.	Ministry of Finance
3.	Tax exemption for funds invested in research by local manufacturing industries.	Ministry of Finance
4.	Increasing service charges made by Central Drug Control Laboratories in respect of services to companies sending drugs for evaluation and testing.	Ministry of Health
5.	Re-organization of IRCC to enable it to provide better management services to industry and earn additional revenue.	Ministry of Industry

6.	Publish regulations requiring traditional medical practitioners to register with ministry and obtain a license to practice. Review draft legislation on the subject.	Ministry of Health
7.	Publish regulations requiring attareens (local shops for traditional medicine) to register and obtain a license to sell medicinal plant or other medicinal products.	Ministry of Health
8.	Requirement of more professionally prepared project proposals from companies applying for investment relief and funding from development banks.	Investment Public Corporation & NIDB

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project of the Government of
Sudan

JOB DESCRIPTION
XA/SUD/95/613/11-01/0730DO

Post title: Chemical Technologist

Duration: 1.0 m/m

Date required: Khartoum, Sudan

Duty station: August 1995

Purpose of project:

To evaluate the potential for industrial utilization of medicinal and aromatic plants in Sudan and to assess the requirements in terms of infrastructural facilities, human resource development, equipment and technology for a technical assistance project.

Duties:

The Industrial Technologist as team leader and the marketing expert with assistance and co-operation of the National Consultant and counterparts will perform the following duties:

1. Study the data available on the indigenous medicinal and aromatic plants and assess the potential for industrial processing and product development in terms of raw material availability, agrotechnology, process technology and infrastructural facilities for processing, quality control, research and development and trained personnel and regulatory requirements.

2. Assess the current state of production and quality of plant based medicaments and essential oils and recommend ways of improving production, quality and stability and if necessary setting up of laboratories for quality control.

3. Study the prospects for developing entrepreneurship and cooperation among the existing enterprises and scope of setting up joint ventures.

4. Prepare a priority list of plants having a potential for industrial utilization and indicate the activities to be undertaken to initiate viable processing industries.

5. Prepare a comprehensive joint report on the findings and recommendations including development of entrepreneurship and potential sources of financing and scope of setting up of joint venture arrangements and prepare a draft project document indicating the inputs in terms of equipment, training, expertise, infrastructural facilities and potential sources of financing, both domestic and international, required for a technical assistance project on the industrial utilization of medicinal and aromatic plants.

Qualifications:

A graduate in Chemistry or Pharmacy or Chemical Engineering with at least 10 years of experience in the industrial utilization of medicinal and aromatic plants.

Language:

English

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project of the Government of
Sudan

JOB DESCRIPTION
XA/SUD/95/613/11-02/0730DO

Post title	Economist/Market Analyst
Duration	1.0 m/m
Date required	August 1995
Duty station	Khartoum, Sudan

Purpose of project

To evaluate the potential for industrial utilization of medicinal and aromatic plants in Sudan and to assess the requirements in terms of infrastructural facilities, human resource development, equipment and technology for a technical assistance project and development of entrepreneurship, setting up of joint venture investments and identification of sources of funding.

Duties

The marketing expert together with the industrial technologist (Team Leader) and with assistance and cooperation of the National Consultant and counterparts will perform the following duties:

1. Study the data available on the demand and marketing of indigenous medicinal and aromatic plants and assess the potential for industrial production in terms of raw material availability and sales potential.

2. Suggest methods of stream lining market practices and recommend arrangements for marketing and sales promotion.

3. Investigate the domestic and export market potential for plant based medicaments and essential oils particularly from those plants in the priority list.

4. Study the prospects of developing entrepreneurship and cooperation among the existing enterprises and the scope of setting up joint ventures.

5. Recommend prospective buyers and procedures for negotiating with them.

6. Prepare a comprehensive joint report on the findings and recommendations including development of entrepreneurship and potential sources of financing and scope of setting up of joint venture arrangements and prepare a draft project document indicating the inputs in terms of equipment, training, expertise, infrastructural facilities and potential sources of financing, both domestic and international, required for a technical assistance project on the industrial utilization of medicinal and aromatic plants.

Qualifications

A graduate in marketing or economics or other science with at least 10 years of experience in marketing, sales and cost analysis, preferably of plant based products. Experience to this effect in Africa will be an advantage.

Language

English/knowledge of Arabic is an advantage.

ANNEX 3

PERSONS CONTACTED

UNDP Sudan

1. Mr. Peter Manoranjan, Contact Director, UNIDO Sudan.
2. Ms. Kirsten Jorgensen,Senior Deputy Resident Representative, UNDP, Sudan.

Government of Sudan

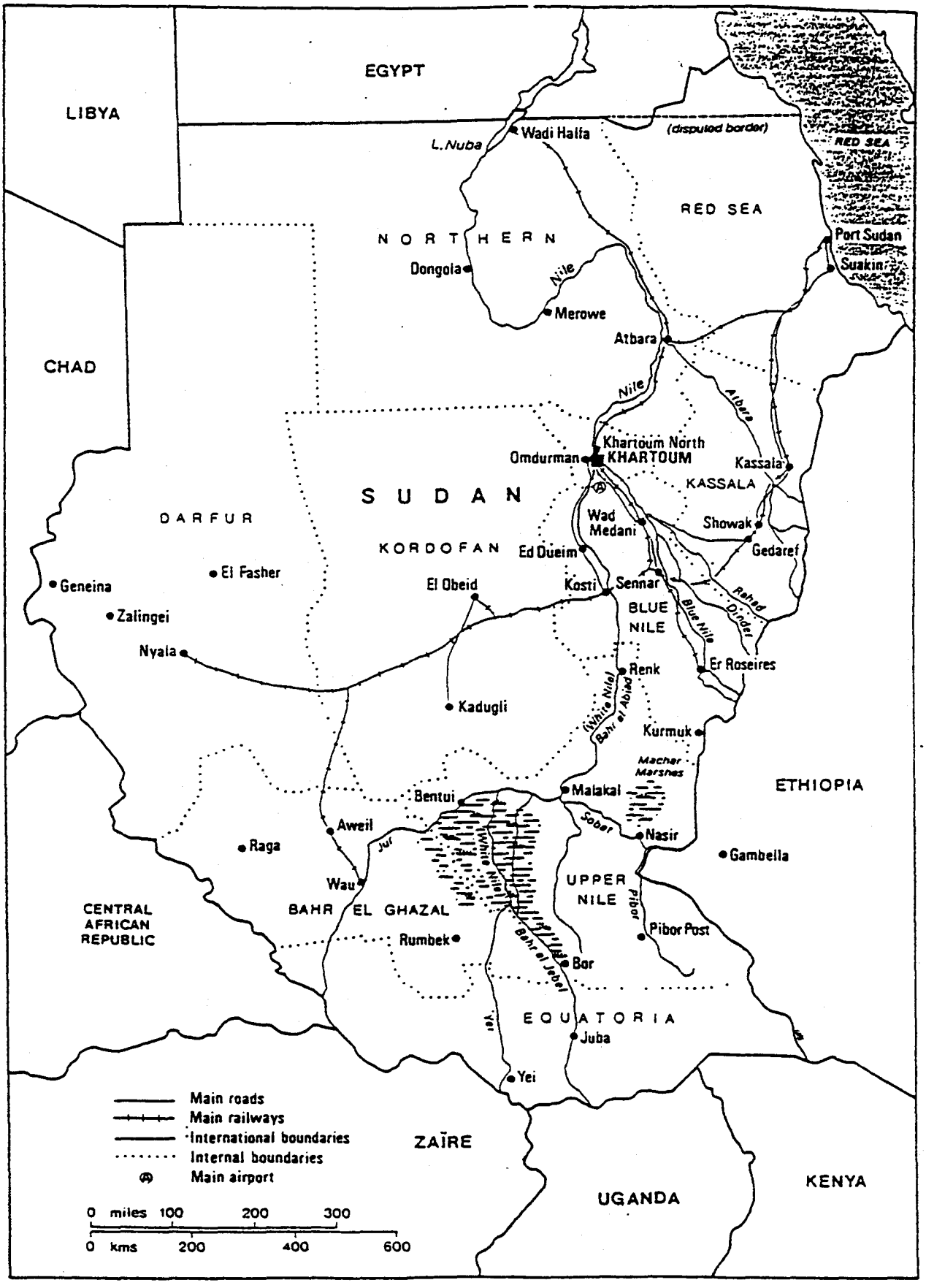
3. Hon. Badr al-Din Suleiman, Minister of Industry.
4. Mr. Osman El-Amin, First Under-Secretary, Ministry of Finance.
5. Mr. Mohamed Widatollah, Director, External Relations, Ministry of Industry.
6. Dr. M. El Amin A. Rahman, Director General, Industrial Research & Consultancy Center, Khartoum.
7. Dr. Rahman Ali Fadel Moola, Chemical Industries Dept., IRCC.
8. Mr. Elnazeer Abdel Rahman, Food Industries Dept., IRCC.
9. Mr. Elfatih Khalid, Director, International Organisations, Ministry of Finance.
10. Mr. Babiker Abdalla Babiker, International Financial Cooperation Directorate, Ministry of Finance.
11. Mr. Abdelati Gabir, International Financial Cooperation Directorate, Ministry of Finance.
12. Dr. Mahgoub Sherif Eltohami, Director, Medicinal & Aromatic Plants Research Institute, National Centre for Research.
13. Dr. Mohamed Bashir Ali, Head, Dept. of Pharmacology & Toxicology, Medicinal & Aromatic Plants Research Institute.
14. Dr. Hassan Elsubki Khalid, Medicinal & Aromatic Plants Research Institute.
15. Ms. Magda A. Osman, Medicinal & Aromatic Plants Research Institute.
16. Mr. Mohamed El Fatih Ahmet Omer, Medicinal & Aromatic Plants Research Institute.
17. Mr. Gamal E.B. El-Ghazali, Medicinal & Aromatic Plants Research Institute.
18. Mr. Mubarak El-Siddig El-Amin, Chemical Research Dept., IRCC.
19. Dr. Abdelaziz Mohammad El-Faki, Directorate of Pharmacy, Drug Office Section, Ministry of Health.
20. Dr. Aladdin Ali Malgan, Director, Horticulture Department, Ministry of Agriculture.
21. Dr. Gamal Osman Elhassan, Director, Drug Control & Research Directorate, Ministry of Health.
22. Dr. Mohamed Nageeb, Director of Phramaceutical Industry, Ministry of Health.
23. Dr. Abdel Aziz Mohamed El-Faki, Director, Drug Affairs Section, Ministry of Health.
24. Mrs. Marimona M. Bashir and Mrs. Kaltoum Osman, Quality Control Section, Sudanese Standards & Metrological Dept.
25. Prof. Abdel Karim M.M. Salih, Deputy Director, National Council for Research.
26. Dr. Mohamed Ahmed Osman, General Manager, Investment Public Corporation.
27. Mr. Abdel Mooniam Abdul Dafai, General Manager, Nilen Bank, UN Square Branch, Khartoum.
28. Mr. Isam Eldin Mohamed Ibrahim, Industrial Economist, Nilen Industrial Development Bank.
29. Dr. Idris Babiker Eltayeb, Dean, Faculty of Pharmacy, University of Khartoum.
30. Mr. Mubarak Ahmet Adam Fudol, member, Medicinal Plants & Traditional Medicine, Dept. of Pharmacy, Ministry of Health.

Private Sector

31. Mr. Elie G. Haddad, Managing Director, G.M. Haddad & Sons Ltd.
32. Dr. Ali Lutfi, Manager, Environmental/Health Division, Sudanese Cosmetics & Household Products Co. Ltd.
33. Dr. Hindy Mikhael, Area Manager, Amoun Pharmaceutical Industries Co. of Egypt.
34. Mr. Baha Eldin Abdel Hamid, Chairman/MD, Sigma-Tau Sudan Ltd.
35. Mr. Elrashid Mohd Elamin Hamid, Director, Amipharma Laboratories Ltd.
36. Mr. Al-Rasheed A. El-Awad, Managing Director, Vulcan Engineering Co.
37. Mr. Mohammad Tag, Technical Director, Tag Cosmetics & Toileteries Ltd.

38. Mr. Gabriel Haddad, Director, Agriproducts (Holdings) Ltd.
39. Dr. Alhag M. Awouda, Deputy Director, Gum Arabic Co., and General Manager, Gum Development Corporation.
40. Mr. Robert B. Boulos, Managing Director, The Union Trading Co.
41. Dr. Abdel Salam Abdel Moniem, Abdel Moniem Industrial & Engineering Co.
42. Mrs. Maha Abdel Salm, Pharmacist-in-charge, Abdel Moniem Co.
43. Dr. Eltayeb Yousif Salih, Managing Director, Concord Medical Enterprises Co.
44. Dr. Eltayeb Yousef Salih, Manager, Concord Medical Enterprises Co. Ltd.
45. Rev. Filotheos Faraj, Director, Al Raja Agricultural Project, Al Geteina Province.
46. Dr. A. Karim Mohamed, Climax for Drugs, Industrial Estate, Khartoum North.
47. Mr. Ibrahim Abul Kailik Mohamed, Asst. General Manager, Medical Development Enterprises Ltd., Khartoum, Sudan.

Sudan


EGYPT
LIBYA
CHAD
CENTRAL AFRICAN REPUBLIC
ZAÏRE
UGANDA
KENYA
ETHIOPIA
L. Nuba
Wadi Halfa
(disputed border)
RED SEA
NORTHERN
Dongola
Nile
Merowe
Atbara
Port Sudan
Suakin
Khartoum North
KHARTOUM
Omdurman
Kassala
KASSALA
SUDAN
DARFUR
KORDOFAN
Wad Medani
Showak
Gedaref
Ed Dueim
El Fasher
Geneina
El Obeid
Kosti
Sennar
BLUE NILE
Rahad
Dinder
Blue Nile
Zalingei
Nyala
Renk
Er Roseires
Kadugli
White Nile
Bahr el Abiad
Kurmuk
Machar Marshes
Malakal
Bentiu
Aweil
Sobat
Nasir
Gambella
Raga
Jur
Wau
BAHR EL GHAZAL
UPPER NILE
Pibor
Pibor Post
Rumbek
Bahr el Jebel
Bor
EQUATORIA
Yei
Juba
Main roads
Main railways
International boundaries
Internal boundaries
Main airport
0 miles 100 200 300
0 kms 200 400 600

ANNEX 5

SELECTED USEFUL PLANTS FROM THE FLORA OF SUDAN

Alangiaceae	Alangium chinense	Flowers fragrant
Amaryllidaceae	Allium ascalonicum	Shallot, cultivated
Amaryllidaceae	Allium cepa	Onion, cultivated
Amaryllidaceae	Allium sativum	Garlic, cultivated
Amaryllidaceae	Gladiolus psittacinus	Ornamental
Ampelidaceae	Ampelocissus schimperiana	Fruit edible
Ampelidaceae	Cissus cornifolia	Fruit edible
Ampelidaceae	Cissus quadrangularis	Medicinal
Anacardiaceae	Lannea kerstingii	Flowers (male) fragrant
Anacardiaceae	Pistacia falcata	
Anacardiaceae	Pseudospondias microcarpa	Fruit edible
Anacardiaceae	Sclerocarya birrea	Fruit with juicy mucilaginous flesh
Annonaceae	Annona senegalensis	Fruit edible
Annonaceae	Hexalobus crispiflorus	Flowers fragrant
Annonaceae	Hexalobus monopetalus	Fruit juice stains yellow when ripe
Annonaceae	Monodora myristica	Calabash-nutmeg, fruit pulp fragrant
Apocynaceae	Landolphia comorensis	Fruit pulp edible
Apocynaceae	Landolphia owariensis var. tomentella	Fruit edible, yields best Sudan Landolphia rubber
Apocynaceae	Rauvolfia vomitoria	Medicinal
Asclepiadaceae	Solenostemma argel	Medicinal
Balsaminaceae	Impatiens elegantissima	Flowers fragrant
Bignoniaceae	Kigelia aethiopum	Flowers unpleasantly scented, fruit medicinal
Bignoniaceae	Stereospermum kunthianum	Flowers fragrant
Bombaceae	Adansonia digitata	Fruit edible
Boraginaceae	Arnebia hispidissima	Root yields blood red dye
Boraginaceae	Codia abyssinica	Fruit with sweet mucilaginous pulp
Burseraceae	Boswellia papyrifera	Frankincense Tree - Flowers fragrant
Burseraceae	Canarium schweinfurthii	Incense Tree - exudes a fragrant resin
Burseraceae	Commiphora opobalsamum	Balm of Gilead, Mecca Balsam
Cactaceae	Opuntia dillenii	Prickly pear, fruit edible, cultivated
Caesalpiniaceae	Daniellia oliveri	Flowers fragrant
Caesalpiniaceae	Isoberlinia doka	Flowers fragrant
Caesalpiniaceae	Piliostigma thonnongii	Flowers fragrant
Caesalpiniaceae	Tamarindus indica	Tamarind

Cannabaceae	Cannabis sativa	Cannabis, marijuana
Cappariceadeae	Capparis erythrocarpos	Fruit edible, tasteless
Capparidaceae	Boscia angustifolia	Flowers fragrant
Capparidaceae	Boscia senegalensis	Flowers scented, fruit edible
Capparidaceae	Capparis decidua	Fruit edible
Capparidaceae	Capparis micrantha	Fruit edible
Capparidaceae	Capparis spinosa	Caper-Capparis (10 sp.)
Capparidaceae	Cleome chrysantha	Aromatic herb
Capparidaceae	Cleome coeruleo-rosea	Strong-smelling annual herb
Capparidaceae	Cleome schweinfurthii	Flowers unpleasant smelling
Capparidaceae	Crateva adansonii	Flowers fragrant
Capparidaceae	Maerua crassifolia	Flowers fragrant
Capparidaceae	Maurea oblongifolia	Flowers fragrant, fruit edible
Caryophyllaceae	Paronychia argentea	Medicinal
Celastraceae	Maytenus	5 sp.
Celastraceae	Mystroxylon aethiopicum	Fruit edible
Chailletiaceae	Dichapetalum schweinfurthii	Flowers fragrant
Combretaceae	Combretum bongense	Flowers fragrant
Combretaceae	Combretum ghasalense	Flowers fragrant
Combretaceae	Combretum gueinzii	Flowers fragrant
Combretaceae	Terminalia brownii	Shaf, ingredient of bakhour
Compositae	Ageratum conyzoides	Aromatic herb, medicinal
Compositae	Ambrosia maritima	Aromatic herb
Compositae	Blumea aurita	Strongly scented herb
Compositae	Blumea lacera	Strongly scented herb
Compositae	Eupatorium africanum	Glandular herb
Compositae	Geigeria alata	
Compositae	Grangea maderaspatana	Hairy odorous herb
Compositae	Helichrysum	9 sp.
Compositae	Helichrysum	9 sp., aromatic herb
Compositae	Microglossa pyrifolia	Aromatic herb, slightly viscid
Compositae	Pegolettia senegalensis	Aromatic herb
Compositaepa	Pulicaria crispa	Aromatic herb
Compositae	Pulicaria undulata	Pulicaria (7 sp.), aromatic herb
Connaraceae	Jaundea pinnata	Flowers fragrant
Convolvulaceae	Ipomoea alba	Moonflower, cultivated
Convolvulaceae	Ipomoea batatas	Sweet potato, cultivated
Convolvulaceae	Ipomoea muricata	Cultivated
Convolvulaceae	Ipomoea sp.	39 sp.
Cruciferae	Anastatica hierocuntica	Rose-of-Jericho, Meryem Ana Eli
Cruciferae	Brassica nigra	Black mustard
Cucurbitaceae	Adenopus breviflorus	Fruit edible when ripe
Cucurbitaceae	Citrullus colocythis	Colocynth
Cucurbitaceae	Citrullus vulgaris	Water-melon
Cucurbitaceae	Cucumeropsis edulis	Fruit edible
Cucurbitaceae	Cucumis melo	Melon, cultivated

Cucurbitaceae	Cucumis sativus	Cucumber, cultivated
Cucurbitaceae	Cucurbita maxima	Pumpkin, cultivated
Cucurbitaceae	Cucurbita pepo	Marrow, cultivated
Cucurbitaceae	Kedrostis foetidissima	Foetid herb, fruit foetid
Cucurbitaceae	Lagenaria cylindrica	Loofah gourd
Cucurbitaceae	Lagenaria vulgaris	Bottle gourd
Cucurbitaceae	Momordica charantia	Momordica (9 sp.)
Cupressaceae	Juniperus procera	
Cyperaceae	Cyperus esculentus	Tuber edible
Cyperaceae	Cyperus rotundus	Cyperus (81 sp.)
Dilleniaceae	Tetracera potatoria	Flowers fragrant
Dioscoreaceae	Dioscorea bulbifera.	Yam, rootstock edible, 8 sp., cultivated
Droseraceae	Drosera indica	Carnivorous herb
Ebenaceae	Diospyros mespiliformis	Fruit pulp edible
Ebenaceae	Euclea divinorum	Fruit edible
Ebenaceae	Euclea schimperi	Fruit edible
Erythroxylaceae	Erythroxylum fischeri	
Euphorbiaceae	Bridelia micrantha	Fruit edible
Euphorbiaceae	Manihot esculenta	Cassava, cultivated
Euphorbiaceae	Phylanthus niruri	Medicinal
Euphorbiaceae	Ricinus communis	Castor-oil plant
Flacourtiaceae	Oncoba spinosa	Flowers fragrant
Graminae	Arundinaria alpina	Bamboo
Graminae	Avena sp.	Oat, cultivated
Graminae	Coix lacryma-jobi	Job's tears, cultivated
Graminae	Cymbopogon caesius	
Graminae	Cymbopogon citratus	Lemongrass
Graminae	Cymbopogon commutatus	
Graminae	Cymbopogon excavatus	
Graminae	Cymbopogon giganteus	
Graminae	Cymbopogon proximus	
Graminae	Cymbopogon sennarensis	
Graminae	Eleusine coracana	African millet, cultivated
Graminae	Melinis minutiflora	Viscous, odorous herb
Graminae	Oryza sp.	Rice, cultivated
Graminae	Oxytenanthera abyssinica	Tall leafy bamboo
Graminae	Pennisetum sp.	Bulrush millet, cultivated
Graminae	Setaria italica	Italian millet, cultivated
Graminae	Sorghum halepense	Johnson Grass
Graminae	Sorghum sudanense	Sudan Grass
Graminae	Sorghum virgatum	Tunis Grass
Graminae	Triticum sp.	Wheat, cultivated
Graminae	Vetiveria nigritana	Rhizome aromatic
Graminae	Zea mays	Maize, cultivated
Guttiferae	Garcinia buchanani	Fruit edible, stigma sticky
Guttiferae	Garcinia ovalifolia	Tree with creamy sap
Hypericaceae	Harungana madagascariensis	Flowers fragrant
Hypericaceae	Hypericum perforatum	St.John's Wort
Labiatae	Acrocephalus	3 sp.
Labiatae	Aeolanthus	3 sp.
Labiatae	Ajuga integrifolia	
Labiatae	Basilicum polystachyon	Labiatae Becium 4 sp.
Labiatae	Calamintha sp.	

Labiatae	Capitanya otostegioides	
Labiatae	Coleus	7 sp.
Labiatae	Endostemon	2 sp.
Labiatae	Englerastrum scheweinfurthii	
Labiatae	Geniosporum padulosum	
Labiatae	Hoslundia opposita	
Labiatae	Hyptis	3 sp.
Labiatae	Iboza multiflora	
Labiatae	Lavandula	2 sp.
Labiatae	Leonotis	3 sp.
Labiatae	Leucas	8 sp.
Labiatae	Mentha longifolia subsp.	schimperi
Labiatae	Micromeria	2 sp.
Labiatae	Nepeta	2 sp.
Labiatae	Ocimum basilicum	Ocimum (6 sp.)
Labiatae	Orthosiphon	5 sp.
Labiatae	Otostegia	2 sp.
Labiatae	Platostoma africanum	
Labiatae	Plectranthus	3 sp.
Labiatae	Pycnostachys	3 sp.
Labiatae	Salvia aegyptiaca	
Labiatae	Scutellaria	3 sp.
Labiatae	Teucrium nummulariifolium	
Labiatae	Tinnea aethiopica	
Lauraceae	Tylostemon ugandensis	Fruit with a dark red-purple juice
Leguminosae	Abrus precatorius	Seeds medicinal
Leguminosae	Acacia mellifera	Flowers fragrant
Leguminosae	Acacia nilotica var. nilotica	Fruits bakhour ingredient
Leguminosae	Acacia nubica	Flowers fragrant
Leguminosae	Acacia senegal	Gum Arabic Tree
Leguminosae	Acacia seyal	Gum Talha Tree - Flowers fragrant
Leguminosae	Acacia sieberiana	Flowers fragrant
Leguminosae	Albizzia malacophylla	Flowers fragrant
Leguminosae	Albizzia sericocophala	Flowers fragrant
Leguminosae	Ambligonocarpus schweinfurthii	Flowers fragrant
Leguminosae	Canavalia ensiformis	Wild and cultivated
Leguminosae	Clitoris ternatea	Wild and cultivated
Leguminosae	Cyamopsis senegalensis	Local Guar tree - C. tetragonolobus-cultivated
Leguminosae	Dalbergia melanoxylon	African Ebony - Flowers fragrant
Leguminosae	Entada sudanica	Flowers fragrant
Leguminosae	Glycyrrhiza glabra	Liquorice
Leguminosae	Indigofera arrecta	Medicinal
Leguminosae	Indigofera tinctoria	Indigo, Indigofera (58 sp.)
Leguminosae	Lablab niger	Wild and cultivated
Leguminosae	Mucuna pruriens	Medicinal
Leguminosae	Parkia filicoidea	Flowers fragrant
Leguminosae	Prosopis africana	Flowers fragrant
Leguminosae	Trigonella foenum-graecum	Fenugreek, cultivated
Liliaceae	Aloe sp.	3 sp.
Liliaceae	Gloriosa simplex	Ornamental, bulb medicinal

Liliaceae	Urginea sp.	4 sp., bulb medicinal
Loganiaceae	Lachnophylis congesta	Flowers fragrant
Loganiaceae	Strychnos innocua	Fruit pulp edible
Loganiaceae	Strychnos spinosa	Fruit pulp edible
Lythraceae	Lawsonia inermis	Henna- Flowers fragrant
Malvaceae	Adansonia digitata	Baobab, Gongolaise
Malvaceae	Gossypium anomalum	
	Gossypium somalense	Wild cotton species
Malvaceae	Gossypium arboreum	Cotton, cultivated
Malvaceae	Gossypium barbadense	Egyptian cotton, cultivated
Malvaceae	Gossypium barbadense var. brasiliense	Cotton, cultivated
Malvaceae	Gossypium herbaceum var. acerifolium	Cotton, cultivated
Malvaceae	Gossypium herbaceum var. africanum	Cotton, cultivated
Malvaceae	Gossypium hirsutum	American cotton cultivated
Malvaceae	Gossypium hirsutum var. punctatum	Cotton, cultivated
Malvaceae	Hibiscus esculentus	Okra, Ladies' fingers, edible
Malvaceae	Hibiscus sabdariffa	Karkadeh
Meliaceae	Ekebergia rueppelliana	Flowers fragrant
Meliaceae	Khaya senegalensis	Senegal Mahogany
Meliaceae	Pseudocedrela kotschyi	Flowers fragrant
Meliaceae	Trichilia prieureana	Flowers very fragrant
Meliaceae	Trichilia retusa	Flowers fragrant
Molluginaceae	Limeum kotschyi	Glandular-viscid herb
Moraceae	Antiaris africana	Medicinal
Moraceae	Ficus capreifolia	Fruit edible
Moraceae	Ficus glumosa	Fruit edible
Moraceae	Ficus urceolaris	Fruit edible
Moraceae	Ficus vasta	Fruit edible
Moraceae	Myrianthus arboreus	Fruit edible
Moraceae	Treculia africana	Flowers fragrant
Moringaceae	Moringa oleifera	Horseradish Tree - Flowers strongly fragrant, bark gummy
Musaceae	Musa sapientum	Banana, cultivated
Myristicaceae	Pycnanthus angolensis	Seed and aril aromatic
Myrtaceae	Psidium guajava	Guava - Cultivated
Myrtaceae	Syzygium guineense	Flowersfragrant, fruit edible
Myctaginaceae	Mirabilis jalapa	Jalapa, medicinal
Ochnaceae	Lophira alata	Flowers fragrant
Olacaceae	Ximenia americana	Flowers fragrant, fruit edible
Oleaceae	Jasminum floribundum	Flowers fragrant
Oleaceae	Olea chrysophylla	Fruit edible
Opiliaceae	Opilia celtidifolia	Flowers fragrant
Orchidaceae	Habenaria cirrhata	Flowers scented like vanilla
Oxalidaceae	Oxalis anthelmnintica	Medicinal
Palmae	Elaeis guineensis	Oil-palm, cultivated
Palmae	Medemia argun	Fruit not edible, bitter
Palmae	Phoenix dactylifera	Date-palm, fruit edible

Pedaliaceae	Sesamum indicum	Cultivated, 3 sesamum sp.
Pittosporaceae	Pittosporum abyssinicum	Flowers fragrant
Plantaginaceae	Plantago lanceolata	Ribwort plantain, medicinal
Polygalaceae	Securidaca longepedunculata	Flowers fragrant
Portulacaeae	Portulaca oleracea	Herb edible
Primulaceae	Anagallis arvensis	Medicinal
Punicaceae	Punica granatum	Pomengranate, cultivated
Ranunculaceae	Nigella sativa	Black cumin
Rhamnaceae	Ziziphus mauritiana	Flowers fragrant, Fruit edible
Rhamnaceae	Ziziphus mucronata	Fruit bitter
Rhamnaceae	Ziziphus pubescens	Fruit edible
Rhamnaceae	Ziziphus spina-christi	Fruit edible
Rosaceae	Hagenia abyssinica	
Rosaceae	Parinari excelsa	Fruit pulp edible
Rosaceae	Pygeum africanum	Flowers fragrant
Rosaceae	Tragiella natalensis	Fruit pulp edible
Rubiaceae	Belonophora glomerata	Flowers fragrant
Rubiaceae	Canthium rubrocostatum	Flowers fragrant
Rubiaceae	Canthium vulgare	Flowers fragrant
Rubiaceae	Cephaelis suaveolens	Flowers fragrant
Rubiaceae	Cephaelis suaveolens	
Rubiaceae	Coffea arabica	Arabian Coffee, Flowers fragrant
Rubiaceae	Coffea excelsa	Flowers fragrant
Rubiaceae	Coffea robusta	Robusta Coffee, Flowers fragrant
Rubiaceae	Cremaspora triflora	Flowers fragrant
Rubiaceae	Crossopteryx febrifuga	Flowers unpleasant smelling
Rubiaceae	Galiniera coffeoides	Flowers fragrant
Rubiaceae	Gardenia erubescens	Flowers fragrant, fruit edible
Rubiaceae	Gardenia jovis-torantis	Flowers fragrant, fruit edible
Rubiaceae	Gardenia lutea	Flowers fragrant
Rubiaceae	Gardenia triacantha	Flowers fragrant
Rubiaceae	Gardenia vogelii	Flowers fragrant
Rubiaceae	Lachnosiphonium niloticum	Flowers fragrant
Rubiaceae	Macrosphyra longistyla	Flowers fragrant
Rubiaceae	Morelia senegalensis	Flowers fragrant
Rubiaceae	Morinda lucida	Flowers fragrant
Rubiaceae	Morinda morindoides	Flowers fragrant
Rubiaceae	Mussaenda arcuata	Flowers fragrant
Rubiaceae	Nauclea latifolia	Flowers fragrant, fruit edible
Rubiaceae	Oldenlandia dolichantha	Flowers fragrant
Rubiaceae	Oxyanthus formosus	Flowers fragrant
Rubiaceae	Pavetta crassipes	Flowers fragrant
Rubiaceae	Pseudomussaenda flava	Flowers fragrant
Rubiaceae	Psychotria mucronata	Flowers fragrant
Rubiaceae	Rothmannia macrantha	Flowers fragrant
Rubiaceae	Rothmannia urcelliformis	Flowers fragrant
Rubiaceae	Rothmannia whitfieldii	Flowers fragrant
Rubiaceae	Rutidea smithii	Flowers sickly scented

Rubiaceae	Tricalysia niamniamensis	Flowers fragrant
Rubiaceae	Vangueria venosa	Fruit edible
Rutaceae	Aeglopsis eggelingii	Seeds surrounded by strongly scented balsamic resin
Rutaceae	Citrus aurantiifolia	Lime, cultivated
Rutaceae	Citrus aurantium	Bitter orange, cultivated
Rutaceae	Citrus limonia	Lemon, cultivated
Rutaceae	Citrus maxima	Pommelo, cultivated
Rutaceae	Citrus paradisi	Grape-fruit, cultivated
Rutaceae	Citrus reticulata	Mandarin, cultivated
Rutaceae	Citrus sinensis	Sweet orange, cultivated
Rutaceae	Clausena anisata	Medicinal
Salvadoracea	Salvadora persica	Miswak, Arak
Sapindaceae	Allophylus africanus	Flowers fragrant
Sapindaceae	Aphania senegalensis	Fruit edible
Sapindaceae	Blighia unijugata	Flowers very fragrant
Sapindaceae	Cardiospermum grandiflorum	Flowers fragrant
Sapindaceae	Haplocoelum foliolosum	Flowers fragrant
Sapindaceae	Lecaniodiscus cupanioides	Fruit pulp edible
Sapindaceae	Zanha golungensis	Fruit edible
Sapotaceae	Butyrospermum niloticum	Shea-Butter Tree
Sapotaceae	Chrysophyllum albidum	Fruit pulp edible
Sapotaceae	Manilkara schweinfurthii	Flowers fragrant
Sapotaceae	Mimusops fragrans	Flowers fragrant
Sapotaceae	Pachystela brevipes	Fruit pulp edible, milky juicy, white mucilaginous, acid-sweet
Saxifragaceae	Vahlia digyna	Very viscous herb
Scrophulariaceae	Cycnium adonense	Flowers sweet scented
Scrophulariaceae	Stemodia serrata	Viscid-glandular pubescent herb
Simarubaceae	Balanites aegyptiaca	Fruit edible
Simarubaceae	Irvingia smithii	Flowers fragrant
Solanaceae	Capsicum abyssinicum	Round chillies
Solanaceae	Capsicum frutescens	Chillies
Solanaceae	Datura innoxia	
Solanaceae	Datura metel	
Solanaceae	Datura stramonium	Thorn Apple
Solanaceae	Hyoscyamus muticus	Egyptian Henbane
Solanaceae	Nicotiana rustica	
Solanaceae	Solanum nigrum	20 sp. of Solanum
Solanaceae	Withania somnifera	
Tiliaceae	Christiana africana	Flowers fragrant
Tiliaceae	Grewia flavescens	Fruit edible
Tiliaceae	Grewia tenax	Fruit edible
Umbelliferae	Anethum graveolens	Dill, cultivated
Umbelliferae	Centella asiatica	Source of asiaticoside
Umbelliferae	Coriandrum sativum	Coriander
Umbelliferae	Cuminum cyminum	Cumin, cultivated
Umbelliferae	Daucus carota	Carrot, cultivated
Umbelliferae	Foeniculum vulgare	Fennel
Umbelliferae	Petroselinum crispum	Parsley, cultivated
Umbelliferae	Pimpinella	4 sp.
Verbenaceae	Lippia multiflora	Medicinal, 3 Lippia sp.
Verbenaceae	Vitex doniana	Fruit edible

Verbenaceae	Vitex madiensis	Fruit edible
Zygophyllaceae	Tribulus terrestris	Medicinal

KHARTOUM - SUDAN

سيجما-تاو سودان ليمتد
sigma-tau SUDAN Ltd.
Phytopharmaceutical Division
قسم العقاقير النباتية

Telex: 23019 Sigma SD.
22280 Sharaf SD

Tel. Office 73109 - 78649 - 76721 - 78676
Factory 611943 - 611774
Fax 611801

P.O. Box 1701 Khartuom

ANNEX 6

your ref.
our ref. Khartoum,

Prof. K. Husnu Can Baser
UNIDO Consultant,
UNDP Khartoum.

24 December 1995

Dear Prof. Baser,

With reference to your letter dated 12 December 1995, herewith you kindly find an outline of our proposed programme.

SENNA PROJECT:
- We intend to prepare 20% crude extract of the local Senna pods and leaves (*Cassia acutifolia*). Our present plan is to process 60 Tons of raw Senna to produce 20 Tons of crude extract. According to a recent agreement with an Italian company a large proportion of the crude extract will be exported to Italy.

- Small quantity of the crude extract will be retained for the production of Senna tablet for the local market.

- It is mutually agreed that the Italian company will provide the technical assistance and purchase a substantial amount of the crude extract. It is scheduled that the production of Senna extract will commence by the end of 1996.

SALVADORA PROJECT:
- The production of some oral hygiene preparations (toothpaste & mouthwash) represents our second goal. These preparations are based on the extracts of the stems and leaves of ARAK (*Salvadora persica*).

- Our local manufacturing facility has already a full production line for the manufacture of toothpaste which it is not utilized at the moment. Research to develop these oral hygiene formulations is well underway. However, certain technical assistance is required for large-scale extraction and standardization of the crude extract of *S. persica*.

Thanking you in anticipation.

With my best regards.

Dr. Baha Eldin A/Hamid
Chairman & Managing Director

cc. Prof. Sami A. Khalid

THE UNION TRADING CO. LTD.

TELEPHONES :
71833 - 76891
BANKERS :
EL NILEIN BANK
KHARTOUM

IMPORTERS & EXPORTERS
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KHARTOUM - SUDAN

CABLE ADDRESS :
"UNICO" KHARTOUM
TELEX No. : 22548
A/B "UNICO"
FAX No. : (011) 76328
or (451724)

Our Ref. UTC/EXP/446/95 *Your Ref.* *Khartoum* 19TH Dec., 95

The UNIDO Mission for Developing
Medicinal Herbs Industry in Sudan.

Dear Sirs,

Re : EXTRACTION PLANT FOR SENNA

We wish to refer to yesterday's visit to our office of your mission lead by Prof. Dr. K. Husnu Can Baser of Anadolu University, Mr. Kenneth Abeywickrama of C.B.S., and Prof. Sami Ahmed Khalil and the pleasant discussion held regarding the captioned subject.

As explained to above gentlemen, we are keenly interested to start this industry, especially that we are leading exporters of this commodity and other Medicinal Herbs and Teas.

In this connection, we seek your kind assistance in furnishing the following wherever possible :

1] **Preparation of feasibility studies for such a project in the Sudan and the possibility of financing same.**
2] **Facilitating financing possibilities through joint-venture, or technical assistance**
3] **Any other facilities you can extend along export marketing, etc... for the propagation of the finished product**

Thanking you in anticipation, while hoping our achievements will be crowned with success, we remain,

Yours faithfully,
THE UNION TRADING CO. LTD.,

ROBERT B. BOULOS
MANAGING DIRECTOR.

EGH COMMERCIAL COMPANY LIMITED.

A COMPANY OF ELIE GROUP HOLDINGS LTD.

Telephone [249 11] 780224/771181
Fax [249 11] 773218

P.O.BOX: 2304, KHARTOUM.
SUDAN

December 18th, 1995

Prof. K. Husnu Beger,
UNIDO.

Dear Professor,

Thank you for your kind letter of 12th instant. In reply, please note:-

(A) The items we are interested in are for:-

(1) **HIBISCUS FLOWERS:-** To be prepared for:-
- Soft drinks - concentrated juice in bottles.
- Cleaned square / Round cut and prepared in small 100/200 gram packages as a Herbal Tea.
- For food colouring.

(2) **SENNA PODS:-** To extract the senoside content and pack it properly for export.

(3) **GUM ARABIC:-**
- Following types of **GUM:-**
  - Acacia Senegal (Kordofan)
  - Acacia Seyal Variety Fistula (Talha)
  - Acacia Polycantha (Kakamout)
  - Acacia Fistula (White Talha - Soufar)
  - Anogaisus Shimpri (Sahab)
  - Acacia Leata (Like Hashab Shoubahi)
  - Sterculia Setigera (Karaya - Tartar)

all these gums to be prepared in spray dried form for export in standards acceptable to European/American/Japanese buyers.

(4) Seeds of Sterculia Setigera for Hydrogination and other uses.

(5) **Tamarind:-** For both soft drinks and food preparation.

(6) **Gongolaise:-** For soft drinks. Baobab fruits

(b) Assistance required is for both **Technical** as well as **Financial** assistance. We can pay all the local costs and the UNIDO to bear the foreign part.

..../2

(c) If **Technical** and **Financial** assistance is available, no difficulties are expected in implementing these projects immediately.

(d) Once **Technical** and **Financial** assistance are available, then projects can be implemented immediately. As you are aware, the land for the buildings is available, and we already have the various offices for purchasing the raw materials.

(e) Expected consumption after market establishment:-

- Hibiscus Flowers :- 5000 tons.
- Tamarind :- 3000 tons .
- Gongolaise :- 3000 tons.
- Senna Pods :- 2000 tons.
- Various Gums :- 35000 tons.
- Tartar Seeds :- 5000 tons.

We look forward to your assistance and we thank you in advance for your efforts.

Sincerely yours,

Elie Haddad
Chairman & Managing Director.

AMIPHARMA Laboratories Ltd.

P.O.Box :180
Khartoum North
SUDAN

Amipharma assistance requirments from UNIDO

Amipharma expects UNIDO's assistance in the following fields:

1. Process design and process & machinery layout
2. Airconditioning and airhandling Design and selection of machinery and enviromental control.
3. Training of personnel in pharmacuetical production, chemical and biological analysis and related subjects.
4. Development of new pharmaceutical formulations and upscaling of these formulation to the production level.
5. Documentation: production and laborotary SOP's and SAPs.

Amipharma Laborotaries is prepared to share the costs of experties with unido.

Tel : Fact. 611443, 611442 - DRUG STORE 79297,81975,81755
Tlex. 22510 SD. FLIC. KHARTOUM - CABLE. FLICO OMDURMAN

بسم الله الرحمن الرحيم

كلماكس للأدوية

ص ب: ١٠٢٤٩ الخرطوم – السودان ت: ٤٥٢٥١٥ – ٤٥٢٥١٦

CLMAX

December 27th., 1995

UNIDO CONSULTING TEAM

Dear Sirs,

It gives me a great pleasure in addressing you at this celebrated occasion. CLIMAX For Drugs is a new pharmaceutical plant located in Khartoum North New Industrial State. The firm is embarking on an ambitious project aimed at utilization of enormous, locally available facilities of medicinal plants both as active ingredients and excipients in various types of pharmaceutical dosage forms. At this junction, reference is made to the submission made to your team, during your recent visit to Khartoum, by Dr. Abdel Karim M. Abdel Karim, Head of CLIMAX Research Group.

Therefore, you are kindly requested to extend all the possible and greatly appreciated technical and financial assistance necessary to implement such an ambitious project and make it a success.

We are looking forward to receiving your reply at your earliest convenience, with many thanks and best regards.

Yours faithfully,

Dr. Asim Farouk Mustafa

Manager, CLIMAX For Drugs

كلماكس للأدوية – الخرطوم – السودان

CLIMAX

P.O. Box 10249 - Khartoum - SUDAN

CLIMAX FOR DRUGS

MAX FOR DRUGS P.O.Box: 10249 KHARTOUM CLIMAX TEL. ADDRESS TLX.

بسم الله الرحمن الرحيم

TAG

تاج للتجميل والتواليت المحدودة

COSMETICS &
TOILETRIES LTD.
P .O.Box 324
Omdurman Sudan

ص . ب ٣٢٤ امدرمان السودان – تلغرافيا : ياهادى امدرمان – تلكس : دلكة ٤٠٠٢٨ الخرطوم
تلفونات ٥٥٨٧٦ – ٥٥٩٣٧ – ٧٩٧٨٨ – ٥٢٤٢٤ فاكس: ٧٨٣٦٤ (١١ ٢٤٩ ..)

11.12.1995
Prof.Dr.K.Husnu Can Baser
UNIDO CONSULTANT
KHARTOUM - SUDAN

Dear Sir,

Referring to your visit to our factory on 11.12.1995 , we would like to express our interest in growing Lemongrass and extracting the oil in Sudan.
The objective is to make perfumes, cosmetics and help soap industries use Lemongrass oil in their products.

however, essential oils and cosmetics manufacturers pay 60% Excise Duty + 10% Sales Tax on all their final products. This is a big obstacle.

We need an Expert, after the land is secured for plantation for a period ranging from 6 to 12 months. A pilot plant is helpful at the start.

Please note that we have an established factory since 1977. We have been promised by the Government to be granted 1000 Hectars of land as a joint venture in the Sudanese Kuwaiti Waha Area.

Our board of directors consists of:
(1) Mr. Tag Senior -Expert in perfumes.
(2) Eng. M.Tag -Mech.Eng. since 1971.
(3) Mr. Ahmed Tag - Economist since 1972.
(4) Mr. Yousif Tag - Economist.
(5) Eng. Abdullah Tag - Chemical Engineer.

Please be kind to give us your ideas.

Thank you.

Mohammad Tag

شركة عبد المنعم الصناعية والهندسية ليمتد

Abdelmoneim Industrial & Engineering Co. Ltd.

Importers Register : 333

سجل المستوردين : ٣٣٣

Our Ref. : F.24/M.S/794/r : ملفنا

Your Ref. : ملفكم :

Date : 26th of December 1995 . : التاريخ

To: Prof. Dr. K.Husmu Can Baser.
Professor of Pharmacognosy,
Dean, Faculty of Pharmacy,
Director, Medicinal and Aromatic Plant
and Drug Research Centre (TBAM) .
T u r k e y .

Dear Sir,

Enclosed here we have the Company Profile which gives you a very good view of the activities of our company.

We have been interested in Medicinal Herbs and Plants for many years, it increased particularly after the course Ms. Maha A/Salam attended at Anadolu University Research Centre (TBAM) in Eskisehir, Turkey.

Upon seeing the advancement of the Pharmaceutical division, we decided to establish a pre - industrial plant where in medicinal Herbs are cleaned, sorted out and crushed, if the Herb needs it and then pack it into its appropriate packing.

Therefore we were wondering if some sort of assistance could be offered by UNIDO.

Thank you very much for your co - operation and hope that this will be the beginning of a fruitful relationship.

Yours Sincerely
A/Moniem Ind. & Eng. Co. Ltd.

Mr. Mohammed A/Moniem
Mohamed A. Moneim

Maha A/Salam.
Ms. Maha A/Salam
Pharmacist - in - Charge.

Enc.: Company Profile.

5 . M . Company L.T.D.
Hope Agri. Project

شركة فايف إم المحدودة
مشروع الرجاء الزراعي

Date: 22.01.1996
Fax Message

Fax No. 001 301 438 3940

TO : ABEJWICKRAMA
ATT : Mr Kenneth. L. Abeywickrama
382 Gawayne Terrace
Silver Spring. MD 20906, USA

Dears sirs,

Subct: Leman grass farm

We refer to the discussions we had with your UNIDO team when prof. Baser and Mr. Kenneth Abeywickrama visited our farm.

we are interested in cultivating about 500 hectares within our farm with lemon-grass, provided we receive technical support for the project from UNIDO. Since the land area within our farm is irrigable and the climate is ideal for this crop, we expect a yield of about 190-200 kg. Per hectare. This will give us a yield of about 100 tons of lemon-grass oil per annum, with a sale value of around US$ 1.2 million. We need technical assistance in cultivation methods and the production of farm-sited distillation units. You have informed us that these could be fabricated locally with UNIDO technial assistance.

Thanking you in anticipation,

Yours Sincerely,

Alraja Agricultural Project.

Reverend Father Filothous Faraj

ANNEX 7

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project of the Government of
Sudan

JOB DESCRIPTION
XA/SUD/95/613/17-51/0730DO

Post title	National Consultant/Analyst
Duration	1.0 m/m
Date required	September 1995
Duty station	Khartoum, Sudan

Purpose of project

To evaluate the potential for industrial utilization of medicinal and aromatic plants in Sudan and to assess the requirements in terms of infrastructural facilities, human resource development, equipment and technology for a technical assistance project.

Duties

The national consultant will assist the international experts during the preparatory assistance mission for the industrial utilization of medicinal and aromatic plants in Sudan and will perform the following duties:

1. Collaborate and work with international experts to obtain all the necessary information and collate available marketing data in both private and public sectors.

2. Mobilize the national institutions involved in the activities of medicinal and aromatic plant industry to contribute and provide information to assist the mission in its assessment.

3. Assist in drafting the project document to be prepared by the international experts.

4. Prepare a final report detailing all his activities during the assignment.

Qualifications

A graduate in marketing or economics or other science with at least 10 years of experience in marketing, sales and cost analysis. Experience in Africa will be an advantage.

BIBLIOGRAPHY

1. National Drug Policy, Ministry of Health, Sudan, (1994).
2. Sudan Country Strategy, 1997-2001, UN document, Sudan, (1995).
3. The Comprehensive National Strategy, 1992-2002, Govt. of Sudan, (1990).
4. The Economist Intelligence Unit, Country Profile Sudan, 1995-95, UK.
5. Sudan Pharmaceutical Manufacturers' Group, Annual Report, 1994, Sudan.
6. Sudan, The Economic System & Investment Activities, by Sudan Investment Promotion Centre, Sudan, (1995).
7. The Encouragement of Investment Act, 1990, Amended March 1991.
8. W.A.M.Abdel Magied, Plants commonly used as medicine by "Attareen" in the three towns with special reference to spices, B.Sc.Dissertation, Ahfad University for Women (1991).
9. Khartoum Marketing of Medicinal and Aromatic Plants, Medicinal and Aromatic Plants of the Sudan, Khartoum (1982).
10. G.E.B.El Ghazali, Medicinal plants of the Sudan, Part I: Medicinal plants of Erkowit, Medicinal and Aromatic Plants Research Institute, Khartoum (1986).
11. G.E.B.El Ghazali, E.A.Bari, A.K.Bashir and A.K.M.Salih, Medicinal plants of the Sudan, Part II: Medicinal plants of the Eastern Nuba mountains, Medicinal and Aromatic Plants Research Institute, Khartoum (1987).
12. G.E.B.El Ghazali, M.S. El Tohami and A.A.B. El Egami, Medicinal plants of the Sudan, Part III: Medicinal plants of the White Nile provinces, Medicinal and Aromatic Plants Research Institute, Khartoum (1994).
13. Anon., Medicinal and aromatic plants of the Sudan, Unpublished manuscripts, Sudan Investment Promotion Centre, Khartoum.
14. S.A.Khalid, unpublished notes.
15. H. Vogt, The Conversion of the Babanousa Dairy Plant into a Karkadeh Powder Production Plant, Final project report, Natec Institute (1993).
16. F.W. Andrews, The Flowering Plants of the Sudan, Vol. 1 & 2, T. Buncle & Co. Ltd., Arbroath, Scotland (1950, 1952 and 1956).