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19956

DP/ID/SER.A/1617
9 December 1992
ORIGINAL: ENGLISH

1.19p
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PREPARATORY TECHNICAL ASSISTANCE FOR UPGRADING AND
STRENGTHENING THE ARTISANAL INDUSTRIES IN
FRANKINCENSE, ROSE WATER AND POTTERY

DP/OMA/89/011/11-53

THE SULTANATE OF OMAN

Technical report: First mission of the expert*

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

Based on the work of A. N. Ercetin, expert of rose water

Backstopping Officer: T. De Silva
Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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ABSTRACT

DP/OMA/89/011/11-53

To upgrade and strengthen local production of rose water.

The expert as a member of a team, stayed in Muscat and traveled in the country, in order to upgrade this industry, cooperating with local producers.

During the studies on the rose water production, it is found that the units and the distillation method are not suitable for this purpose. The rose water has not characteristic rose smell and taste. It has smokey smell and brown colour.

For upgrading the rose water industry; it is recommended, to use traditional peasant type stills. These stills are simple and easy to use. They are very economic for family type production and the sub-structure which the producers already have, will be sufficient to install these stills.

Besides the modernization of the rose production, rose plants and fields are also should be taken care. Pruning and application of insecticide against insect and pests infestation are required to be done regularly.

INTRODUCTION

The Project DP/OMA/89/011 "To upgrade and strengthen local production of Frankincense, Rose Water and Pottery" involved a team of three experts; one in each of the three products. The current report is by the Expert in Rose Water. Job description is given at Annex-1.

During briefing in UNIDO, Vienna, by the backstopping officer it was suggested to incorporate the follow-up action in terms of a Project Document comprising of work on both Frankincense and Rose Water.

The expert was attached with the Ministry of Commerce and Industry and Ministry of Agriculture and Fishing of the Government of the Sultanate of Oman. The mission of one month duration started from 9 th October, 1992.

The Sultanate of Oman is the second largest state in the Arabian Peninsula covering an area of 300,000 sq.km. and having a population of 2 million.

Rose water is produced for many years in The Sultanate of Oman. Producers use a traditional method to produce rose water and they sell their production in the local market. 50-60 tons of rose flowers are cultivated in Jabal-Al Akdhar region.

I-ROSE WATER PRODUCTION IN OMAN

The strong and pleasant fragrance attributed to roses has been known to mankind from ancient times. And most authors refer, distillation of rose flower started in Iran first. Actually rose water is produced as a by-product, by hydrodistillation -water distillation- of rose flowers. Eventhough there are many rose species, the most suitable one, is *Rosa damascena* Miller which gives high yield and quality. For the high yield, the flowers should be picked in early morning and be transferred to the factory at once. Otherwise, it loses the smell of sweet rosaceous character. When it becomes difficult during the peak-crop days, the flowers should be kept in a cool places till distillation, in order to avoid fermentation of rose flowers. In Oman, rose water is produced in **Jabal-Al Akdhar**.

A- Jabal-Al Akdhar region :

In the Sultanate of Oman, rose plants are cultivated in **Jabal-Al Akdhar** region for the last few hundred years. This mountaneous region lies on the North-east of Sultanata of Oman facing Gulf of Oman. The main production area is **SHIREJE** at an altitude of 2000 meters above sea-level, its average temperature during the crop is 15-20 C. There are about 20 producers of rose water with different capacities. Estimated rosewater production is roughly 5-6 tons per year. It means 40-50 tons of rose flowers are being picked during the crop. The picking of crop starts in April and finishes by mid-May. It is about 40 days. The most cultivated rose species is *Rosa damascena*, but we were informed that there are also some *Rosa alba* and *Rosa centifolia*. Estimated age of rose plants are 30-40 years. The rose fields are irrigated from **Al Falaj**.

II-PICKING AND DISTILLATION OF ROSE FLOWERS

Producers have their own rose plants. They pick the flowers in early morning and evening. Quantity of picked flowers increases day by day up to mid-crop season then starts to decrease. During the peak days, producers distill all day continuously. All family members work during the harvesting season to pick flowers.

Producers use earthenware stills placed inside a furnace built from bricks. All stills are hand made and because of it, have no standard.

Their capacity is roughly 10-15 liters. There are also 2 other small vessels used for distillation. First one, a **receiver** made of brass for collecting the distilled rose water, second one, a **condenser** made of brass for cooling the vapour.

At the beginning, the producers put 2 kg. of rose flower inside the still and place a receiver inside, on the top of flowers, and at last, placing the condenser on the top of still, filled with cold water. First part of distillation takes 40-50 minutes. Then they put 1 kg. of fresh rose flower. Distillation goes on for 30 minutes more and lastly, again 2 kg. of fresh rose flower are charged. During the distillation, rose flowers settle on the bottom of still. This constitutes one charge. Each charge takes 2 1/2 hours and 6 kg. of rose flower could be distilled. The amount of rose water obtained is one bottle of 0.750 liter. It can be seen that 10 kg. of rose flower gives 1.250 liter rose water.

The stills are heated by gas directly, during the distillation. And the distillation system used, is therefore **Destructive distillation**. The rose water produced is very weak in rose smell and has smokey smell and brown colour. Before bottling/storing, rose water from the still is filtered to remove dark brown suspended matter. The rose water is stored either in bottles or earthenware containers at a cool, dark places.

A-Trade and use of rose water

Rose water is a well known product for many many years. It has been largely used as a refreshing and food flavoring product. Nowadays, the technological improvements brought, large number of products for these uses. But, because of traditions and people's care for their health, continue rose water consumption. There are three types of rose water available in Oman markets. One, is imported from Turkey which is produced as a by-product during the rose oil production. Second, which is not produced naturally, but perfumed with rose fragrances. And the last, is produced in Jabal-Al Akdhar by local producers. High freight costs of imported rose waters and limited production of local producers are some of the bottlenecks to supply the market demand.

B-Modernisation of rose water production

Rose water, the water white in appearance and having distinct rose odour and taste is normally produced by water-distillation method in copper still. Rose water is produced both in large capacity units (charging capacity 500 kg. rose flowers), or in field-village level units with charging capacity of 15 kg. to 20 kg. Design of such a unit is given at Annex

The procedure for producing rose water in field units is as under:

Depending upon their capacity, 15-20 kg. of roses are charged into the still, and 70-80 liters of water is added. End of distillation which takes 1 hour, 30-35 liters of water -First Water are obtained. The First Water is placed in the still, then redistilled slowly until 15-20 liters of Second Water come over. This distillate contains rose oil and rose water. After removal of the oil -oil can be taken easily, its specific gravity is 0.860-0875 at 15 C -, the distillate called as rose water.

C-Economic Benefits of Modernisation of Rose Water Production

At the present, 6 kg. of rose flowers yield rose water worth OR 6.- per bottle i.e. US\$ 20 per litre. By using modern method 6 kg. flowers would yield 8-10 litres of rose water worth US\$ 160-200. Moreover, this quantity of rose water would be acceptable to wider segment of society. Rose oil produced over and above rose water would be extra income.

It can be seen that by adopting modern method of rose water production coupled with improved method of rose cultivation the Omani producers of this product will earn at least ten times more the present income.

RECOMMENDATIONS

1-It is given to understand that there are 3 species of rose in the Sultanate of Oman: *Rosa damascena*, *Rosa alba*, and *Rosacentifolia*. *Rosa damascena* is the only species, which gives better yield and quality. Cultivation of *Rosa alba* and *Rosa centifolia* for rose water may not be preferred.

2-"Destructive distillation" is being used for rose water production. Whereas, Hydrodistillation is used for this purpose in all other countries. Hydrodistillation is a well known system and is as old as rose flowers. May be, lack of water induced the producers to adopt this distillation system year ago. But now, water is available. Furthermore, the distillation units which are still, condenser and receiver are not suitable for rose water production. From the beginning, the stills and condensers made of copper are being used by producers, as copper is a good heat transferer material.

3-Rose flowers should be picked in early morning only, while these are picked twice a day, i.e. morning and evening in Jabal-Al Akdhar. The rose flowers which are picked in the evening give low yield.

4-Rose plants seem neglected. Once in every 5-6 years, rose plants are cut to rejuvenate. And also some plants are very old. Some of these 30-40 year old, while plants can be productive for up to 20-25 years. Pruning and application of insecticide against insect and pests infestation are required to be done regularly. Spacing of about 1 meter among the rows, will be good for proper cultivation.



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project of the Government of
The Sultanate of Oman

JOB DESCRIPTION

DP/OMA/89/011/11-53

Post Title: Expert in Rose Water Production
Duration: One month 1.0 m/m
Date Required: ASAP
Duty Station: Muscat, with travel in the country
Purpose of project: To upgrade and strengthen local production of Frankincense, rose water and pottery.
Duties: The expert will be a member of a team of three experts in Frankincense, rose water and pottery respectively who, in close co-operation with local specialists will assess the potential for up-grading these three industries. Specifically, he will be expected to:

1. Make a detailed study of the production of rose oil and rose water from the species used in the Sultanate of Oman - mainly Red Bulgarian and White Bulgarian.
2. Make recommendations as to the modernization of the rose products industry and the technologies employed as well as regards quality control procedures and requirements, storage and marketing policies.
3. Elaborate a plan for further UNIDO assistance in this field for discussion with Government officials and UNIDO Headquarters.
4. Make recommendations as to the modernization of the rose-products industry and the technologies employed, as well as to quality control procedures and requirements of storage, packing and marketing policies. Identify the best available source of technology suitable to the proposed/existing scale of operations, and make recommendations for Government implementation.

Qualifications: Chemist, chemical engineer or equivalent with extensive practical experience in the manufacture and marketing of rose products.

Language: English, Arabic an asset

Background Information: Rose water has for many years been produced in Oman using improved traditional methods. The present availability of flowers is 60 mt per year from about 6,000 plants. The types of roses grown are Balady, Red Bulgaria and White Bulgaria, and the flowers are available during the period March-May.

Persons Met

1. Ministry of Commerce and Industry

Mr. Khamis Al Kiyumi	Director General
Dr. Faisal Mohamed Elamir	Technical Adviser
Ms. Hilda A. Al-Hinai	Management Researcher

2. Ministry of Agriculture, Livestock and Fisheries

Mr.	Minister
Mr. A. Mohamed Al-Hinai	Director General

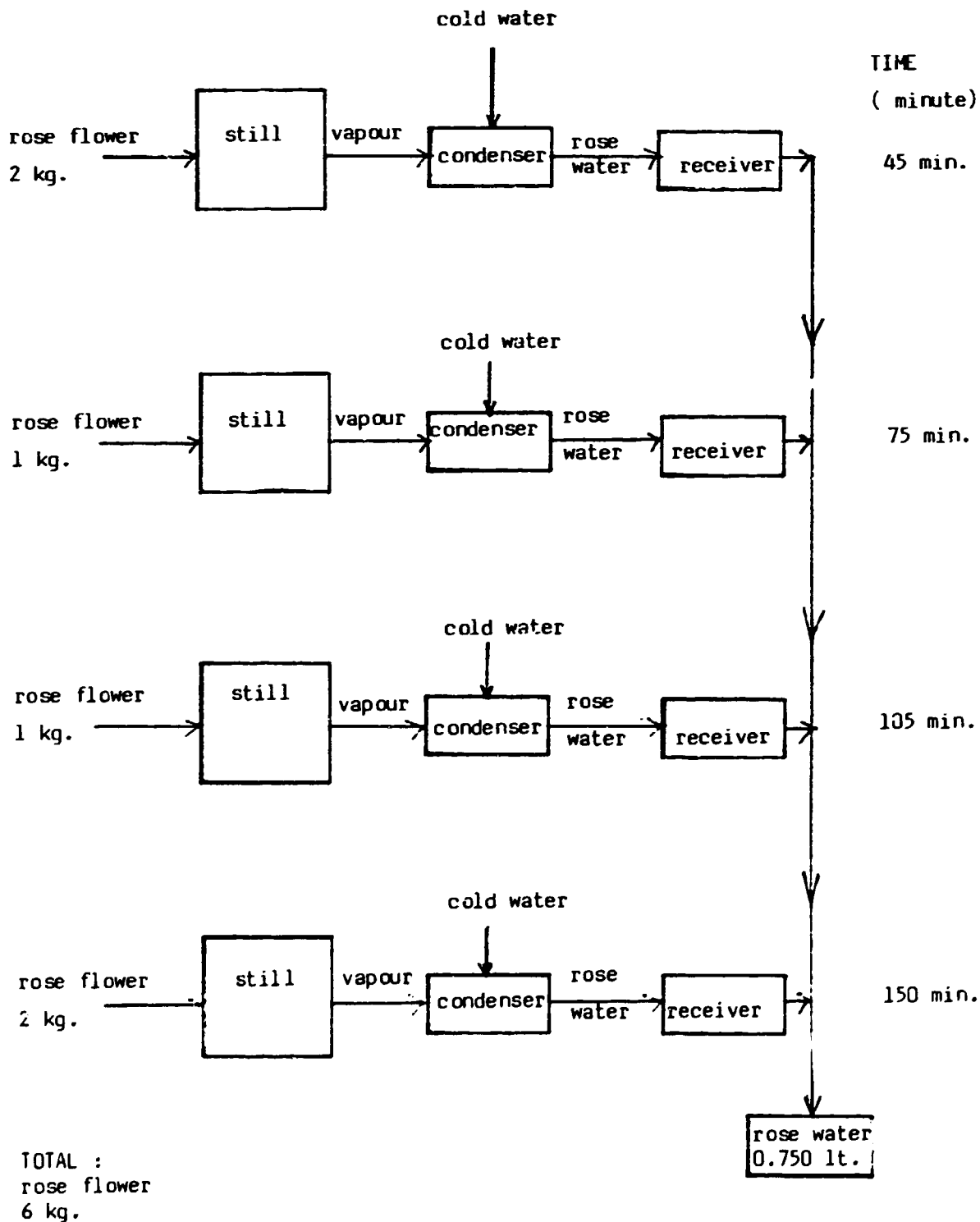
3. Ministry of Interior

Mr. Seif Salim Al Zayeed	Deputy (Waly)
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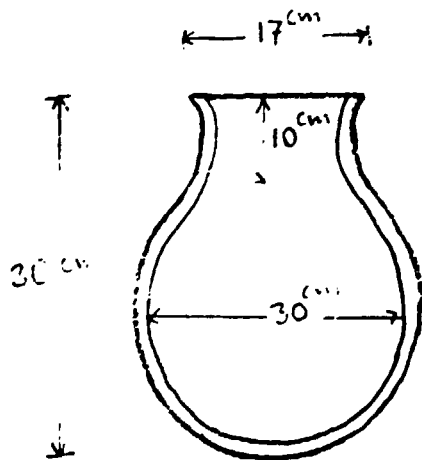
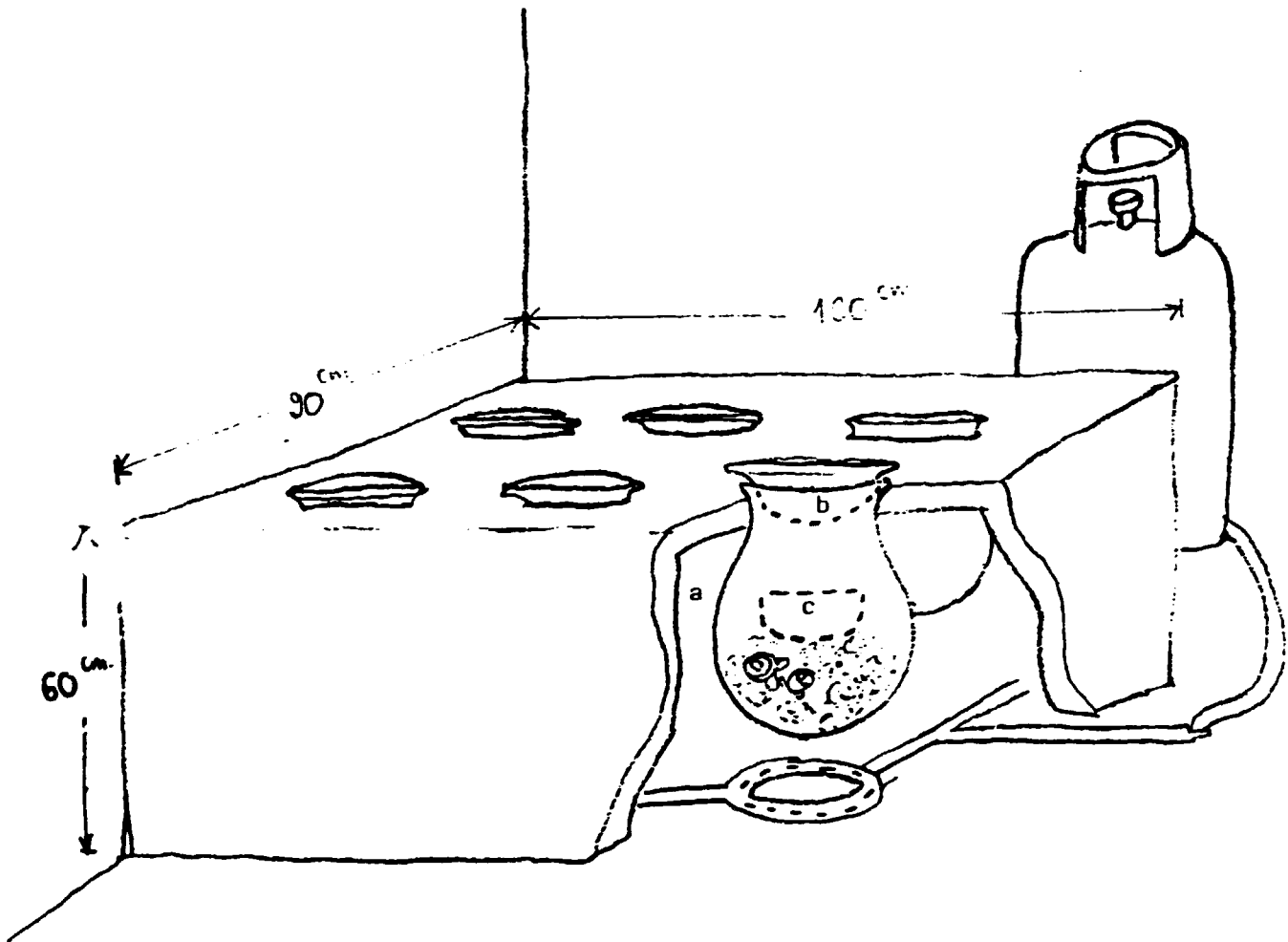
4. UNDP Muscat

Ms. Barka S. Al-Bakry	Programme Officer
Mr. Jihad Al Zaaby	Finance Assistant
Mr. Patricio Castro Boisier	Consultant, UNIDO
Mr. Balder Gulati	Consultant, UNIDO Team member

PROCESSING OF ROSE IN SULTANATE OF OMAN

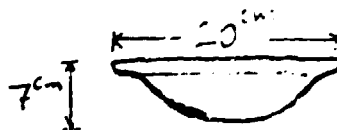


DIMENSIONS OF THE DISTILLATION UNITS :

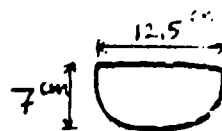


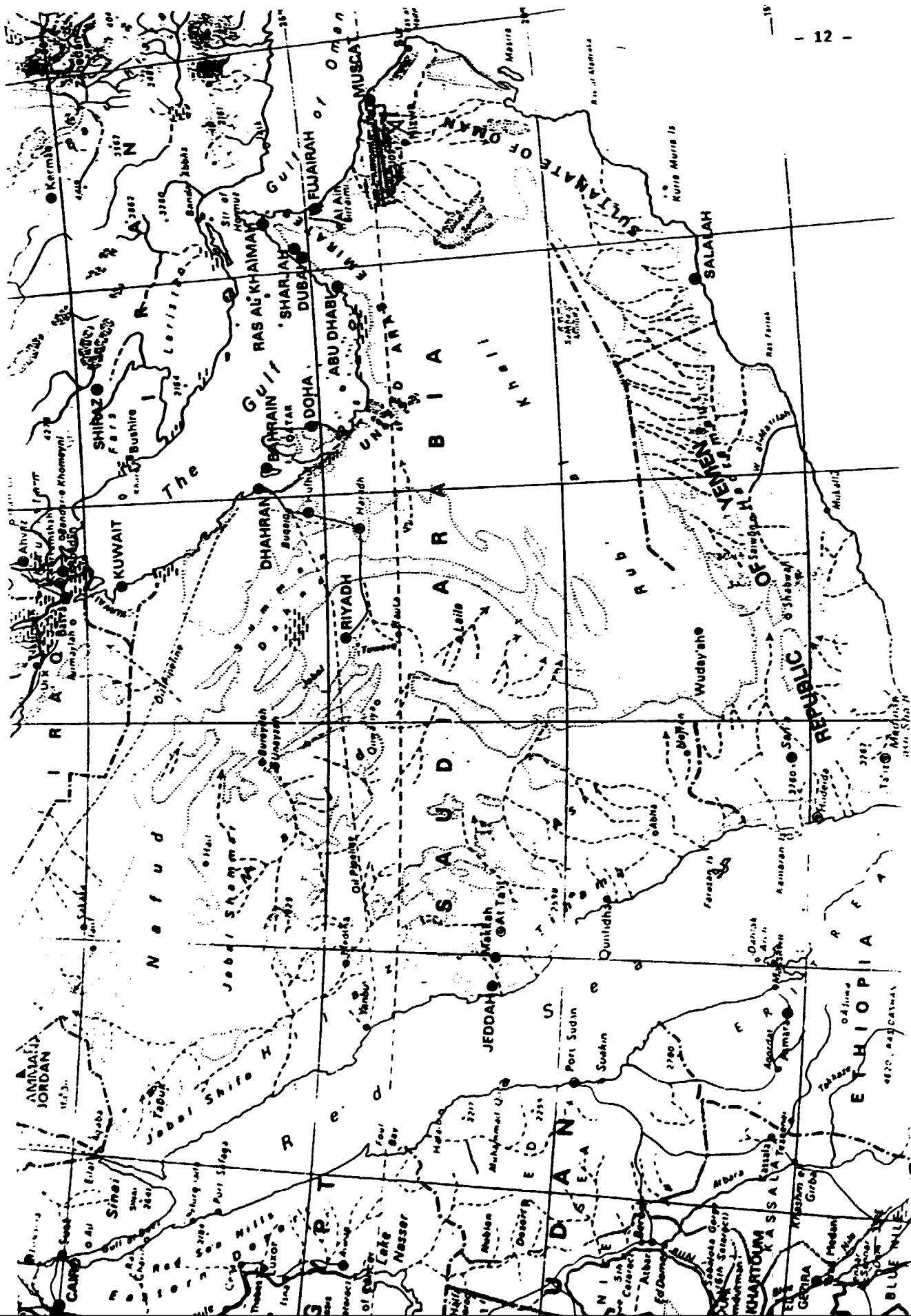
a- STILL

b-CONDENSER



c-RECEIVER





I-BOTANY

Rosa damascena Mill. -Pink damask rose -:

Rosa damascena is very fragrant and contains a relatively large amount of volatile oil, which can be obtained by hydrodistillation or by extraction with solvents. The most important of all perfumery roses. It is widely accepted to have originated from the hybridization of Rosa gallica L. and Rosa canina L. It is planted extensively in Bulgaria and in Turkey.

Rosa alba L. -White cottage rose -:

Contains much less volatile oil than Rosa damascena, the oil being also lower quality. Rosa alba is considerably hardier and more resistant to unfavorable climatic factors than Rosa damascena. Most of the distillers do not use because of its inferior quality.

Rosa centifolia L. -Light pink cabbage rose -:

Is known as "Rose de Mai". It is grown in Morocco. It contains a good amount of oil. Limited quantities are used for the production of the fragrant rose water.

Planting, Cultivating and Harvesting :

Prior to planting, the field should be well plowed. Then parallel ditches 50 cm in depth and 50 cm. in width are prepared and manured. This must be done in the fall, or not less than two months prior to planting. So that the earth can be exposed to air and moisture sufficiently long for the organic matter to decompose. The cuttings 30-40 cm are taken from the base of healthy old rose bushes, are placed into the ditches horizontally. Then a layer of earth, 3-5 cm. thick, is placed on top of the cuttings, this is followed by 5-6 cm. of seasoned stable manure. In May the first shoots appear above ground. The soil is then slightly hoed, weeds are removed, and some more earth is shoveled into the ditches and placed around the young plants. During the first year this procedure has to be repeated at least 6-7 times. In the second and third year the field must be hoed and plowed 4-5 times each year. After 6-7 years, the plants are cut down to the ground for rejuvenation. Because the plant shows signs of decay. Properly taken care of flowers, makes the field productive up to 25-30 years. In the third year, the first harvesting can be done. In Turkey and in Bulgaria, blooming begins in May and finishes by end-June. Duration of the crop depends upon the weather conditions. Warm and rainy weather prolongs the harvesting period. And also increases the yield and quality. Dry and hot weather causes lower yield due to loss by evaporation.

Picking of flowers starts in the early morning, i.e. 6-7 o'clock, while the dew is still fresh on the flowers. These roses give a higher yield of oil than when picked in the afternoon. The villagers drop the roses into bags which are charged to the distilleries as soon as possible.

II-METHOD OF DISTILLATION

A-In Traditional Peasant Stills

In this system, rose oil and rose water is produced in small, direct -fire stills by peasant-growers. These stills set up in convenient places to the fields, or in villages, and near a source of water. These simple stills consist of a retort and a head. The retort is wider at the base than at the top. Two handles on the side walls permit lifting of the retort and emptying the residual after distillation. The head is removable and spherical, from which a gooseneck or connecting pipe leads through a barrel filled with cool water, for cooling of the condensate. On the other side of the barrel, the condenser pipe ends above a bottle in which the oil and water collected. The stills are made of copper. It may be tinned on the inside. The still capacity is 100-150 liters and is heated by an open fire.

Depending their capacity, from 15 to 20 kg. of roses are charged into the retort, and 70-80 liters of water is added. At the end of first charge, 30-35 liters of oily water -**First Water**- is obtained. Then the **First Water** is placed in the still, and redistilled slowly until 15-20 liters of **Second Water** come over. The residual water in the retort is used for next charge of rose flowers. The yield of oil in this method is about 0.04%.

B-Industrial Stills

In this system, 3000 liters capacity of stills are used. 400-500 kg. of rose flowers and 1500 kg. of water are charged each time. The stills are provided with a steam jacket at the bottom for heating with indirect steam, and with a steam coil for the injection of live steam. The direct steam allows for quicker heating and the rising steam bubbles effect a certain stirring action on the rose flower mass. Otherwise the method of operation are the same.

III-TURKISH STANDARDS OF ROSE WATER

1. Description

Rose water is produced as a by-product, by hydrodistillation of *Rosa damascena* Mill.

2. Specifications

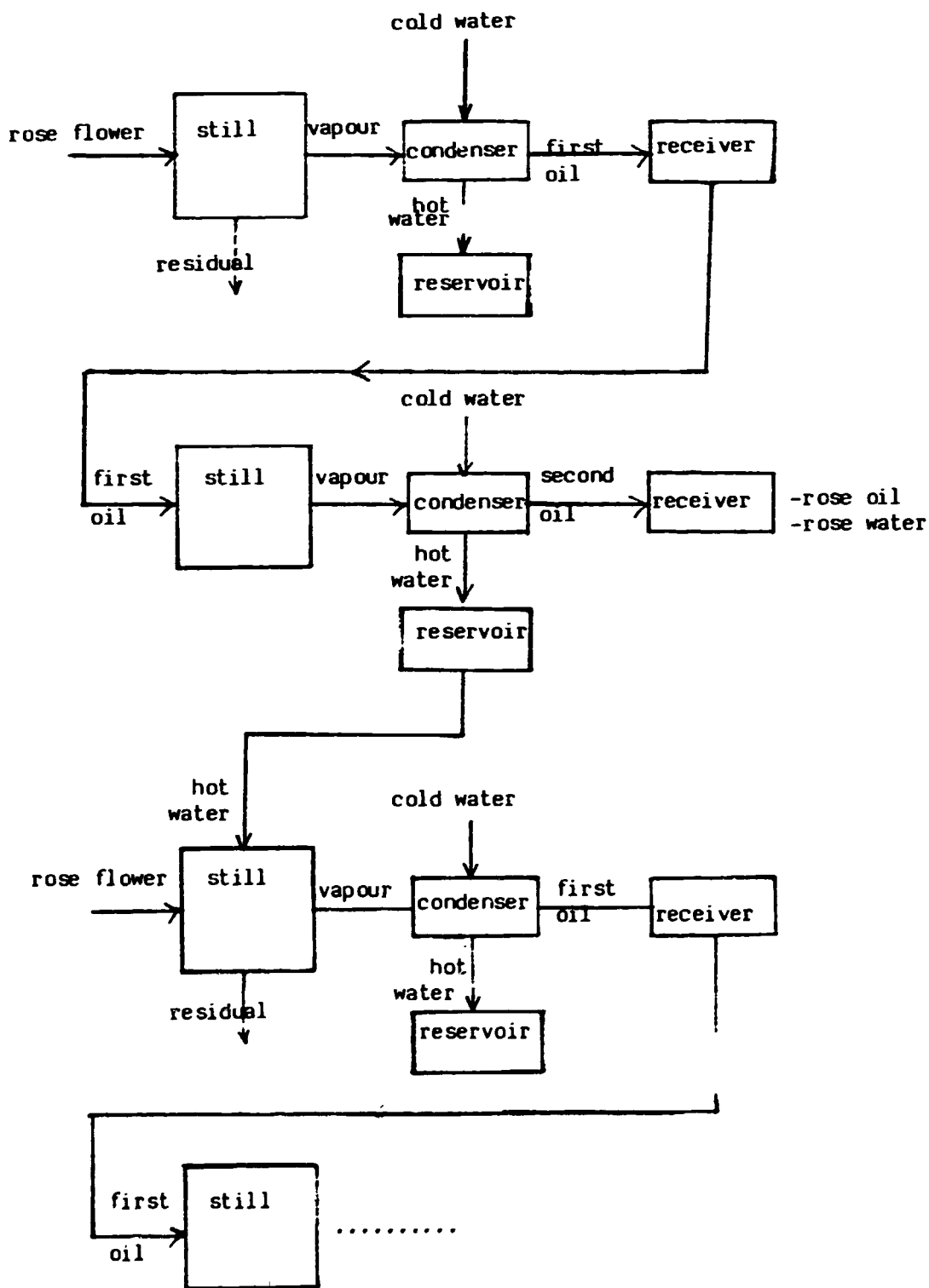
2.1. Apparence, smell, taste

Rose water colourless, transparent, free from impurities, sediments and turbidity, has smell and taste of rose.

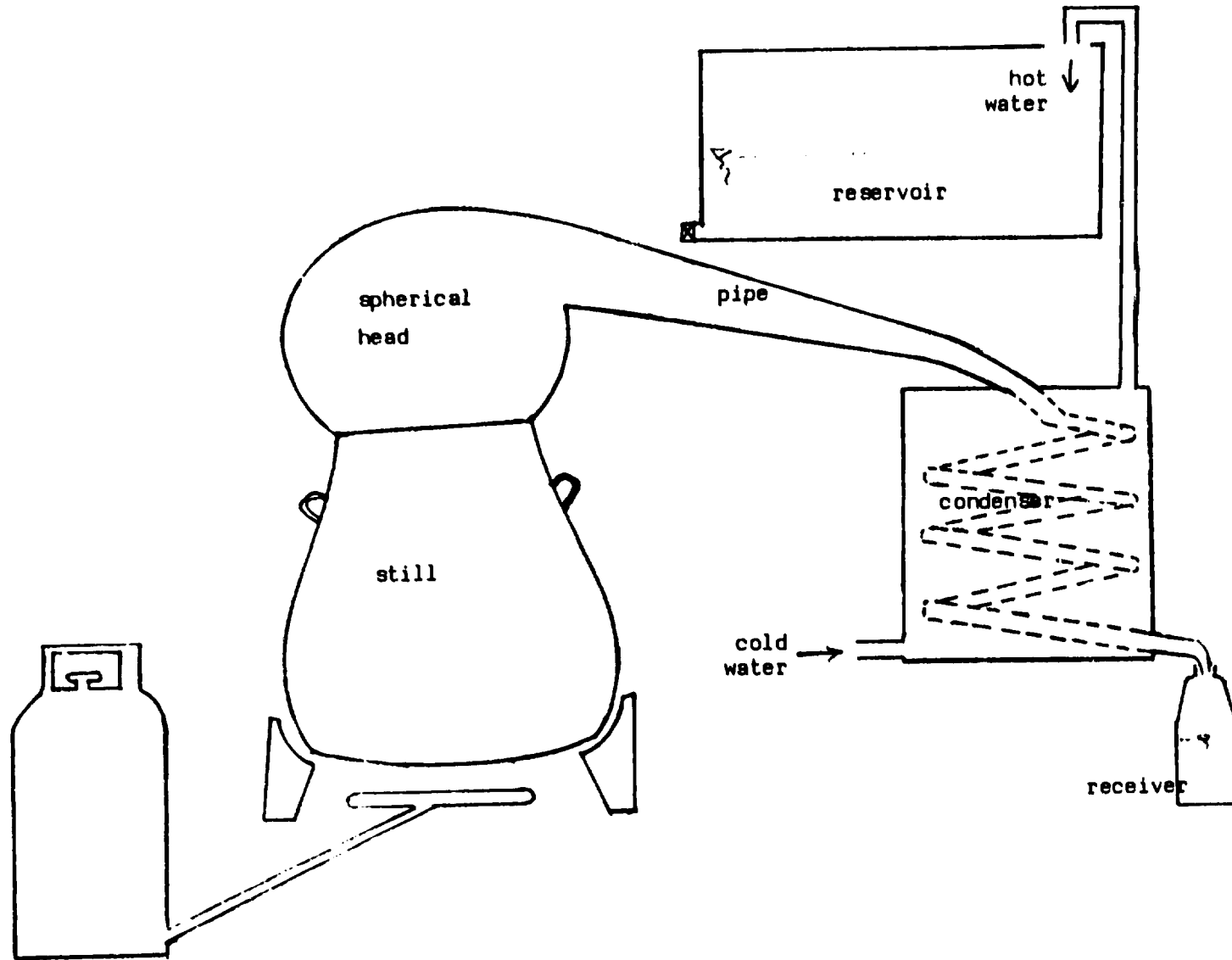
2.2. Physicochemical properties

ph	-	5.5 / 7
specific gravity (20 C/20 C)	max. -	0.9999
acid value	max. -	0.4
non-volatile matters %	max. -	0.015
volatile oil %	min. -	0.01
total count of bacteria	-	not allowed
heavy metals	-	not allowed

PROCESSING OF ROSE IN TRADITIONAL SYSTEM
WITH PEASANT TYPE STILL



TRADITIONAL STILL AND CONDENSER (PEASANT TYPE)



REFERENCES

- 1-H.C.BASER : "Turkish Rose Oil"
Perfumer & Flavorist
Vol.17.May/June 1992
page 45
- 2-E.GUENTHER : "The Essential Oils"
vol.4

Backstopping Officer's Technical Comments
based on the work of Mr. A.N. Ercetin
DP/OMA/89/011/11-53

The report gives an account of the work carried out by the expert and his recommendations for technical assistance. The old methods of distillation still used has to be upgraded if rose water conforming to international standards is to be produced.

The expert has recommended a small scale field distillation still as a production model to transfer technology. This can then replace what the farmers are presently using. There is also the possibility of having a larger central unit, which could collect the flowers from farmers for distillation. The recommendations of the expert have been discussed with the Government authorities and incorporated into the project document.