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ASSISTANCE TO THE ESSENTIAL OIL INDUSTRY, ZANZIBAR

DP/URT/86/026/11-01

UNITED REPUBLIC OF TANZANIA

Technical report: Maximizing the capacity utilization of the clove stem oil distillery, Chake Chake*

Prepared for the Government of the United Republic of Tanzania
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

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Vienna

* This document has not been edited.

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ANNEXES

ABBREVIATIONS

T.Sh. or Sh.	Tanzanian Shilling
$	United States Dollar
G O Z	Government of Zanzibar
M O I	Ministry of Industry, Government of Zanzibar.
Z S T C	Zanzibar State Trading Corporation
U N D P	United Nations Development Programme
U N I D O	United Nations Industrial Development Organisation.
DISTILLERY	Clove Stem Oil Distillery, Chake Chake Pemba (The Clove Stem Oil Distillery is now named as "ZSTC Pemba Essential Oils Distillery").
T P R M	Tripartite Review Meeting
G C	Gas Chromatography
Q C L	Quality Control Loboratory
FOREX	Foreign Exchange

Conversion Rate: as in December 92--January 1993

Official T.Sh. 330.00/ dollar

Market rate T.Sh 385 to 430/ dollar

A B S T R A C T

The Project "Assistance to the Essential Oils Industry, Zanzibar: Maximising Capacity Utilisation of the Pemba Distillery" has entered into its 4th year. Capacity utilisation of the Distillery increased by about 300 percent.

Clove bud oil improvement work undertaken so far has now given clear idea about achieving this vital aspect. Also, production of bud oil from Grade I & II is also likely to yield a superior oil. All this work is expected to be completed during project life. Work in quality basil oil has also given useful information on utilising this for commercial purposes.

At the TPRM some vital decisionswere taken such as production of clove leaf oil and aroma chemicals from clove stem and leaf oil.

Marketing of essential oils produced now and likely to be produced in the Distillery was discussed in detail at the TPRM. Concrete steps to attain regular sales/export have been suggested.

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I. INTRODUCTION

Second split mission of the Chemical Technologist, Essential oils (C.T.A.) during the Second Phase (Extension) of the Project started from 23 December 1992 for a duration of two months (job descritpion is given in Annex I.) Coinciding with the mission of the C.T.A,perfumer Expert was also fielded. Samples of various essential oils produced under the Project were examined. The concerned national staff of the Distillery was also trained in the field of perfumery and related aspects of fragrance and flavour materials.

Due to improved capacity utilisation of the Distillery, there is hardly any stock of clove stems (above 20 tonns during December 92). It is relevant to mention that large stocks of clove stems had accumulated (about 1800 tonnes) prior to the start of the Project. During the Project period of 3.5 years from July 1989 to December, 92, 3326 tonnes of stems were distilled besides 316 tonnes of clove buds and about 600 tonnes of lemonograss.

While optimum conditions for quality production of clove stem and lemongrass oil were standardised, the same could not be undertaken earlier for bud oil for want of GC equipment. This was undertaken only during the mission of the Quality Control Chemist in June 1992 and the current mission of the C.T.A.Details are given in this report.

Most of the Outputs of the Project have been achieved and activities completed. Details are given in Annex II.

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In the Diversification work on trial cultivation of essential oil bearing crops, Eucalyptus citriodora has now been introduced. Expansion of E.citriodora will be undertaken after preliminary evaluation of its oil especially with respect to its citronellal content. Work on cultivation of cardamom (small) has been discontinued. Work on cultivation of essential oil bearing plants has, however, not progressed as expected primarily for want of a national agronomist and consequently inability in fielding of international Expert.

Position of electric supply is still not satisfactory. This is adversly affecting the work of the Distillery. There does not seem to be any solution to this problem in the near forseable future. Operating Distillery on generators is not an economic proposition.

Considering overall situation, it can be safely pointed out that the Project was successful. Not only processing of various materials has increased but sales have also increased bringing in forex. National staff is adequately trained both at site as also through fellowships abroad. It will be highly beneficial if more selected essential oil bearing plants are brought under large scale cultivation and processing some of the oils into value added products. There is a proposal for starting production of clove leaf oil through private sector. If these are implemented work done so far under the project would be used in the industrial development of Zansibar in the field of fragrance and flavour industry.

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II. PROCESSING OF AROMATIC PLANTS MATERIAL AND PRODUCTION OF ESSENTIAL OILS

During 1992-93 (July 92 to December 1992), on the whole production of essential oils was satisfactory. Processing of clove stems, clove buds and lemongrass during the six months of the financial year, 1992-93 was as under:

	Clove Stems	Clove Buds	L.Grass	Total
Material distilled (Tonnes)	543.42	25.06	93.93	662.41
Oil produced (Tonnes)	23.56	3.49	295.30Kg	27.35

The above data for the year 1992(Jan-Dec.) was as under:

	Clove Stems	Clove Buds	L.Grass	Total
Material distilled (Tonnes	966.91	29.72	169.06	1164.69
Oil produced	43.52	4.08	493.54Kg	48.09

During the year 1992-93 (July 92-Dec.92 period), the Distillery operated only for 56 days. It remained closed during December, 92 and January, 93 due to need for major repair of the boiler furnace; it operated only for 3 days during December 1992 and started operation from end of January, 1993.

Lemongrass crop is ready for harvesting. Delay in harvesting has been due to closure of the Distillery for major repair of the boiler furnace.

III. QUALITY IMPROVEMENT IN CLOVE BUD OIL:

Clove bud oil is produced from the Grade IV of clove buds which being of low quality are not exported. Even though clove bud oil from this grade is saleable, it does not conform to the desired level of eugenyl acetate(low) and caryophyllene (high).

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Work on quality improvement of bud oil was undertaken by the Quality Control Chemist by examining the composition of important constituents in various cuts of oil produced in the Laboratory. He also examined by GLC the various cuts of oil in the Distillery produced by the C.T.A.. This study has given some useful data on the progress of distillation of the main constituents viz. Eugenol, Eugenyl Acetate and beta-Caryophyllene. Following table brings out this aspect of the study:

Content of Important Components in Bud Oil Fractions:

Oil Produced in Fraction	Oil (%)	Content of components (% by GC) Eugenol	E.Acetate	Beta-Caryophyllene
A. Laboratory Distilled				
1	3.2	92.49	3.99	2.14
2	3.2	89.88	6.06	3.06
3	3.6	85.54	9.78	3.85
4.	3.2	77.49	16.40	5.04
5	3.6	53.56	27.41	15.93
6	1.2	10.93	9.93	63.04
Total	18.0	74.75	12.80	9.98
B. Distillery Distilled				
1	4.42	79.45	7.67	10.26
2	4.42	84.01	6.77	7.63
3	4.30	77.91	15.69	5.50
Last	1.00	45.70	34.63	16.22
Bulk	14.14	80.07	11.77	7.00

(Components content percentage in the whole oil has been calculated and not by GC analysis)

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C. Madagascar Bud Oil

i)From Madagascar	87.69	7.50	3.59
ii)From London	77.88	8.67	10.68

Clove bud oil samples produced in the Laboratory and Distillery for the above study were from Grade IV of cloves distilled for 32 and 27 hours respectively. Laboratory samples were produced by hydrodistillation with cohobation while the Distillery samples were produced by steam distillation and without cohobation. Inspite of major differences in processing, overall analytical value of the samples follow the same pattern. Last fractions 5 and 6,(4.8percent) of the Laboratory sample were very rich in beta-caryophyllene as compared to the same from the Distillery produced samples(about 1 percent). Recovery of oil from the material distilled in the Distillery was less by about 4 percent as compared to the Laboratory processed material which accounts for its low content of beta-caryophyllene.

As mentioned earlier, only clove buds of Grade IV are processed for the production of this oil; higher grades of clove buds are exported. However, with the collapse of clove bud prices in the world market, it now seems economical to process higher grades of clove buds. Some work on the quality of clove bud oil from higher grades of cloves was done by the Distillery Chemist. Quality of oil was observed to be good. Following table summarizes the analytical value of oil samples of clove buds of different grades from 3 areas of Pemba Island.

GC Analysis of Clove Buds Oil Samples

Material Distilled	Content of (% by GC)		
	Eugenol	E.Acetate	Beta-Caryphyllene
1.Clove Bud 3d-1 from			
(i)Mkoani	72.70	24.19	1.91
(ii)Chake Chake	78.41	15.88	4.23
(iii)Wete	68.65	27.30	2.36
Average	73.25	22.46	2.83

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2. Clove Buds Gd II from:			
i) Mkoani	81.98	15.69	1.61
ii) Chake Chake	80.46	15.17	3.40
iii) Wete	79.11	18.28	1.98
Average	80.52	16.38	2.33
3. Clove Buds Gd III from:			
i) Mkoani	82.54	15.21	1.76
ii) Chake Chake	78.19	17.05	3.73
iii) Wete	90.68	6.42	2.09
Average	83.80	12.23	2.53
4. Clove Buds Gd IV			
i) Distillery Processed			
Bulk supply	78.79	8.44	10.52
ii) Chake Chake	87.07	7.95	3.91
5. Khokar Clove	75.42	15.48	7.89

GC analytical average data on clove bud oil samples from different grades of buds has given useful information as summarised below:

Material distilled	Content of (% by GC)		
	Eugenol	E.Acetate	Beta-Caryophyllene
1. Clove Buds Gd I	73.25	22.46	2.83
2. Clove Buds Gd II	80.52	16.38	2.33
3. Clove Buds Gd III	83.80	12.23	2.53
4. Clove Buds Gd IV (one Sample only)	87.07	7.95	3.91
5. Clove Buds Gd IV (Distillery Processed)	78.79	8.44	10,52

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Except sample No. 5, all the others were laboratory distilled,(It is desireable to repeat the above trials in the Distillery on large charge distillation. This is proposed to be undertaken in due course).

It is evident from the above data that quality of oil with respect to content of Eugenyl Acetata is directly connected with the Grade of Clove Buds distilled. Odour evaluation of these samples is expected to give additional useful information.

From the data gathered so far since the start of the Project, It is observed that -

i) Distillation of clove buds by hydrodistillation and cohobation gives an oil in good yield with high content of Eugenyl Acetate, total phenols as Eugenol and lower content of Beta-Caryophyllene.

ii) Distillation of Clove Buds in the Distillery by steam distillation and without cohobation gives oil in lower yield by about 25 percent. The oil has good total phenols as Eugenol but lower content of Eugenyl Acetate (most probably due to hydrolysis of t his ester by steam) and higher content of Beta-Caryophyllene.

iii) Higher grades of clove buds give (as observed in Laboratory distillation) good quality of oil in the order of grades of buds Even bulk of clove buds, Grade I, II and III can yield an oil better than that from Grade IV clove buds alone as is seen from the following -

Material Distilled	Content of (% by GC)		
	Eugenol	E.Acetate	Beta-Caryo-phyllene
1. Bulk of Gd I, II III of Clove Buds	79.19	17.02	2.56
2. Gd IV Clove Buds	87.07	7.95	3.91

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From the work done as far it would be seen that in order to improve quality of clove bud oil following changes need to be implemented :

i) In the existing set of the Distillery processing units, co-hobation assembly should be provided immediately which would not only improve recovery of oil but most probably also improve content of Eugenyl Acetate and decrease in content of Beta-Caryophyllene.

ii) Ways and means should be explored if the existing steam distillation units could be modified to permit hydrodistillation by providing closed steam coils and/or by providing steam heated jacket. Out of these two, the former might be easier to incorporate.

iii) Economics of producing clove bud oil from higher grades of clove buds should be explored vis-a-vis likely higher sale price of the good quality clove bud oil, as compared to the oil from Grade IV buds only.

iv) Simultanesouly, a trial is also planned by collecting about 1.5-2.0 percent of the oil as last fraction and fractionate it to separate Eugenyl Acetate and Beta Caryophyllene. Eugenyl Acetate would be added back to the oil while Beta Caryphyllena will be marketed separately. This work will be done on receipt of the Pilot Rectification Column.

IV PRODUCTION OF QUALITY BASIL OIL

Ocimum basilicum (Mrehani in local language) was observed to be potential essential oil-bearing plant. Laboratory distillation of the plant at the flowering stage,

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C.T.A. observed 3 morphologically distinct plants in the stand. Oil from all the types gave an oil rich in methyl chavicol; oil content was also nearly the same.

Oil samples from leaves with inflorescens on GC study indicated methyl chavicol and linalool content of about 85 percent and about 1.5 percent respectively, i.e. an oil resembling Madagascar Basil Oil which is consumed by the flavour and fragrance industry. (Methyl chavicol-75-85%, Linalool 0.9-2.8%) . However, basil oil produced from whole plant from pilot scale cultivation had lower content of methyl chavicol andd higher content of Linalool, Data is summarised as under :

Content of Methyl Chavicol & Linalool in Various Harvests of Basil

Harvest	Date	Content of (%)	
		Methyl Chavicol	Linalool
1st	Sept.91	51.57	33.69
2nd	May 92	53.70	32.65
3rd	December,92	53.76	29.94

Reason for variation in content of these two main components in the oil samples produced in the Laboratory and Distillery are not clear. Water distillation and steam distillation as adopted in Laboratory and Distillery respectively are not considered contributory factors. Another difference i.e. distillation of only leaves+inflorescens in the Laboratory and whole plant comprising of leaves, inflorescens and stalks is also not considered a factor in this variation as stalks hardly constribute any essential oil.

More work on the production of a standard quality essential oil of Basil is called for.

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The oil so obtained from large scale cultivation, however, can be considered a useful material for production of pure methyl chavicol and linalool to be marketed as individual components. Work on these lines is proposed.

V. DIVERSIFICATION OF AROMATIC CROPS :

Details of work on the Diversification of aromatic crops were given in the earlier reports of the C.T.A. Present position is as under.

Following essential oil bearing plants are being cultivated.

i) Lemongrass (West Indian type)

ii) Vetiver (Local variety)

iii) Cinnamon(Ceylon)

iv) Ocimum basilicum (Methyl chavicol type)

v) Eucalyptus citriodera-introduced recently.

Details are:

Lemongrass : Lemongrass crop (100 acres: planted in 1989 & 1990) is now 4 years old, a part of it is in its 5th year. Crop stand is still good and there is no visual sign of its decline. Crop yield data and oil produced so far is as under:

Year	Crop yield(Tonnes)	Oil(Kg)
1989-90	39.14	100.00
1990-91	172.41	203.00
1991-92	278.10	680.00
1992-93(July-Dec.92)	93.93	349.00

Crop yield during 1992-93 (till June 93) is expected to be as good if not better than that of 1991-92. Three more harvests are expected. These will be taken and processed if all goes well primarily with respect to transport and distillery operation (depends on electric supply situation).

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As indicated in previous report of the C.T.A. (10 March 92 page 22) unfortunately full potential yield of the oil per unit area from large scale cultivation could not be ascertained, primarily for want of transport. However, from the overall growth of the crop, growing lemongrass appears an economical proposition. Lemongrass is expected to perform still better under extension by small holding growers. However, this aspect is yet to be studied.

Vetiver: Vetiver is still in the field. The crop should have been harvested and distilled earlier. This will be done as soon as pilot scale distillation unit is received.

Growth of root system, oil content and quality, both chemical and olfactory is good. Pemba vetiver oil resembles 'Haiti' vetiver oil. It is rich in alcohols. (Report Dr. Maheshwari, QC Expert, 23 Nov. 1992 pp 25 - 28).

The ZSTC - Pemba Distillery proposes to bring under cultivation by farmers through extension.

Vetiver is not easy to distil. It will be necessary to standardise processing technique in order to produce good quality oil in optimum yield.

Cinnamon (Ceylon type). Considering the growth of the plantof 3 years age, cinnamon is considered an appropriate species for large scale cultivation in Pemba Island. Some of the plants have started bearing fruits. Ripe seeds have been collected and planted in the nursery with good germination. Futher multiplication of cinnamon is planned.

As mentioned in earlier reports of the C.T.A., cinnamon leaves distilled in the laboratory have indicated good yield of oil/standard quality. This has been further confirmed by the QC Expert who found the Pemba cinnamon leaf oil to conform to ISO Specification. Eugenol and eugenyl acetate content was observed to be 81.16 and 7.85 percent respectively by G C analysis. Cinnamic aldehyde content was observed to be 1.32 percent.

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Cinnamon plants in the Magome Farm of the Distillery are suffering from insect, pest and bacterial infestation. Spray of sulphur, Malathion, Dithane M - 45/Z - 78 are suggested which is expected to control most of the infestation.

Samples from diseased and affected plants sent to local and Agricultural Department at Zanzibar have not so far been studied properly as there is no feedback from these Departments.

It will be adviseable to depute a National Agricultural Official, preferrably the agronomist to be employed by the Distillery, to Sri Lanka for study of cinnamon cultivation. He should not only look into cultivation practices of cinnamon but also for producing quality cinnamon bark and harvesting of cinnamon leaves for its oil. In the meantime, expansion of cinnamon may be continued for eventual commercial production of quality bark and quality leaf oil.

Ocimum basilicm - Methyl chavicol type: O.basilicum known as Mrehani in local language was observed to be a potential crop for the production of its essential oil. Laboratory distilled samples from the three morphologically different plants in the population were found rich in methyl chavicol (about 85 percent) and low content of linalool (about 2 percent). However, basil raised in pilot scale and distilled in the distillery was observed to give an oil high in linalool content of more than 30 percent and methyl chavicol content of about 50 percent. Reasons for this change in major constituents are being accertained.

Further work on this oil in respect of producing linalool and methyl chavicol through rectification/fractionation is now proposed.

Eucalyptus citriodora: Seeds of E.citriodora imported from Australia were used to raise these plants. Plants have been put in the field at spacing of 6 feet between row and 3' in between plants as per suggestion of the O.D.A. Officials. It may, however

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be mentioned that a spacing of 3'x3' or so is considered better from the point of view of oil production. The plants are raised as a bush. Three harvests can be taken a year which gives optimum yield of the material which can also be used as fuel after distillation.

The above mentioned suggestion has been given to the Distillery Manager.

VI. WORK DONE IN THE LABORATORY

Work on the local aromatic plants, both cultivated and growing spontaneously was continued. Samples of essential oils were also produced afresh for odour evaluation by the Perfumer. Details of the work are summarised as under :

i) Bitter Orange Leaf (Petitgrain)

Bitter orange leaf oil samples produced from a single tree earlier were found to be good as per GC evaluation and odour. Present study was made on 3 trees growing in the Distillery premises in order to ascertain uniformity in the oil from population of bitter orange trees. Oil content ranged between 0.56 to 0.70 percent calculated on fresh weight of the leaves.

Terminal tender twigs, without leaves, contained 0.27 percent of oil on fresh weight basis corresponding to 0.91 percent on dry weight basis.

Bitter orange trees studied for leaf oil were in fruiting stage at the time of harvesting of leaves.

ii) Ocimum sauve

Oil from the leaves plus inflorescens of Ocimum sauve (Mtule), besides being rich in eugenol (about 80 percent) and eugenyl acetate (about 4 percent) has other useful components from odour of view. Fresh samples of oil have been produced again. Oil content

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varied from 0.73 to 1.03 percent calculated on fresh weight basis.

iii) Another species of Ocimum (locally known as Mzamda) was located and distilled. The oil obtained contains thymol. Based on this aspect, the species of ocimum seems to be Ocimum viride. The plant is grown as a garden plant and is used in case of stomach problems by the local population.

Oil content was observed to range from 0.43 to 0.72 percent, on fresh weight basis corresponding to 0.76 to 2.01 on dry weight basis. Oil samples will be analysed by G C in due course, especially for its content of thymol.

iv) Besides the above, oil samples from vetiver, khokar cloves, green cloves, mixture of various grades of clove buds, Pogestemon plectaranthiodes were also produced for analysis and odour evaluation.

v) Absolute of Artemisea camphorata:

Concrete of Artemisea camphorata from fresh and dry leaves was produced earlier. Absolute from these concretes was produced. Yield of concrete and absolute was observed to be:

Solvent & Material used	Yield of (Percent)	
	Concrete	Absolute
a)Ethanol	19.80	12.00
b)Benzene		
- Fresh leaves	8.49	7.90
- Dry leaves	14.86	10.06 (67.72% from concrete)

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vi) Analysis of Concretes and Absolutes:

The Distillery Chemist was trained in the analysis of concretes and absolutes. Analytical data on the concrete and absolutes of A. camphorat- is as under :

Characteristics	Product			
	Concrete From		Absolute From	
	Fresh Leaves	Dry Leaves	Fresh Leaves	Dry Leaves
Colour	Greenish yellow	Dark Green	Green	Dark Green
Consistency	Solid Waxy	Thick liquid	Solid Waxy	Tick liquid -
Acid value	-	26.09	-	-
Ester value	-	104.35	-	-

VII. MARKETING OF ESSENTIAL OILS

Processing of clove stems, buds and lemongrass and production of their oils has increased by about 275 percent (annual average) during Project period as compared to the pre-Project period. Simultaneously, exports also picked up with an annual average by 367 percent in dollar for these periods. Highest export of the essential oil was during 1990-1991 ($440,000) which came down drastically to $182,300 during 1991-92. Exports during 1992-1993 (6 months) was only worth $89,800. Decrease in exports during the last 2 years could be attributed to overall world recession. However, marketing/export of the three essential oils still needs urgent and immediate attention.

Steps taken through the UNDP for achieving regular exports were elaborated in the earlier reports of the CTA (Report:12 June 1992 and 10 March 1992). Further to the above, actions taken so far and proposed are described now.

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The International Trade Centre, Geneva, (ITC/UNCTAD/GATT) sponsored a marketing study tour of a team comprising of Export/ Marketing Manager, ZSTC, Director, Trade, Ministry of Commerce & Industry and Production Manager, Distillery, Pemba, They visited Switzerland, France, Holland and England. Their observations and study are likely to help ZSTC in improving exports.

The Export/Marketing Manager, ZSTC is to undertake a Training-cum-Study Tour under the Project. He has already covered Europe and contacted the potential buyers under the ITC sponsored tour. He should now undertake such a tour of U.S.A. specifically to explore market for clove oils and for other essential oils proposed to be produced in Pemba. It was,however, decided that, in the first intance, with the help of an Expert, market potential of clove oils should be explored.

It is again emphasised that UNDP Project while having contributed significantly to the rehabilitation of the Distillery, now needs to concentrate on marketing aspects. However, the Ministry of Industry and the ZSTC are to clearly spell out such a help from the Project.

VIII. TRAINING OF NATIONAL PERSONNELS:

Up to date status on the training of the National Personnels both at site by the International Experts and through fellowship abroad is described here-under:

Training at Site: On Job Training

So far, 5 Experts have beenfielded; These are:
Chemical Technologist: C.T.A.
Quality Control Chemist
Marketing Expert
Agronomist
Engineer and
Perfumer

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Out of the above, Agronomist completed preliminary mission only. All the other Experts except the CTA have completed their missions.

Except Agronomist on the National level, all the National counterparts were available and were fully involved with the Experts for on job training.

In the absence of Agronomist Experts, (not yet selected) and his counterpart, the CTA got involved in the work of cultivation of aromatic plants. His counterpart, the Plant Manager of the Distillery was involved in this work.

Training Through Fellowhips:

Following National Personnel have undertaken study Tours/ Training abroad.

National Personals	Study Tour/Trainig
i) Plant Manager (Mr.Nasib S.Omar)	a) Participated in the International oils Congressof Essential/etc. New Delhi 12-16 Nov. 1989.
	b) Proceeded to Poland, U.K., France and India for 10 weeks from 29 July 1990 - 14 Oct. 1990.
	c) Participated in the second UNIDO WORKSHOP ON Essential Oils Industry, Manilla, 4 - 8 Feb. 1991.
	d) Participated in the workshop for National Project Director of UNIDO Project and Training Programme in Turkey, 14 - 17 Sept. 1992.

(Besides the above, Mr. Omar also took part in the Exhibition in the Trade Fair on Essential Oil sponsored by the Cenrum tot Becordering van de Import, CBI (Centre for the Promotion of Imports from the Developing Countries) in Rotterdam, Holland on behalf of ZSTC & sponsored by CBI).

ii)	Production Manager (Ramadhan K. Feruzi)	Completed Training in India and Srilanka, 12 Sept. - 22 Nov.1990.

(Mr. Feruzi as a member of a team also visited Switzerland, France, Holland and U.K. on Market Training cum study Tour sponsored by the I.T.C. UNCTAD/GATT Geneva, during 24 September -19 Oct.1992)

iii)	Distillation Foreman (Mr.Ali Shaali)	Completed Training alongwith the Production Manager in India and Srilanka, 12 Sep.-22 Nov. 1990.
iv)	Maintenance Foreman (Mr.Badru Ali Zubeir)	Completed training in Pakistan, 6 May - 5 July 1990.
v)	Marketing/Export Manager ZSTC (Mr.Suleiman J.Jongo)	Participated in the International Congress of Essential Oils etc., New Delhi, 12-16 November 1989.

(Mr. Jongo as a member of a team visited Switzerland, France, Holland and U.K. on Marketing Training-cum study Tour sponsored by the ITC, UNCTAD/GATT, Geneva, during 24 September - 19 October 1992).

Future Training Programme

Training Programme/Study Tours of the National Personnels both pending and proposed are given below :

a) Pending Study Tours/Training Programmes : Following Study Tours/Training Programmes are pending which could not be completed due to unavoilable circumstances:

i) Marketing/Export Manager, ZSTC.

Marketing Manager, Mr. Suleiman J. Jongo undertook recently a tour of Switzerland, France, Holland and U.K.

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in connection with marketing study on essential oils.

It is, therefore, now proposed that he need not go to Europe; instead he should visit USA to explore market for clove oils and lemongrass oil specifically and those oils which are proposed for production in Pemba/ Unguja.

ii) Chemist : For further training in various aspects of essential oils such as analysis by conventional and instrumentation technique and olfactory evaluation, the chemist is proposed to be sent to :

a) Institute of Medicinal Plants, Poznan, Poland.

b) Pollena Aroma, Warszawa, Poland.

Duration : 6 weeks

iii) Agronomist : Till today, National Agronomist has not been appointed. As and when appointed, he may be sent abroad in suitable Institutes in India and Srilanka to gain first hand knowledge on the essential oil bearing crops being cultivated in Pemba and proposed for future introduction.

Duration : 6 - 8 weeks

iv) Production Manager : Production Manager of the Distillery is engaged both in the processing of raw material as also in the maintenance of the distillation equipment, it is suggested that he may be sent to Turkey to work on the Processing unit established through UNIDO Project. He should also take this opportunity to see the working of distillation units in the private sector.

Duration : 4 weeks

v) It is also proposed that the Principal Secretary, Ministry of Industry, Government of Zanzibar and the General Manager, ZSTC should undertake a Study Tour to

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see working of the Export Promotion Council in Basic Chemicals, Pharmaceuticals and Essential Oils (Chemexil), Bombay and meet prominent dealers and consumers of essential oils in France and U.K. They may also visit Rotterdam, Holland to meet authorities in the Centre for the Promotion of Imports from Developing Countries.

Duration : 2 weeks

vi) The Distillery should have a computer to streamline data storage and evaluation. It is proposed that a suitable official working in the office of the Distillery may be trained locally for a period of 4 weeks.

vii) There are two Production Formen in the Distillery. One of these (Mr. Ali) was trained abroad (India & Sri Lanka). It is now proposed that the second Production Forman may be sent to Madagascar. For such a visit, help of the UNIDO Project CTA in Madagascar may be required.

Duration : 3 weeks.

IX. CO - ORDINATING ACTIVITIES OF EXPERTS

Following International Experts have been selected, Status of their fielding is also summarised below:

Fielding of Experts

Expert & Designation	Duration	M/M/Used
1. Dr. Baldev Gulati Chemical Technologist Essential Oils; C.T.A.	18 months	16(including current mission)
2. Dr. M.L. Maheshwari Quality Control Chemist	2.5 "	2.5
3. Mr. Klaus A. Duerbeck Agronomist	3.0 "	1.1
4. Mr. A.M.A. Abeysinghe Marketing Expert	2.0 "	2.2.

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5.	Mr. Shahid Ahmad Engineer	2.0 Months	2.0
6.	Mr. Sudhir Jain Perfumer	0.5 "	0.5

The CTA will be completing his mission within 1993. Only Agronomist is yet to be selected and fielded. So far, Experts suggested by the UNIDO were not approved by the MOI/ ZSTC. Also Agronomist on the National level has not yet been appointed.

It seems logical that an International Expert-(Agronomist) may be fielded only after appointment of the counterpart.

Work done by the Experts will be summarised in the Terminal Report of the C.T.A.

X. TRIPARTITE REVIEW MEETING:

Tripartite Review Meeting of the Project first scheduled for 25 - 26 Jan 93, postponed to 28-29 Jan. was ultimately held on 5 Feb. 93. Detailed minutes of the T.P.R. will be submitted later on. However, some important issues discussed and decisions taken are summarised hereunder:

i) Fielding of Agronomist and appointment ofnational Agronomist:

A national Agromist is now likely to be appointed in the near future.

The Government of Zanzibar has suggested that instead of an Agronomist, an Expert in Aroma Chemical should be provided.

ii) Marketing of Essential Oils:

Considering the declining trend of export of clove stem and bud oils as compared to 1990 - 1991, it was suggested that an Expert well versed in the trade of essential oils in Europe and U.S.A. should be provided

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by the Project. He will explore the market potential of clove oils and other essential oils likely to be produced in the Pemba Distillery in Europe and specifically in U.S.A. After his report, Z.S.T.C. will establish contacts through its Marketing Department. Till then, visit of the Export-Marketing of Z.S.T.C. will be kept in abeyance..

Note prepared by the C.T.A. for discussion is given at Annex IV.

iii) Proposal for the Production of Aroma Chemicals:

Based on the Project Concept on the production of Quality Esential Oils, Aroma Chemicals and Fragrance Materials using indigenous raw material received from UNIDO Vienna, the Z.S.T.C. and the Ministry of Industries suggested to have a programme for poducing only aroma chemicals. The C.T.A. was asked to prepare a background note for discussion at the T.P.R.. This note is given in Annex V.

It was decided that to implement this proposal, an Expert in Aroma Chemicals be provided by the Project and that in the absence of additional funds, appointment of an Agronomist may be cancelled.

iv) Proposal for the Production of Clove Leaf Oil:

At a meeting held prior to the T.P.R. involving the Ministry of Industries, Z.S.T.C. and the Project Personnels suggestion of the C.T.A. regarding production of clove leaf oil, considering the availability of clove leaves, was accepted. The C.T.A. of the Project was asked to prepare a short note for discussion at the T.P.R. meeting. This note is given at Annex VI.

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It was decided at the T.P.R.M. to implement this programme. As this involved setting up of Field Distillation units in the private sector after preminiminary trials by the Pemba Distillery, overall Management of the programme was recommended to be entrusted to the 'Umbrella Project' of the Ministry of Industry, Govt. of Zanzibar.

v) Training Programmes :

Considering the overall financial constraints and some fresh proposals it was decided to reconsider the Training Programmes and study Tours proposed by the Z.S.T.C./Project. It was also decided to implement the two training programmes, one each for the Chemist and the Agronomist. After the re-allocation/revision of the Project Budget only, other proposals of training programmes/study tours may be implemented.

vi) Miscellaneous :

a) The C.T.A. of the 'Umbrella Project' of the Ministry of Industry was requested to study the financial and Management aspect of the Pemba Distillery and to suggest ways and means for streamlining its operations on commercial lines.

b) The Project may be extended by another six months, in order to complete its activities in the light of new proposals. However, as more financial assistance may not be available, the budget revision may be made accordingly.

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XI. RECOMMENDATIONS

Following recommendations are made:

i) Large scale distillation of Grade I, II and III of clove buds may be undertaken in the Distillery for evaluation of the quality of oil and market study regarding the sale price. Also to study the economics of production of bud oil from these grades of buds.

ii) To instal co-hobation assembly with the Distillery units for the production of clove bud oil. This is expected to improve not only the yield but also the quality of bud oil.

Simultaneously, one or two Distillery distillation units may be modified to permit production of clove bud oil by hydrodistillation coupled with cohobation.

iii) According to the Perfumer fielded by the Project, yetiver- oil produced in Pemba, is a class by itself Large scale cultivation and production may be expedited.

iv) Large scale distillation of bitter orange tree leaves may be organised for market evaluation.

v) Marketing of essential oils produced in the Distillery needs foremost attention of the Z.S.T.C. and the Project.

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UNIDO

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

De Silva/jbg
13 October 1991

JOB DESCRIPTION
DP/URT/86/026/11-01

Post Title: Chemical Technologist - Essential oil distillation plant expert (CTA)

Duration: 2.0 w/m

Date Required: December 1992

Duty Station: Chake, Chake, Pemba

Purpose of Project: Maximising the capacity of the Clove Distillery in Chake, Chake

Duties: The Chemical Technologist will be responsible for activities connected with eh modernization of the Chake Chake Distillery, optimisation of its present capability and introduction of an appropriate production programme. Specifically the expert in collaboration with local personnel will be expected to carry out the following:

a) Formulate and implement a comprehensive plan for better utilization of existing installation thus bringing the plant into two shift operation and recommend additional hardware and other requirements.

b) Assist in the installation and commissioning of equipment ordered.

c) Co-ordinate the activities of the experts and will be specifically involved in the in-service training programme by means of lectures or seminars or any other method of instruction that may be required.

d) Develop parameters for the distillation of other essential oils in addition to clove oils.

The expert will embody his observations and recommendations in a report which he will be expected to finalise and present to UNIDO upon completion of his mission.

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operating Division

UNIDO,VIENNA INTERNATIONAL CENTRE,P.O.Box300,Vienna, Austia

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ACHIEVEMENT OF OBJECTIVES

Progress on the achievement of Development and Immediate Objectives of the Project is summarised here under:

DEVELOPMENT OBJECTIVE: Rehabilitating the existing industrial plants and increasing capacity utilisation to help Economic Revovery Programme of the Country is one of the priorities of the Country Programme specifying industries with export potential.

PROGRESS: During the Project, capacity utilisation of the Clove StemOil Distillery (CSOD) increased by about 250 percent with significant increase in the foreign exchange earning as compared to pre-project years i.e. 1983-1989.

IMMEDIATE OBJECTIVES:

Immediate Objective-1: Up grading of the performance of the Chake Chake Clove Stem Oil Distillery.

1.1 Outputs: As a fully operational plant able to process up to 1700 tons per annum of raw material (clove buds and/or clove stem).

Activities:	Progress/Status:
1.1.1 To review existing buildings, equipment, process technology and manpower resources.	Completed.
1.1.2 To order spare parts for the plant and lorries.	Completed to a large extent.

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1.1.3	To train key personnels both on job and through fellowships, Plant Manager, Foreman Maintenance Section, Distillation Section	Training of personnels is an on-going activity: Training programme abroad completed for: i) Plant Manager ii) Production Manager iii) Distillation Supervisor iv) Foreman Maintenance.
1.1.4	To order lorry for assisting collection of clove stems from 56 buying stations in Pemba.	Not purchased for lack of Project funds.
1.1.5	To instal spare parts on the Plant equipment	Completed. (Repair of equipment components, as and when required, is done by the Distillery from its own funds).
	To start operation of the Plant in two shifts.	Achieved successfully with improvement of 274.15% in the processing of raw material.
	To design and implement an equipment sub/system with schedules of inspection and check.	Completed.

1.2 Output-2: Upgraded quality control system for grading and certifying the products to International standards.

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	Activities:	Progress/Status:
1.2.1	Draw up requirements for building specification for installation of quality control equipment.	Completed
1.2.2	Z.S.T.C. to modify building according to requirement specified under 1.2.1	Completed
1.2.3.	Order and instal Quality control equipment.	Completed
1.2.4	Develop procedures and practices for quality control certifying the quality of the product according to International standards.	Existing standards and procedures are being followed.
1.2.5	Training counterpart personnel both on the job and through a fellowship for the Analytical tasks described under 1.2.4.	Both the Chemist and the Lab. Attendant working in the Distillery have been trained. The Chemist is scheduled to go abroad through a fellowship.

2. Immediate Objective-2: Selection and trial propogation of essential oil bearing plant species based on International Market prospects.

2.1 Output-1: A short list of plants yielding essential oils which are suitable for the World market selected.

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	Activities	Progress/Status:
2.1.1	Experimental propagation of plant species selected under 2.1	Lemongrass, Vetiver, Cinamon (Ceylon type) and basil (local) are under trial cultivation. Eucalyptus citriodora has been added recently.
2.2.2	Z.S.T.C. to cultivate crop-wise 2-3 essential oil bearing plants.	Accomplished.

2.3 Out-put-3: Essential oils from distillation of 2 or 3 species under 2.2.2.

	Activities:	Progess/Status;
2.3.1	Modify distillation equipment to enable it to distil essential oils from species selected under 2.1	Completed for distilling lemongrass and for oils lighter than water. Major modification of the existing units not considered adviseable.
2.3.2	Experimentally distil essential oils from species selected under 2.1	It is an on going activity Pilot scale distillation unit has been ordered. Progress of work will improve on its receipt and operation.

3 Immediate Objective-3: Development of marketing strategy for the increased trade of clove stem oil.

Output - 1

3.1 Report on marketing strategy for clove stem oil:

Activities:	
To develop marketing strategy for clove stem oil due increased output of Pemba Plant and possible need to attract present consumers of clove leaf oil.	Sales of clove stem oil increased from 1989-90. Sales of clove bud oil also picked up. Sales/Export data is as:

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Year	Export (US dollar)
1988-89	152,230
1989-90	220,460
1990-91	440,000
1991-92	182,000
1992-93 (6 months)	89,800

Sales of clove bud oil was only 1.9 tonnes in 1988-89. The same was 1.54, 12.34, 8.4 and 3.30 tonnes during 1989-90, 90-91, 91-92 & 92-93 repectively. Sales of lemongrass oil is below expectations. Decreasing trend of export is attributed to world recession. Marketing Expert completed his mission and submitted his report.

3.2 Output-2

Sales promotion trip to major present and potential consumers of clove stem oil leading to increased exports.

Activities:

To plan and implement sales promotion study tour to major present and potential consumers of clove stem oil.

Besides the Plant Manager, the Production Manager, the Marketing Manager went abroad in connection with sales promotion of clove oils etc. He undertook following trips abroad:

i) Participated in the International Congress of Essential oils(along with the Plant Manager) held in New Delhi, Nov. 1989.

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ii) As a member of the team (other members, Production Manager, Distillery, Director of Trade, Ministry of Industry) visited Switzerland, France, U.K and Holland in Sept.-Oct. 92.

iii) He is scheduled to proceed again to abroad under Fellowship to Europe and USA in order to explore possibilities for improved export of essential oils produced in Pemba Distillery.

(This is now deferred till information is gathered about the market potential of clove oils in the U.S.A.).

...34/-

Annex III

LIST OF PERSONS MET.

1. Government of Zanzibar:

Ministry of Trade and Industry:

- Mr. Issa S. Machano	Principal Secretary.
- Mr. Takrima	Director, Trade.
- Mr. Sangoro	Director, Industries.

Zanzibar State Trading Corporation:

- Mr. Abdulrahman Rashid	General Manager.
- Mr. Shaib Ali Mossi	Economic Advisor.
- Mr. Hamad K. Hammad	Dy. Gen.Manager, Pemba.
- Mr. Suleiman J. Jongo	Marketing/Export Manager
- Mr. Henry Kaleza	Marketing Officer.

UNDP/UNIDO Das-es-Salaam

- Mr. Toon Vissars	Dy. Resident Representative
- Mr. A. Krassikov	Unido Country Director
- Mr. Akim, V	UNIDO, Dar-es-Salaam
- Ms. Anja Kostiana	UNIDO JPO

Others

- Mr. W. Rupert	NRI Project (ODA)

Counter-part Personnels:

- Mr. Omar S.Nasib	National Project Director & Plant Manager, Distillery.
- Mr. Ramadhan K.Feruzi	Production Manager.
- Mr. Habib Ali Mohammed	Maintenance Engineer
- Slim Rashid Juma	Distillery Chemist.

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Annex IV

PROPOSAL FOR MARKET INTELLIGENCE FOR CLOVE STEM, BUD & OTHER ESSENTIAL OILS

Under the project, both production and export of clove stem, bud and lemongrass oils have improved; sales are however, confined only to Europe, excluding East Europe & Russia. There is no sale of these oils in the Far East and the United States of America which could be potential another outlets for these oils.

In the absence of market requirement of clove oils and their derivatives it is not worthwhile to depute someone now under the project for establishing contacts.

It is now proposed that an International Expert well versed in the essential oil trade may be provided through the project to gather requisite information on the market demand for these product in USA and the Far East.

A provision for an Expert for one month and US Dollars 20,000 are requested for this study and gathering market requirement. Thereafter, Z.S.T.C. will take suitable steps to establish contacts for regular export.

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Annex V

PROPOSAL FOR PRODUCTION OF AROMA CHEMICALS IN PEMBA DISTILLERY

Title Standardisation of technique and parameters for the production of Aroma Chemicals.

Objectives: To develop national capabilities for utilising the existing raw material resource of essential oils such as clove stem & leaf oils, lemongrass, Eucalyptus citriodora, Basil and Ocimum sauve oils for commercially important aroma chemicals.

Background: Under the project URT/86/026 "Assistance to the Essential Oils Industry, Zanzibar" production of Essential Oils of Clove stem, Clove bud and Lemongrass has increased significantly, as is evident from the following table.

Table PRODUCTION OF ESSENTIAL OILS

YEAR	CLOVE STEM (TONNES)	CLOVE BUD (TONNES)	LEMONGRASS (KGS)	CAPACITY UTILIZATION %
1983	24.40	-	-	30.3
1984	22.70	-		18.9
1985	17.74	-	-	14.7
1986	10.00	-	-	8.3
1987	27.10	-	-	22.5
1988	20.31	0.9	-	19.4
1989	26.77	2.00	6.13	25.6
1990	51.83	7.61	304.6	55.9
1991	46.80	19.8	800.6	72.0

(Data provided by the National Project Director of the Project).

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Simultaneously, exports of the above mentioned Essential Oils has also increased as can be seen from the following table.

Table : Export of Essential Oils

FINANCIAL YEAR	CLOVE STEM (TONNES)	CLOVE BUD (TONNES)	LEMONGRASS (TONNES)	VALUE US DOLLAR
1984-85	1.25	-	-	12,125.00
1985-86	10.3	-	-	64,300.00
1986-87	4.86	-	-	31,452.00
1987-88	14.74	-	-	102,619.00
1988-89	20.2	1.9	-	152,230.00
1989-90	31.00	1.54	-	220.460.00
1990-91	60.94	12.34	0.1	440,000.00
1991-92	18.7	8.4	0.6	182,300.00

(1984-89 Pre-Project Period: 1989-92 Project Period).

Justification: Sofar, the project has concentrated mostly on the maximising capacity utilisation of the Pemba Distillery. Change in the working pattern has given positive results. All the stocked and available clove stems have been processed. Production of clove bud oil, earlier from Gd-IV of buds and now from Gd-I, II and III is also on the increase. Production of Lemongrass Oil is also on the increase.

During the production of clove stem oil, about 2 tonns of oil from the settlingtank becomes available. This oil is of good quality but being dark brown/black in colour is not exported. Besides, while processing clove stem of lower grade, oil of lower grade, both for its eugenol content and inferior odour is also likely to be available. This quality of oil is a suitable starting material for the production of eugenol, iso-eugenol and other derivatives therefrom.

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Lemongrass Oil is an important raw material for the production of highly valuable ionones, both for perfumry purpose and for the manufactures of Vitamin A.

Ocimum species occuring locally, especially, Ocimum basilicum and O.sauve are also useful starting material for the production of aroma chemicals such as methly chavicol, linalool, eugenol, eugenyl acetate (natural).

In the processing of above essential oils, especially clove stem and O.sauve, caryophyllene is obtained as a by-products which is also marketable commodity.

Production of aroma chemicals/value added products utilising sub-standard and black coloured Clove stem Oil, Lemongrass and other Essential Oils will result in a good product mix of valueable items. It will also enhance the export earnings of the country.

Production of the aroma chemicals/value added products needs standardising the processing techniques and training of national personnels and to produce these on upgraded facilities at a later date.

UNDP/UNIDO/ZSTC in puts

The production process development techniques for the aroma chemicals from the availabee raw materials will need the assistance of UNDP for funds, UNIDO for technical assistance and the ZSTC for local facilities. An idea about this assistance is as under:

International Expert (Aroma Chemicals) 3m/m	U.S.$ 35,000.00
Pilot scale equipment	" 25,000.00
Chemicals & Solvents	" 5,000.00
Training of National Personnel	" 10,000.00
TOTAL	" 75,000.00

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Z.S.T.C. Inputs

Modification and/or
building of a suitable room
(area about 60 Sqm) with water
Electricity & Steam Pipe
connections
Estimatal cost in local currency T.shs. 2.0 million.

...40/-

Annex VI

PROPOSAL FOR PRODUCTION OF CLOVE LEAF OIL BY FIELD DISTILLATION UNITS

According to the International Trade Centre, Geneva, world production and trade in clove leaf oil is of the order of about 2,000 tonns per year. Madagascer and Indonesia are the main producers at the present. In order to avoid cost of transporting clove leaves from the producing areas, clove leaf oil is produced only in field distillation units located in areas of leaf availability.

Even though clove leaves are available in plenty in Unguja and Pemba, clove leaf oil is not produced. There is never the less adequate scope of its production.

Without actual harvesting of leaves from the trees, leaves are available throughout the year. The sources are:

i) Leaves that fall naturally throughout the year
ii) Leaves are available from the branches broken during harvesting of clove buds.
iii) Leaves which are available from the dead trees due to "sudden death" disease. According to an estimate about 5 percent of trees die every year due to this disease.

An exhaustive study undertaken a few years back under a UNIDO-Project (SI/URT/82/803) it was established that leaves from the above sources give economic yield of an oil of standard quality. As indicated earlier due to high component of transportation cost, leaves cannot be distilled in a centrally located unit such as Pemba Distillery.

It is now proposed that under the existing project "Assistance to the Essential Oils Industry, Zanzibar"

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two field distillation units may be established in Pemba within plantation of clove trees. Oils distilled will be brought to Pemba distillery for clarification, quality control, packing and sale. After the initial trials, more field distillation units may be established through the private distillers, thus setting up cottage industry throughout the two Islands i.e. Pemba and Unguja.

UNDP/UNIDO ASSISTANCE:

For the initial field distillation trials assistance of UNDP/UNIDO will be required as under:

- Expert in Field Distillation of Essential Oil bearing crops — Im/m $ 12,000
- Field Distillation Units — Two $ 10,000

Design of a Field Distillation Unit with complete engineering drawings to be provided by the CTA of the present Project and/or through the UNIDO Head quarter, Vienna.

Backstopping Officer's Technical Comments
based on the work of Mr. B. Gulati
DP/URT/86/026/11-01

The report describes the work carried out by the consultant and a review of project activities up to now. The delay in achievement of expected activities in cultivation of good varieties has been highlighted as being due to the non-recruitment of counterpart staff. This matter has to be taken up seriously by the project management in discharging their obligations as systematic cultivation has to be carried out under the guidance of an agronomist.

Preliminary laboratory studies have been conducted for the improvement of quality of clove bud oil and basil oil. A summary of items discussed at the TPRM has been included in the report. Headquarters will justify the need for the international expert on agronomy in keeping with project outputs. There seems to be justification for the visit of counterpart staff to establish market contacts but not for fielding another international expert. Proposal for the production of aroma chemicals can be agreed as an extension phase to include new outputs and activities. It cannot be included in the present project outputs. HQ does not view the proposed extension of the project being necessary for the completion of project activities.