OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

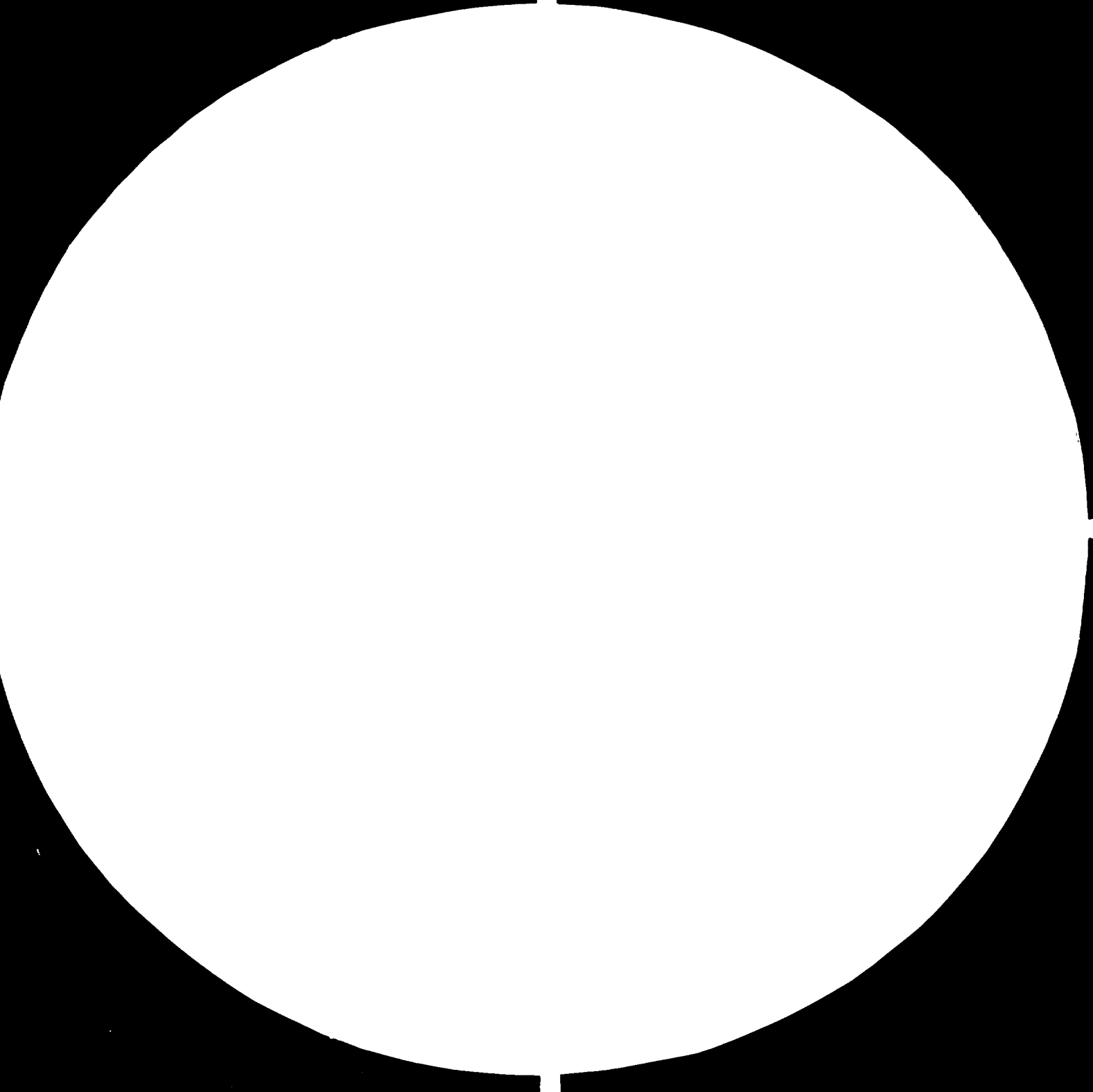
FAIR USE POLICY

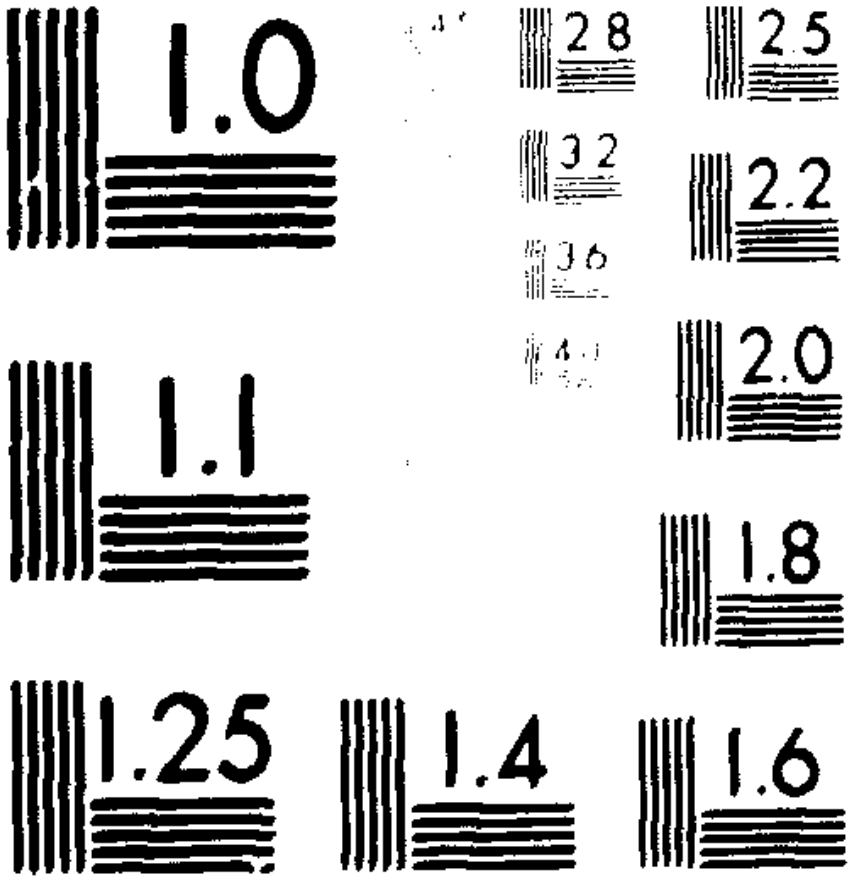
CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





09580

RESTRICTED

DATE 20-2-78

(R) THE PRODUCTION AND USE OF AGRICULTURAL IMPLEMENTS,

TOOLS AND MACHINES

IN

YEMEN ARAB REPUBLIC

(SI/YEM/075/811/11-01/31.9.E. REV2)

Project Findings and Recommendations

TERMINAL REPORT

Prepared for the Government of the Yemen Arab Republic

BY

D.N. KHERDEKAR

Expert in the Production of Agricultural Implement

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Acting as Executing Agency for the

UNITED NATIONS DEVELOPMENT ORGANIZATION

(This report has not been cleared with the United Nations Industrial Development Organization which does not therefore necessarily share the views presented)

(ii) TABLE OF CONTENTS

Recommendation NO. 2 - Suggestion for Quick results

Recommendation NO. 3 - Power-tiller and Small tractor

Recommendation No.4 - Bullock breed, shoeing, Nagpuri Yoke.

Recommendation NO. 5 - Hydraulic Ram

Recommendation No. 6 - Solar Energy use (D-3)

Recommendation NO. 7 - Bone-Digestor (D-5)

Recommendation NO. 8 - Bio-gas plant (D-6)

" NO. 9 -1 Winnowing fan (A-1)

" NO. 10 -2 Cotton Stalk puller (A-4)

" NO. 11 -3 Secateur-Double lever (A-15)

" NO. 12 -4 Hand seedrill @ hoe (A-8)

" NO. 13 -5 Chaff or fodder cutter (A-5)

" NO. 14 -6 Maize Sheller (A-3)

(B) Animal Driven Implements

Recommendation NO. 15 -1 Steel Bladed Harrow (B-4)

" NO. 16 -2 Multipurpose tool bar with plough, ridger and 3 row seeddrill (B-8)

" NO. 17 -3 Single row cotton planter with fertilizer attachment (B-14)

" NO. 18 -4 Small turnwrest mould board plough (B-2)

" NO. 19 -5 Steel bladed hoe and AKOLA Hoe (B-15)

" NO. 20 -6 Soil scoop or scraper small size (B-10)

(C) Power Driven Equipment

Recommendation NO. 21 -1 Tractor Mounted fodder cutter (C-5)

" NO. 22 -2 Tractor with offset Implements (C-12)

" NO. 23 -3 Combine harvester for wheat (C-16)

" NO. 24 -4 Tractor powered wheat thresher (C-6)

" NO. 25 -5 Scarifier (C-2)

" NO. 26 -6 Road Roller (using heavy tractor) (C-15)

(4) Appendices

(1) Appendix NO. 1 - Orginial Job Description
(2) Appendix NO. 2 - Copy of a letter for amendment by the Director General
(3) Appendix NO. 3 - A copy of my letter to UNIDO regarding the Amendment.
(4) Appendix NO. 4 - Revised Duties or Terms of Reference
(5) Appendix NO. 5 - An Extract from "Lima Declaration"
(6) Appendix NO. 6 - An Extract from Annual Report of the Executive Director Industrial Development Board of UNIDO Chapter 111 P. 53-55 (1977)
(7) Appendix NO. 7 - Names of Persons contacted in the Yemen Arab Republic.
(8) Appendix NO.8 - Bibliography
(9) Appendix NO.9 - Map of the Yemen Arab Republic
(10) Appendix NO.10- Abbreviations
(11) Appendix NO.11- Glossery of useful Terms and weights and measures and meterological data.
(12) Appendix No 12- A quick survey of Indigenous Implement and tools and availability of Power in Yemen Arab Republic.
(13) Appendix NO.13- Agricultural situation in Yemen - a study.
(14) Appendix NO.14- Industrial situation in Yemen - a study
(15) Appendix NO.15- A pre-feasability report for foundry.
(16) Appendix NO.16- A scheme for the establishment of a workshop under UNIDO Technical Assista along with the suggestion to getquick results (R-1 ornoR-2).
(17) Appendix NO.17- A study of Mechanization of Agricultur in Yemen.

(iii) EXPLANATORY NOTES

Y.A.R. = YEMEN ARAB REPUBLIC

YRs = YEMENI RIYALS

The monetary unit in the Y.A.R. id the YEMENI RIYALS (YR!_). During the period covered by the report, the value of the Yemeni Rials in relation to the US Dollars was 1= YR'S 4.55.

Other abbreviations, weights and measures, exotic terms and a glossery of useful local words is given in A,pendix NO.10 and 11.

The Designations employed and the presentation of the material in this report do not imply the expression of any opinion whatsoever on the part of the Secretaria of the United Nations concerning the legal status of any country, city or area or of its authorities, or concerning the delimitation of its boundries.

Mention of firm names and Commercial Products does not imply endorsement by the UNIDO.

SUMMARY

The Yemen Arab Republic is one of the Least Developed Countries. It is an ancient country which was progressive in the past but due to some geographical, historical and social reasons was isolated for a long time and the development was arrested. The real development has started only during the last 8 to 10 years but during this short period it has made remarkable progress showing that there is an urge and potential for planned development. The Government has drawn up its First Five Year Plan - 1976.-77 to 1980-81 which is ambitious but need-based and appropriate.

In Yemen, Agriculture still forms the main stay of its economy. Industrial Development is still in its infancy. The period during which the Planned Development has been carried out is too short - about 8 to 10 years. The Government have passed progressive laws for investment and joint ventures and with this open door policy a lot of foreign capital is being attracted to Yemen.

The country is faced with constraints that sometimes look formidable, if not insurmountable. Amongst these the main are the following:-

(1) Lack of technically trained personnel

(2) Shortage of Labour both in urban and rural areas.

(3) Very high cost of labour making prices of locally produced goods costlier than the imported ones.

(4) Some social customs like qat-eating which considerably reduces working hours.

(5) Lack of communications - Roads, Port facilities etc.

(6) Out of total population of 6.5 million about one million Yemeni's, mostly young males have migrated to oil producing countries.

(7) General health and malnutrition problems giving comparatively less work per day.

(8) Lack of raw materials such as wood, iron, non-ferous metal etc.

(9) Lack of power or energy such as oil, hydraulic power, fuel, coal, coke.

(10) Lack of women's participation in agriculture or industry except for very light and domestic jobs.

(11) Small size of land holdings, terrace cultivation and share-cropping.

On the plus side can be mentioned

(1) Enthusiasm and ambition of the people, the planners and the young generation for forging forward.

(2) An aptitude for trade and commerce.

(3) Availability of finances and eagerness to invest in the development projects.

(4) The Government's steps toprovide for financial support both to industry and agriculture by establishment of special banks for the purpose.

(5) Comparatively favourable soil and climate conditions for agricultural growth as compared to other Arab Countries.

(6) Willigness to work on co-operative basis.

(7) The farmers are receptive to new ideas, machines, fertilizers and pesticides.

As education spreads, the mal-nutrition is controlled and the health improves many of these constraints are likely to be reduced but the labour problems in terms of quantity, quality and wage standard are likely to increase in future and therefore the most urgent need to introduce now and immediately labour saving tools, implements and machines both in Agriculture as well as industry. In this respect the urgency is so much that even one year lost is likely to make very appreciable difference. Hence the Expert would like to give greatest emphasis onthis aspect. The specific recommendations given on pages 38 to 60 are very important and the most immediate need is for training indicated on pages 36 and 37. Amongst the recommendations the first three are of priority one importance. Without the use of labour saving machines like power-tiller or small tractors, the agriculture in Yemen is likely to receive a heavy set back. A time is likely to come shortly when many fields cannot be sown or the crop harvested for lack of labour or its very high cost. Given the necessary high priority for the job, it is possible to give to Yemeni farmers improved labour saving hand tools, animal driven plow equipment of appropriate size. The proposed UNIDO workshop would act as a nucleus for this activity. In the meanwhile a detailed feasability report regarding power-tillers and small tractors should immediately be prepared. With these power-tillers (5 to 10 Horse Power) and small tractors (10 to 15 Horse Power) it is possible to carry out all agricultural operations such as ploughing, spraying, harrowing, hoeing, harvesting, transport, pumping, fodder cutting etc. Therefore, they are the most ideal ones for Yemen.

(Please see photographs on page 42-A.)

The other major recommendations pertain to increasing the source of power, both animal and man power, saving the scarce fodder, avoiding the wastage of fuel making use of organic manures, introducing soil and water conservation practices by using suitable implements.

In short there is a tremendous scope for introducing modern and labour saving implements, tools and machines in Yemen.

(1) INTRODUCTION

The Project Background:

(1.1) The Conditions that led the Government to request UNDP AID:

The origin of this project is said to have taken place in 1970-71 when a need was felt for introducing and manufacturing power driven pumps both for domestic and for agricultural use. A beginning was made by a private firm named M/S Juman Foundry in assembling and partially manufacturing deep-well water pumps in their small foundry employing about 20 people. As the demand increased, it was felt by the Government that both the production and the quality of their product should be improved. To do this the proprietors of the factory supported the authorities in the Ministry of Economy, requested the UNIDO for the services of two qualified and experienced specialist, one primarily for the foundry proper (A Foundry Engineer) and the other an Expert in the Production of Agricultural Implements.

This expert in the Production of Agricultural Implements was expected to examine the production of agricultural implements in the foundry in addition to the main task of

(i) Assessing the existing and the potential demand for agricultural tools and implements and for hand tools required for construction and industrial purposes in the Y men Arab Republic.

(ii) Examine the availability of the raw materials, capital manpower, and skills required for the local manufacture of these products.

(iii) Formulate recommendations on any additional items (agricultural implements: hoes spades, axes, pitchforks, rakes rippers, scoops, ploughs, sprayers, harrows, other hand tools hammers, pliers, spanners, screwdrivers etc. and spare parts which could be locally manufactured).

(iv) Prepare a short and long-term production programme to provide for an expanded production of deep water pumps and other suitable products and make an estimate of such a programme.

The project somehow was delayed due to want of funds and other reasons. In the meanwhile the proprietor of the factory decided to shift their operation from Sana'a to Hodeidah and the Government after reconsideration thought of having their own workshop for manufacturing small agricultural implements and tools suitable for the majority of farmers in the Yemen Arab Republic and accordingly modified the Job Description of the Expert in the Production of Agricultural Implements as indicated in Appendices Numbers 2,3 and 4. The original job description is given at the Appendix NO.1.

The Governments attention to the need for carrying out the work on improvement and manufacture of animal driven agricultural implements and hand tools was first drawn by M.R. C.M. Downing an expert on Mechanization of Agriculture when he visited Yemen Arab Republic in 1971 under FAO/UNDP (Special Fund) Highlands Farm Development PProject (Chapter ix Information Paper NO. 9 (UNDP).

The relevant extract from his report is give below:

"Although there is demand and purchasing power for tractors and related equipment animal power will be important to agriculture in the Yemen Arab Republic for many years. A continuation and improvement of traditional methods and equipment will lead to the development of agriculture, much can be achieved without changing the source of power .

Development of mechanization on the steep terraced lands and small plots is necessarily limited to hand tools, animal draft equipment and single axle tractors. All these possibilities require investigation, evaluation and promotion".

Considering these and other recommendations of the agricultural experts and the needs of the millions of small farmers in Yemen, the Government thought of giving priority to the identification of improved implements and tools for the Yemeni Farmers and their modifications, testing and manufacture on prototype basis. This work was assigned to the Expert in the production of Agricultural implements and the present Report pertains to it.

The Report covers all aspects of Mechanization of Yemeni Agriculture including a study of indigenous implements, Research, Extension, Training, finance, Manufacture etc. and includes in its recommendations the following.

(1) Hand tools for Agriculture, Horticulture etc.

(2) Animal driven Implements

(3) Power driven Equipment such as tractors, power-tillers, pumps, sprayers, fodder-cutters etc.

This is a systematic and a comprehensive study covering all the aspects of the Agricultural Mechanization. Considering the present situation of the labour problem in Yemen the following assessment has been made:

(1) About 50% farmers in Yemen would be using hand tools and animal driven implements for the next 20 to 25 years.

(2) About 25% of the farmers in Yemen would be using a combination of small implements and power driven implements such as tractors, power tillers etc. mostly on custome hiring.

(3) About 25% of the farmers would be using only power drive modern agricultural machines such as tractors, power til power threshers, combine harvesters, fodder cutters etc.

Year after year the agricultural labour is going to be scarce and costly, hence the urgent need to use both small as well as power driven labour saving machines and prepare for the full fledged mechanization of agriculture during next 25 to 30 years.

(1.2) A short description of Existing facilities

At present there is no Government Institution or workshop in Yemen which carries out the work of identification, modification, testing or manufacturing agricultural implements and tools.

However when the proposed project of a small workshop under the UNIDO assistance is approved, the Government proposes to establish it by renting a few sheds at the Industry I/ndustrial Estate which has been recently established and which has covered sheds as well as open space and other facilities such as electricity, water roads etc. This will form the nucleus for further development which seems to be inevitable and the present is the right time to start this workshop as ea as possible.

(1.3) Work done in the same field previously

No such work covering all aspects of Agricultural Mechanization was ever undertaken in the Yemen Arab Republic but some sporadic work was done in the covering either mechanization by tractors or in the covering particular regions of the country as indicated below:

(I) A Brief Study of tractor Mechanization and Importation of tractors and machinery into the Yemen Arab Republic by MR. C.M. Downing from U.K. F.A.O./UNDP (Special Fund) Highlands Farm Development Project (Chapter ix, Pages 110 to 129, Information Paper NO. 9 (UNDP) Sana'a). 1971.

(ii) Consultancy Report on "Development of Farm Mechanization in Y.A.R. with emphasis on irrigation crops including Horticulture in Tihama Plains (Coastal Region of Y.A.R.) by MR. B.V.D. Osten Warinitz, West Germany (Project NO. FAO/AGON: YEM/73/011 :- 1st Feb., 1976 to 29th Feb., 1976- one month (Total proje for 1½ months including visits to ROME and CAIRO).

Both the above reports are available and have been studied and their main findings and recommendations are given below:

(1) MR. C.M. Downings Report:

He undertook a brief study of tractor mechanization and importation of tractors and machinery into Y.A.R. The objective was to assist the Government to establish a a mechanization and importation policy and to set up guide lines for the future mechanization. The study was not restricted to highlands area only but was a country wide study.

His findings and recommendations in brief are summarised below:-

(a) Selection and Adaption of farm Machinery- A thorough and continuing field application and evaluation programme for selection and adaption of machinery should undertaken.

(b) There is need to have an organization within the Ministry of Agriculture for agricultural mechanization matters such as selection, training, hire schemes, operation service and spare parts facilities etc.

(c) The planting procedure needs to be changed and the row crop spacing increased from 35cm to 60cm to allow inter-cultivation by the row-crop tractors.

(d) Training of tractor repair mechanics and upgrading the skill of the existing mechanics should be given priority.

(e) The use of very big tractors be discouraged

(f) The hire charges for tractors be based on scientific principles and should include interest depreciation etc.

(g) The use of matching implements be recommended.

(h) The tyre wear is tremendous in volcanic rock region. Proper tractor tyre size should be selected. Wheel weights should be used.

(ii) Mr Ostenb Report:-

(a) Recommend changes in cropping methods to suit tractor mechanization. For instance change in the rew width to allow row crop tractors for intercultivation.

(b) Involve machinery dealers in training programmers.

(c) Procurement of small airplanes for travel in rural areas.

(d) Many machines are out of order at various places like farms. They should be repaired.

(e) High priority should be given for training mechanics for repair work.

(f) Some additional machines were suggested for the Gumeisha Farm

(g) Suggests 'bonus' for good machine operator and penalties for bad.

(1.4) Other Useful Information:

In addition to the two reports on mechanization some practical work is being done at the following two centres under the the bilateral agreements.-

(1) Plant Protection Project under West German Assistance established at Sana'a is doing very good work in introducing spray dusters, tractors etc. with emphasis on plant protection. A summary of work done is given in Appendix NO.

(2) Agricultural Mechanization Centre

Located at Taiz under assistance from the British Government where mostly training is being imparted. As there is lack of trained personnel in Yemen, this work of training farm mechanics in repair and maintenance of agricultural machines is also very important and useful. The centre was started with a view to make independent assessment of agricultural machiner in Y.A.R. and to test or modify the equipment developed and selected by the overseas Department of the National Institute of Agricultural Engineering in U.K. One of the objectives is to investigate the practicabilities of local manufacture and distribuition of equipment found suitable. The second phase of the programme has just started.

(3) The Repair Workshop under the assistance of the Korean Government is under the process of establishment at Hodeidah.

(1.5) Summary outline of official arrangements

(1) Dates of request and approval-

authorization of the project (signature of the project document / project data sheet by the Government /UNIDO/UNDP, as approiate.

(1.6) Any amendment to the Project document

Project data sheet with dates and reasons

As indicated in paragraph NO.1.1 The Job Description of the Expert in Production of Agricultural Implements was amended by the Government. The original Job can be seen at Appendix 1 and the letter of amendment by the Director General (Industries), Ministry of Economy, at Appendix NO. 2.

My letter regarding the amendment is also placed below at Appendix NO.3 and revised terms of reference at Appendix NO.4

Thereafter MR. Abdul Wahab, Senior Industrial Development Field Adviser, c/o UNDP, P.O. BOx. 2993, Kuwait came here in November (8th-30th 1977) nd this amendment was discussed by him in a meeting with the Director General, (Industries), Ministry of Economy, Y.A.R. nd the Resident Representative, U.N.D.P., Sana'a and approved and the expert was asked to proceed with the project as amended and

(i)Prepare a"project for establishment of a Demonstration Piolt Engineering workshop for Assembly and Manufacture of Agricultural tools and animal drawn implements, hand operated Agricultural machines and allied metal amd metal fabricated products with repair and maintenance activities" for a possi UNIDO assistance.

(ii) And cover item NO's 2,3,4,5, and 6 given in Appendix NO

(iii) Later on the Ministry of Economy also requested the Expert to prepare a pre-feasibility report of a small foundry to be established in Y.A.R. Thus the reports consists of thr main groups. For brevity it has been designated as,

"The Production and Use of Agricultural Implements tools and machines in the Yemen Arab Republic"

(1.7) Starting, Completion and Agency

(i) When did the Project become operational ?

24th October 1977

(Arrival in Sana'a, the Capital of the Yemen Arab Republic, on 30th October 1977)

(ii) How long did it last?

23rd February 1978

(Departure from Sana'a, on 18th February 1978)

(iii) The name of the Cooperating Agency?

The Department of Industries

(iv) Project Site (Ministry/Institution Etc)

The Ministry of Economy, Government of the Yemen Arab Republic

(1 8) Contributions

(1) Total Contribution of UNDP That is the amount originally stated in the project document with subsequent adjustments.

(ii) Substantive reasons for adjustments, if any?

(iii) Total contribution of host Government in cost or kind

(1.9) Objectives of the Project

With the partial revision or modifications of the duties or the terms of reference of the Expert in the Producti of Agricultural Implements as explained in paragraph NO. 1.1 and 1.6 the objectives of the project slightly chang The new objectives are given below:

(1) To identify which agricultural implements and tools ar suitable under the conditions in Yemen.

To know these it was necessary to study the existing indigenous agriculturalimplements used by the Yemeni farmers. This study was undertaken and is placed below at part 1 of the Appendix NO.12. Also a study of availability of various types of power in Yemen was made and has been included in Part11 of the Appendix NO.12.

It was also necessary to study Agricultural Situation and Industrial Situation in Yemen Arab Republic in order to know precisely which implements can be suitable and to judge whether and how they could be manufactured in Yemen. These two studieswere made as far as they relate to or influence the use of agricultural implements, tools nad machines and their possibility of manufacture. These two studies are placed below at Appendices NO'S 13 and 14 respectively.

(ii) To suggest any modifications or improvements that could be done in the indigenous as well as power driven equipment to suit the local conditions and to test implements.

(iii) To assess the existing and potential demand for agricultural implements and tools and for allied tools such as for poultry, bee-keeping, dairying, and for construction work.

(iv) To formulate recommendations on what additional tools could be manufactured in Yemen.

(v) To prepare a short and long term programme for producing agricultural implements of all types.

(vi) To assess the technical assistance required to help the Government toprepare a sound base for agricultural implements industry by providing a nucleous for activities such as testing on farm and in the laboratory, demonstrating the implements, giving training to farm mechanics, educating the skilled artis in the modern methods of small scale production, carrying out applied research, and training in repair of maintenance etc.

(vii) To examine the possibility of establishing a small but modern foundry in Yemen.

As a result of the detailed studies made by the expert and to achieve the above objectives a scheme for technical assistance has been prepared on the lines of similar projects assisted by the UNIDO .

This is the "project for establishment of a Demonstration pilot engineering workshop for assembly and manufacture of Agricultural tools, animal drawn implements and hand operated Agricultural Machines and allied metal and metal fabricated products with repair and maintenance Activities" has been prepared. Since Yemen Arab Republic is one of the most least developed countries and since the country's real development has started only Since 1974, there is at present no institution which can pioneer this type of work and therefore, there is urgent necessity to have such a small workshop project which will form a nucleus for further development.

The study reveals that there is a great scope for agricultural implements in Yemen and the time is ripe now to make a beginning by establishing a workshop under the technical assistance of the UNIDO.

Because of its importance the proposal to establish such a workshop forms the Recommendation NO.1 indicating the highest priority. The details for such a workshop project are given in Appendix NO. 14

In addition, at the request of the Government a preliminary feasability Report on a small Foundry has been prepared and is placed below at Appendix NO. 15.

The relation of all these objectives mentioned above is very close with the National Plans of both the Sector of Agriculture and Industry. This is elaborated below:

Yemen is essentially an Agricultural Country with about 80% population employed in Agriculture and only about 1% in Industry.

The following tabulated statement shows the percentage of the G.N.P in Agriculture and Industry.

Year	Agriculture%	Industry%
1969	66.0	3.9
1970	64.3	4.5
1971	64.1	4.9
1972	59.6	4.9
1973	54.1	6.0
1974	57.0	5.3

(Source statistical Year book - 1976).

Amongst the inputs required for increasing the Agricultural Production, probably the most important is Agricultural implements and machines for the obvious reasons that the other inputs partly or wholly depend on the use of these tools. For instance IRRIGATION from wells is possible only by the use of pumps. Proper use of irrigation water is possible by levelling of fields by impleme The improved seed can be cleaned, graded and treated by machines such as winnowers cleaners, graders, slusry treaters. The improved seed can be properly sown or planted by seed drills or planters with or witho fertilizer placement attachments. The insecticides and pesticides can be applied to plants by sprayers and dusters .

Thus it will be seen that the application and the use of usually recommended inputs to increase agricultural production such as water seeds, fertilizers and pesticides can be effectively done only through the use of various tools, implements and machines. Hence the importance of these implements in the National Plans. Again agricultural implements required by the farmers are to be produced or manufactured in the country. This is the work of the Industrial Sector.

Fortunately a redeeming feature of National Planning in Yemen is that they have realised the importance of agricultural machinery and have provided for development and credit through the recently established Agricultural Credit Bank and The Industrial Credit Bank.

(1.10) TRAINING

(a) Training Arrangements

Formal courses or fellowships if any.

NIL SO FAR

(b) Informal, on-The-Job training between experts and counterparts.

NIL SO FAR

(c) Any positive training experience or reasons for absence of it.

NIL SO FAR The training will be started after the workshop scheme is approved.

(1.11) THE LEAST DEVELOPED COUNTRY- YEMENS PLACE AND POSSIBILITIES

It is useful to know how much least developed is a country so as to plan its development. Amongst the Arab Countries the pace of economic development has been rapid in oilwrich countries but generally slow in others since so far there is no oil in Yemen, the degree of development has been slow.

The following data indicates the degree of development in Yemen.

(1) THE RELATIVE POSITION OF YAR IS 1 9th in 140 countries- where as

(a) Kuwait is 27th
(b) Saudia Arabia-65th
(c) Syria -72nd
(d) Egypt -84th

(2) The G.N.P. per Capita

(a) Average for the world is 350
(b) For Kuwait ---------- $4,090

(c) For YAR ----- -------- 90

(3) THE RESEARCH AND DEVELOPMENT(R&D) EXPENDITURE

	Rand D s % of G.N.P.		Per Capita Expenditure on R&D
(a) U.S.A.----	2.5	----------	139.0
(b) F.D.R. Germany	2.3	----------	96.6
(c) Japan -----	2.0	----------	54.4
(d) Egypt -----	0.83	----------	2.2
(e) Yemen Arab Republic	0.25	---------	0.3

(4) SCIENTIFIC AND TECHNICAL MANPOWER

	Total		R&D
(a) Egypt -	593254 (1973)	------	10665
(b) YAR -	1394	------	60

(Source for the above data- "Science and Technology in Development of Arab States"- UNESCO publication Aug.1976- SC-76/CASTRAB/3).

The above data is given just to indicate the least development of the country and therefore the urgent need to assist it. The UNIDO has already declared under the LIMA Declaration its intention to assist the least developed countries (For relevant extract from the Lima Declaration please see Appendix NO.5). Not only that but the UNIDO has also taken some concrete steps and have established a separate section in their organization to make special efforts to assist the least developed countries (please see Appendix NO.6). It will be clear from this that the assistance is now available to these countries if they want to avail of it.

In this respect the following comments of Mr Toni Hagen Resident Representative, U.N.D.P. Sana'a made in 1971 are also applicable now

"The Indicative Planning Figure (IPF) of UNDP for YAR is $15 million for 72-76 which gives an annual budget of $3 million. This is one of the highest per capita IPF in the UN system but not nearly enough The sucess of UN system depends on recruitment of competent and suitable experts and of delivering the 'goods' in one time on one hand, but to no lesser degree on adoption of the recommendations of the foreign experts. This latee and decisive action can only be taken by the Government itself".

It is now for the Government to take full advantage of the Lima Declaration and the Special arrangements made by the UNIDO, for putting forth viable and economically important projects on priority basis, by providing counterparts and counterpart expenditure such as land, buildings, raw materials, transport etc. It is evident from the able planning that has been done for the First Five Year Plan by the YAR Government, that it is not only keen for rapid development but are taking concrete steps for fulfilling the targets. The following extracts from the Summary Tables prepared by the Economic Commision for Western Asia re: the First Five Year Plan of YAR (1976-77 to 1980-81) show this:

The Growth of Gross National Product (GNP) and Gross Domestic Product (GDP) during the Plan Period and the percentage contribution of various sectors. (Million Rials in const. = 1975=76 prices)

Table 1	Base Year Absolute	%	Target Year Absolute	%	AV. Annual Growth Base	% share Throughout the plan period
GDP	5181	100%	7671	100%	8.2	100.00
Agriculture	2306	44.5	3010	39.2	5.5	41.2
Industry	300	5.8	526	6.9	11.9	6.4
GNP	7751		10757		6.8	

Table 2 Investment envisaged in the plan period.
(M. Rials at const. prices of 75-76)

Expenditure	Absolute		% Share
Agriculture	2278	---	14.3
Industry	3545	----	22.2

Table 5 Employment by Economic Activity (Thousands) and the Respecti Productivity Increase in the plan period.

Sector	Base Yr.		Target Yr.		Percentage total increase		Production % increase
Agriculture	854.0	----	876.6	----	2.6	----	27.2
Industry	42.6	----	54.4	---	27.7	----	36.4

Another important factor has to be kept in mind in dealing with the Yemen Arab Republic as a least developed Country. Unlike some other least developed countries which virtually never developed in the past, the Yemen was comparatively a well developed country in the past. The earliest irrigation projects in the world (the Marib Dam, during the the rule of Queen Sheba about 2,000 years B.C.) were implemented here.

Then again though coffee was discovered in Ethiopia in natural state, its systematic cultivation was given to the world of Yemen. One need not depend upon historical L urels only but can take encouragement from it for future development. The development in Yemen was arrested for centuries due to various geographical, historical and political factors and when these impediments were removed during last 8 to 10 years it has again started on a march to the progress so this difference between some other least developed countries which were never developed before and Yemen which was comparatively well developed then has to be kept in mind as it shows the potentialities for progress.

Moreover during a very short span of 8-10 years Yemen has made a remarkably rapid progress and the potential in ability and finances is there once the impediments such as lack of education, lack of labour, lack of technical knowledge etc. are removed. Thus though Yemen is now a least developed country it has great potentials for development if technical assistance is made available.

(2) CONCLUSIONS

(2.1) Delays in recruitment of international and/or counterpart personnel

The Yemeni Arab Republic is one of the least Developed Countries where education has started only recently. Out of a total number of 31,315 of Government servants employed in the Government Department in the whole country 5,160 are illerate and only 691 are University graduates including 9 women. (Manpower survey- Table 11 and 13 page 44 Statistical Year Book-1976 by the Stastics Department Central Planning Organization). Out of the total number of 26 graduate employees in the Ministry of Economy at Sana'a in 1975, only 3 were having 'Scientific' degrees. There are no local persons having any degrees in 'Agricultural Engineerir Thus there is utter dearth of technical persons who can act as counterpart.

The Director General, Industries is a young and Enthusiastic person. He having received his post-graduate degree in U.S.A. speaks fluent English and in preparation of this preliminary report he virtually acted as a counterpart having taken keen interest in going through the progress reports and visiting the firms and farms with the expert. Since he has to control the Department of Industries, it is not possible for him to devote his whole attention to this subject and therefore for day to day working he assigned the work to two or three of his assistants. Considering the shortage of educated and qualified personnel in Yemen, this arrangement was considered adequate for this short term assignment of preparing the report.

When the project is finally approved it will be necessary to give first priority for training people both at high level, and at the workshop level.

It is absolutely necessary and vital that the Director General (Industries)is sent on an observation tour to countries like India, Pakistan and Japan for a period of 3 to 4 weeks and the proposed workshop-in-charge for a longer period of about 3 to 6 months in these countries for In-plant training at any Agricultural Engineering Research Institute as has been worked out in detail in the proposed workshop project placed below at Appendix NO. 16.

(2.2) C onditions of Local managerial andAdministrative set up.

The Department of Industries in the Ministry of Economy controls the establishment of Industries in Yemen. So far most of the industries started in Yemen are with a view for import substitution and good progress has been made in this direction during last 7 to 8 years.

With an open door policy adopted by the Government a large number of foreign industrialists are interested in starting their industries in this country. The Government has passed LAW NO.18 to encourage and to control such investment and Joint Ventures. The Industrial Promotion and Advisory UNit (I.P.A.U.) started under the technical assistance of the UNIDO and attached to the Ministry of Economy, Department of Industries is fulfilling the need for scrutinising and advising on the proposals received and if found satisfactorily, they are approved by the Government. In the years to come, the local staff will be trained and procedures laid down which will will be conducive to the development of Industries in Yemen. The desire and the ambition to improve and progress is there and the managerial and administrative capacity is evident in spite of the constraints elaborated in the next paragraph.

(2.3) Problems observed in processes applied or in equipment used.

The main problems observed which hinder or delay The development in Yemen are:-

(a) Lack of trained and educated personnel.

(b) Shortage of Labour both in urban and rural areas.

(c) Lack of communications - Road, telephones, port facilities, air services.

(d) High cost of all articles- which are about 2 to 4 times more than in other countries.

(e) High cost of locally produced goods or crops these are costlier than imported.

(f) Manpower shortage - About one million Yemenis have migrated to oil producing countries.

(g) Health Problems and working hours giving comparativly less overall work.

(h) Lack of Raw materials in the country wood, steel, oil, fuel etc. have to be imported.

(i) Very high cost/wages of skilled artisans

A skilled mason can earn 150 to 300 Y.R.'s per day or about 30 to 60 US $. An unskilled labourer gets about 30 to 40 YR (6to 8 US $).

(f) Shortage of labour in rural areas is likely to increase very rapidly, making it imperative to use labour saving modern agricultural machinery. Every year is important to offset the shortage otherwise agriculture will get heavy set back.

Keeping these serious problems in view, the recommendations in this report have been formulated. Wherever possible the suggestions to overcome the problems have been given but the magnitude of these problems is such that the decisions have to be taken at the highest level. No doubt the Government is aware of these problems.

(2.) **Financial aspects having a bearing on the projects objectives**

Finance is not the serious problem in Yemen. The inflation has been curbed and hard currency is available.

About one million (mostly young males) Yemenis have migrated for work to countries like Saudia Arabia, Kuwait, etc. and they remit every year about US. 100 million which are invested in Agriculture and Industries.

Moreover because of the liberal policy of the Government, lot of foreign capital is being attracted in Yemen.

In addition the Government has established

(a) The Agricultural Credit Bank by Law NO. 31 (1975) with a total loan target of 250 million Y.R. from 1976/77 to 1980/81 The Loans will be given for agricultural machinery, land reclamation, Agro-Industries, digging wells etc.

(b) The Industrial Bank of Yemen by Act NO. 55 of 1976 with the authorized capital of 100,000,000 Y.R. The Bank will encoure establishment of various industries in Yemen.

Both these banks will be in a position to satisify the requirments of industry and agriculture and what is required more is training, technical assistance, raw materials and infrastructure. Initially this has to come from outside assistance

(2.5) **Availability of skilled labour**

This is one of the biggest bottleneck which could only be solved by education, training and attracting youth from urban and rural areas.

This important aspect has been kept in mind while formulating the recommendations and preparing the workshop project.

(2.6) Advice provided to the Government Department

At the request of the Government, a preliminary feasability report on a small foundry has been prepared and placed below at Appendix NO. 15. The establishment of foundry will be useful for manufacturing pumps and fodder cutters. The technical know how or collaboration for a foundry project can be obtained from Pakistan or India which have experience in small foundries. The raw material-pig iron can be imported from Goa (India) or some other suitable source. The use of the local scrap has been included in the project. The machine for such foundry can be obtained from any industrically developed country. Only the modern labour saving machines have been recommended.

(2.7) Relationship of this project with other non-UNIDO projects being carried out concurrently in the same field (Information on Previous Missions is included under 'Introduction').

There are three such non-UNDP/UNIDO projects in Yemen which are doing some work related to agricultural implements and machines.

(a) West German Plant Perfection Project

Shoub Sana'a is meant primarily for all aspects of plant protection and has done commendable work in introducing sprayers, dusters and some agricultural tractors and implements

(b) Agricultural Mechanization Centre

Started by the U.K. Government at Taiz is also doing Pioneering work in training farm mechanics.

In the 2nd phase of the workshop project, ment has been made to utilize both these centres for establishing regional workshops with specialization in particular subject

Any financial or technical assistance under the 2nd phase of the workshop project could be made available to these two centres on mutually agreed terms.

(c) AGRICULTURAL MACHINERY AND AUTOMOBILE REPAIR WORKSHOP IN HODEIDAH under the assistance from ------- Korean Government . The project is likely to be in operation in about a years time.

With the establishment of the main workshop under proposed UNIDO Assistance on Sana'a, regional balance will also be obtained as the local needs of the other two big cities in Yemen i.e. Taiz and Hodeidah will be covered by the projects (b) and (c) mentioned above.

(2.8) Cooperation with other UN or Bilateral experts received. The whole hearted cooperation was received from by the UNIDO Experts of the Industrial Promotion and Advisory Unit attached to the Ministry of Economy, by the officers of the Industrial Estate Authority the Ministry of Agriculture and the Cental Planning Organization.

Also during the discussions with the Project Managers of the West German Plant Protection Centre in Sana'a. The prototype implements and machines that may be obtained under the proposed UNIDO workshop scheme can be given to the German Centre, the British Centre in Taiz and the Korean Centre in Hodeidah so that the independent test reports could be obtained under different soil, crop and climate conditions.

(2.9) INVOLVEMENT OF COUNTERPART STAFF IN PROJECT ACTIVITIES

The position regarding the counterpart staff has been fully explained in paragraph NO. (1) of this Intrduction.

(3) ————RECOMMENDATIONS

(3.1) Relation of Recommendations to the existing plan

The relation of the recommendations to the existing plans of the Government.

( ) Relation to Agriculture - The Government has given priority for agricultural development in their First Five Year Plan which has recently been formulated and discussed in an International Conference held in Sana' between 29th November to 2nd Dec. 1977. At present the fixed capital in agricultural sector is less than 13% of the country's total fixed capital assets. There is need to increase agricultural production and to reduce prices of agricultural produce which are generally higher than the imported ones.

Improved agricultural implements and tools for all the catagories of farmers (small, medium and large) will allow them to apply all other inputs such as water, seed, fertilizer and pesticides properly, thus increasing agricultural production.

In addition to suggesting suitable and improved agricultural implements for the use of the farmers, some special conditions in Yemen have been studied and kept in mind while making the recommendations. The important ones amongst them are:

(1) Shortage of Labour and high Cost of Wages- Unlike other least developed countries, labour intensive practices both in agricultural and in industry cannot be recommended for Yemen hence as many labour saving devices have been recommended as possible.

(ii) A Combination of hand tools and most modern and sophisficated machines has been recommended because the majority of farmers for years to come will still be using animal and manpower, hence for them the simple implements but the large farms, cooperatives and factories can and should use the most modern equipment available though of appropiate size. Therefore, paradoxial though it may seem at the fi st sight to a causual observer a simple 'sickle' or 'hoe' has to exist side by side in Yemen with a tractor, powertiller or automatic foundry or a combine harvester.

(iii) There is lack of wood in Yemen Mostly it is not imported, hence implements made out of wood have not been recommended. In some other least developed countries wood is available in plenty and the implements there can be made of wood and soil working parts of steels but not so in Yemen where steel will have to be used to manufacture implements.

(iv) There is acute shortage of fodder - To overcome this the fodder cutters for cutting sorghum (Dura) stalk have been recommended. They are both manually operated and power driven and tractor mounted.

(v) To conserve coal dust to reduce pressure on cutting of whatever shrubs are left a coal dust pallet making machine is suggested.

(vi) For hilly areas where some perinnial streams are available, the use of Hydraulic Ram to lift the water has been recommended.

(vii) Fertilizer in Yemen is in short supply and has only been recently introduced. There is however good response from the farmers to use fertilizers but it has to be imported Yemen has a lot of cattle and animal wealth and animals are slaughtered for food but the enormous quantity of bones are wasted.

These bones if collected and digested into bone dust and ground into powder can make excellent manure particulary for the fruit trees. Therefore use of such digesters have been recommended.

Thus it will be seen that the recommendations cover a wide field, all closely related to the National Plans and arise out of the urgent need based problems which were observed during the project.

(b) Relation to Industry - Similarly for the industries. The project aims at encouraging production of agricultural implements locally in small scale industries. The production of agricultural implements is already on the priority list of the Industrial Estate at Sana'a. The subsidar foundry project for which a preliminary feasibility report has been prepared aims at utilizing scrap-iron which is available in large quantities in Yemen and some of which is now exported. From 1970 to 1974 metal scrap worth (13+247+72 +186+200 = 668,000 Y.R.'s) about 13,400 US$ has been exported (Table 37, page 84 Value of M in Exports, Statistical Year Book 1976). Probably much more scrap is available and being scattered it may have to be collected but most of it is expected to be in 10 to 12 main cities of Yemen such as Sana'a, Taiz, Ibb, Dhamar, Yerim, Hodeidah, Mukhaa, Saadah etc.

From the tremendous progress made during a very short time (8 to 10 years) it is obvious that the Government has capacity to implement the recommendations, if urgent technical assistance and training are provided. As it stands now there are no financial constraints to impede the implementation of the recommendations.

The social constraints will get reduced as education spreads.

The main constraints are lack of technical knowledge, trained personnel, raw materials and the infrastructure. One sure step to overcome these constraints as far as the agricultural implements are concerned is to establish first a workshop as indicated in the workshop project at Appendix NO. 16 and train the personnel in Yemen as well as abroad. This is the first step on which depends future development. This project should receive the highest priority in the UNDP/UNIDO and some special steps will have to be taken to implement the project quickly instead of in a convention manner keeping in mind peculiar conditions in Yemen.

(c) To achieve quick results it may be necessary to design 4 or 5 implements suitable for conditions in Yemen. This work can be done in India, if approved by the UNIDO. The manufactured prototypes and some special parts can then be air-lifted for field trials in Yemen. The work of designing such useful implements and getting the prototypes manufactured is estimated to take 3 to 4 months in India and after the air-lift the field trials in Yemen for a period of about 3 to 4 months. The total weight of air-lift is not expected to be more than 800 to 1,000 Kg. including packaging.

This preliminary work is sure to give at least 2-3 good, new and improved labour saving implements for Yemen. The total cost for this is likely to be US 20,000. The above suggestion is made with advice to get quick positive results. Since there are no workshops facilities at present in Yemen (machine shop, blacksmiths shop, welding shop, foundry etc.) it is suggested to get them made in a country like India and tranship by air at least 2 to 3 of these improved implements for trial in Yemen.

Even after the workshop scheme as detailed in the Appendix 16 is sanctional by the UNIDO its implementation (i.e. installing machinery, training staff etc.) is likely to take one to two years. Since the need is urgent the above suggestion is made

(3.2) Availability of Resources

To examine the availability of resources it is necessary to examine the plans and provisions made by the Y.A.R. Government both for Agricultural Sector as well as for Industrial Sector as the recommendations given in this report come under both the sectors. Here it is necessary to emphasis that as far as the technical manpower resources and the technical assistance by way of equipment, prototype implements, testing instruments and raw material is concerned the resources in Y.A.R. are almost nil and outside assistance in general and particulary UNIDO'S further assistance is urgently required. Being the least Develope country amongst the other least Developed countries YAR's need is probably greatest. Though least developed the Government and the people are conscience of the need for progress, are ambitious and have the capacity to move forward. Whatever progresss has been made during last 6 to 8 years is spectacularly any standard Given the technical assistance, training and the raw materials there is no doubt that the country can implement the recommendations and it is here that the UNIDO's assistance on the highest priority basis is required.

On their own and as far as the financial resources are concerned, the Government has taken commendable steps to provide finances both to the Agricultyral Sector and to the Industrial Sector by:

(1) Establishin, An Agricultural Credit Bank in 1975

The total loan target for 1976-77 to 1980-81 period os 250 Million YR's which includes 60.4 M/YR's for Agricultural Machinery, 11.9 M/YR's. for Land Reclamation and farming, 30.8/M/YR's for water and well development and 11.4 M/YR's for Agro- Industries, storage and marketing. There are plans to open branches at places other than Sana'a, the personnel are being trained and where necessary assistance from foreign experts to evaluate the projects is being taken.

[illegible] short term loans were being given for poultry, cotton cultivation, bee-keeping and medium term loans [illegible] agricultural machinery 6,81,446 YR's.

The future plans include operation of tube well drilling equipment, pesticide machinery and for establishing agricultural schools.

(2) Establishment of the Industrial Bank of Yemen with the object to encourage establishment of industries in the country. T authorized capital of the bank is 100,000,000 YR's and it was started only in 1976 . The bank proposes to assist industries to evaluate feasibility studies and also to take up follow up action. The Bank'S Five Year Plan (1976-1981) includes total investment of 129 M/YR's out of which 69 M/YR' S will be from the bank and 59.3 M/YR's from the client participation. The aim is to increase GNP by 7.2% annually as decided by the Government. The bank will start its operation towards the end of 1977. The Banks plan was based on the assumption of 10% increase in its paid up capital. However the Government Contribution and preference shares subscribed by the private sector exceeded all expectations in the 1st two years.

	Total Planned	/	paid UP
1976-1977 -	31	----	37
1977-1978 -	16	----	23

This reflects the strong intentions to develop the industrial sector. A good working relation has been established with the Industrial Development centre for Arabic countries (IDCAS), the Arab Banks Association, the IBRD (International Bank for Reconstruction and Development) and its affiliates the IFC and IDA.

Recently DEG Offered to subscribe in the Banks share capital by 5 to 6%. It also promised to encourage German Industrialists to Participation with Yemen private sector in establishing viable industrial projects.

Moreover the Kuwait fund for Arab Economic Development has granted the Bank technical assistance aid to recruit experts and train some local staff in banking operation. By adopting open door policy and providing proper incentives and guarantees (Law NO. 18 of 1975, please see extracts at paragraph NO. on page) the Government has created the right envoirment for the industrial investment.

In the Industrial Estate established recently at Sana'a, the manufacture of agricultural implements is on the priority list.

Thus it will be clear that as far as financial resources are concerned the position in YAR' is sound. It is only for providing for training, and technical assistance that the country needs UNIDO's assistance. Once with this assistance, the useful agricultural implements are identified, tested, modified to suit local conditions, the designs are standardised demonstrated to farmers, the extension workers and farm mechanics and agricultural engineers trained locally and abroad, the other things will follow and the momentum created by such UNIDO assistance will take care of future developments as the finances are available as indicated above.

(5.3) As explained in the above paragraph the investment is no problem in the YAR. It is the initial technical assistance, provision of trained personnel and provision of raw materials that is the real bottle neck. Out of 6.5 million total population about one million Yemenis are working in other countries like Saudia Arabia, Kuwait etc. and it is estimated that they send an appreciable amount of money back to Yemen which is normally invested in agriculture or industries. The amount is estimated to be U.S. 100 Million annually.

Moreover Yemen gets a very large amount of financial assistance/ Loan from other oil-rich Arab Countries, therefore, at present there does not seem to be any special efforts to be made to get outside investment.

(3.4) In the first phase, training abroad is absolutely necessary as there is absolute dearth of trained men and there are no training institutions in agricultural engineering line in YAR.

For higher officers of the Ministry of Economy such as the Director General (Industries), it is suggested that observation tour for a period of about 3 to 4 weeks to Pakistan, India and Japan will be very useful. In this observation tour he should visit Asian Institute of Agricultural Engineering established by Escap, (Economic and Social Commision for Asia and Pacific) [illegible] and Agriculture College and Agricultural Engineering Division at Layalpur, and Pakistan Engineering Company's foundry. In India the Indian Agricultural Research Institute, New Delhi and the Ministries of Agriculture and Industry, the extension training centre at Agra, Okhla Industrial Estate, New Delhi and American Spring and Pressing Works, Bombay. Thereafter he should see the central Agriculture Machinery Research Institute near tokyo, Kubota or Yanmar Power-tiller factory and CECOCO museum of agricultural implements suitable for terrace cultivation. This observation tour would give all round picture of agricultural implements, designs research, testing, training, popularization and manufacture which will immensely help YAR in implementing the recommendations in this report. He may also study during this tour the organizat the procedures followed in the working of the Industries Departments in these countries.

For middle level workers, foremen, supervisors, trainers they could be sent to tractor and machinery testing station, Alexandria (Egypt) or for in-plant training either in India or Pakistan. Before giving them fellowships for training a bond should be taken from them that they will serve the YAR Government at least for a period of five years. This will ensure continuity and avoid rapid replacements of trained personnel. Later on the workshop established under the UNIDO assistance can start their own training courses preferably in Arabic Language.

(3.5) Decisions at high level

As far as these recommendations are concerned, the decisions at the high level relate to provision of counter-part staff, on a fairly long basis, provision of US 100,000 for the establishment of the workshop at S na'a (The Government's Contribution) and the provision of a Land-rover with a driver for carrying out field trials of the implements.

(3.6) Administrative framework and Administrative skills needed to carry out the recommendations

A joint high level advisory Committe consisting of the following be appointed to review and make recommendations regarding all aspects of agricultural machinery.

(1) H.E. The Minister for Economy- Chairman.
(2) H.E. The Deputy Minister for Economy-vice chairman member
(3) Chairman, Industrial Estate authority "
(4) A representative of Agricultural Ministry "
(5) A representative of the Manufacturers. "
(6) A representative of a tractor dealers "
(7) A representative of progressive farmers. "
(8) Project Manager, of Agri Mechanization centre, Taiz "
( ) , Shoub "

(9) Project Manager of the German Plant Protection Centre, Shaub, (Jeneca) --Member.

(10) A representative of I.P.A.U. (Industrial Promotion and Advisory Unit) --Member.

(11) The Director General (Industries) is Conveynor or Member Secretary

The Committe may meet at least twice a year and follow up action should be taken on the recommendation made by this Committe.

THE SPECIFIC RECOMMENDATIONS

The recommendations are arranged in order of their importance and priority. Regarding specific recommendatic of hand tools, Animal driven implements and power driven equip equipment, it is impossible to give placement according to priority because in each of the above groups some implements are more important than others. Therefore under each of the above mentioned groups six implements have been chosen as coming under catagory one and these are given in the following chart. The rest of the tools, implements and machines are mentioned separately but without any classification. If the 26 recommendations given in the following chart are first implemented as priority one recommendation, the rest of the recommendations may be grouped as priority two.

The first eight recommendations are mentioned in order of their priority, the first three amongst them are the most important and if implemented will give the quickest and most positive results and would act as a base or foundatic for further future developments on right and scientific lines and put the Agricultural Mechanization on sound foundations on the following chart.

(The numbers indicated in the brackets such as B.4, A-1 etc. refer to the list of identified implements as given in Annexure 1of Appendix NO. 16---).

In making the recommendations Technology Transfer ~~this~~ has been considered and most of the recommendations concerning the designs or types are based on experience gained in India, Pakistan, Japan, Phillipines, Germany and Italy, Uganda, U.K. U.S.A., U.S.S.R., etc. with emphasis on Appropriate Technology.

The recommendations regarding specific improved agricultural implements, tools and power driven machines which look promising for conditions in Yemen are listed below. For easy identification their sketches and brief description is also given. It is proposed in the workshop scheme to obtain a few samples or prototypes of these for trial purposes and if proved successful, to manufacture them in Yemen initially in the same workshop and as the demand rises in the small scale industries both in public or private sectors.

RECOMMENDATIONS

(In order of Priority, 'R' refers to recommendations)

(R.1) Establishment of Workshop (Appendix-16-)

A- Sanctioning the scheme

B- Observation and Training Tours.

(R.2) Suggestion for Quick Results

(R.3) Power-tiller and Small tractor

(R.4) Bullock breed, shoeing, Nagpuri Yoke.

(R.5) Hydraulic Ram

(R.6) Solar Energy use (D-3)

(R.7) Bone-Digestor (D-5)

(R.8) Bio-gas plant (D-4).

(IV)

(A) Hand tools	(B) Animal Driven Implements	(C) Power Driven Equipments
(R.9) 1. Winnowing fan (A-1)	(R.15) 1. Steel Bladed Harrow (B-4)	(R.21) Tractor Mounted fodder cutter (C-5)
(R.10) 2. Cotton Stalk puller (A-4)	(R.16) 2. Multipurpose tool bar with plough, ridger and 3 row seed-drill (B-8)	(R.22) 2. Tractor with offset Implements (C-12)
(R.11) 3. Secateur-Double lever (A-15)	(R.17) 3. Single row cotton planter with fertilizer attachment (B-14)	(R.23) 3. Combir harvester for wheat (C-16)
(R.12) 4. Hand seedrill & hoe (A-8)	(R.18) Small turnwrest Mould Board plough (B-2)	(R.24) 4. Tractor powered wheat thresher (C-6)
(R.13) 5. Chaff or fodder cutter (A-5)	(R19) 5. Steel Bladed hoe and Akola Hoe (B-15)	(R.25) 5. Scarifier (C-2)
(R.14) 6. Maize Sheller (A-3)	(R.20) Soil Scoop or scraper small size (B-10)	(R.26) 6. Road-roller (using heavy tractor (C-15)

RECOMMENDATION NO.1 ESTABLISHMENT OF WORKSHOP

(A) The details for the establishment of the workshop under the UNIDO technical assistance is given in Appendix-16 -

The total cost of the workshop is estimated at $ 800,000 out of which $700,000 is the share of the UNIDO and $ 100,000 the share of the Government of the Yemen Arab Republic.

(B) After the approval and sanction of the scheme by the UNIDO the first thing that is recommended to be done is training—sending the higher officers on ~~ans~~ observation tour so that they get the idea of what developments have taken place in Pakistan India and Japan and for in-plant training to two or three engineers foreman etc. Being very important high priority has been given to this.

RECOMMENDATION NO.2 SUGGESTION FOR QUICK RESULTS

Even after receiving the approval of the workshop scheme from the UNIDO, actual establishment and operation of the workshop is likely to take one to one and half years. During the this time the training as recommended in (B) above should be given priority number one and if quick results are aimed at, one consultant may be allowed to work in a place like India for 2 to 3 months actually designing and preparing 5 to 6 implements suitable for Yemeni Conditions, to air-lift these prototypes and to allow the consultant to take their field trials in Yemen, modify them if necessary and thus to make available to the Yemeni farmers at least three implements (1) One hand tool (2) One animal-drawn implement (3) One power driven implement Since there are no workshop facilities, raw-materials etc. at present in Yemen, this suggestion has been made.

In the case of other developing countries, the implements could be designed and produced in the country itself but in the case of the most least developed country like Yemen some special efforts to get quick results are required and conventional method of working has to be repalced by some such arrangements.

Once the confidence is created in the local people that good implements can be designed and are acceptable to the farmers the future developments can take place in the proposed workshop.

The amount of $96,000 has been shown against the services of the consultant in the workdhop scheme which will cover salaries, travel expenses, air-freight, raw materials, and the cost of making and testing these implements.

RECOMMENDATION NO. 2 INTRODUCTION OF POWER TILLERS AND SMALL TRACTORS (Figure NO'S 1 to 10)

For 50% farmers in Yemen during next 20 to 25 years, the mechanization of agriculture will be through the use of Power-tillers (walking type tractors of 5 to 10 H.P.) and small tractors of 10 to 15 H.P. For the rest of the 50% farmers mostly hand tools and improved animal driven implements have to be provided.

The prospects of availability of farm labour in Yemen in years to come are such that there is no escape except to use proper type and size of power driven equipment. The prime mover or source of power for these will be power-tiller and small tractor.

There is most urgent need now to make detailed feasibility study of these with the aim to:

( ) Identify the size of the power tillers and tractors.

(b) to identify which implements could be worked by them.

(c) to settle on some standard designs.

(d) to examine whether petrol (gasoline) or diesel fuel will be better.

(f) to make programme for progressive assembly of power tillers in Yemen.

POWER-TILLER WITH ATTACHMENTS

FIG. No. 1:- HOEING AND

FIG. No. 2:- PLOUGHING

FIG. No. 6:- SMALL POWER TILLER

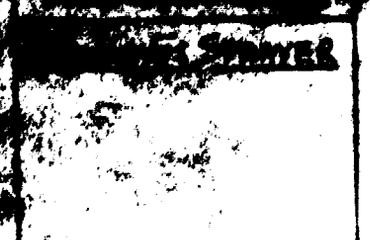


FIG. No. 7:- PUMP

FIG. No. 8:- WITH SEAT

← LAWN MOWER.

(g) to make as a second phase a program of for progressively manufacturing them locally at least 70 to 80% parts.

It is strongly recommended that such a feasability study be made on priority basis. The study would require about 4 to 6 months.

There is absolutely no doubt that once these powertillers and their attachments are made known and are demonstrated to the Yemeni farmers, they will go in for them in very large numbers necessitating progressive assembly and then progressive manufacture of them in Yemen.

In Japan where millions of these power-tillers are in use, about 20 years back when they were introduced, they became so popular that a girl would not marry a farmers son unless he had a powertiller which reduced drudgery in farming operations!

RECOMMENDATION NO.5 'THE USE OF HYDRAULIC RAM' may be given trial in hilly areas near Taiz and Ibb where some perennial but small streams are reported to be available (Figure NO'S 14 and

In hilly areas irrigation by modern methods using electricity or diesel pumping sets is difficult because the areas are usually inaccessible for want of roads or electricity is not available there nor can heavy tractors go and work on such terraced farms. In many such hilly areas, if there are small perennial streams with high gradient an useful tool will be a hydraulic ram.

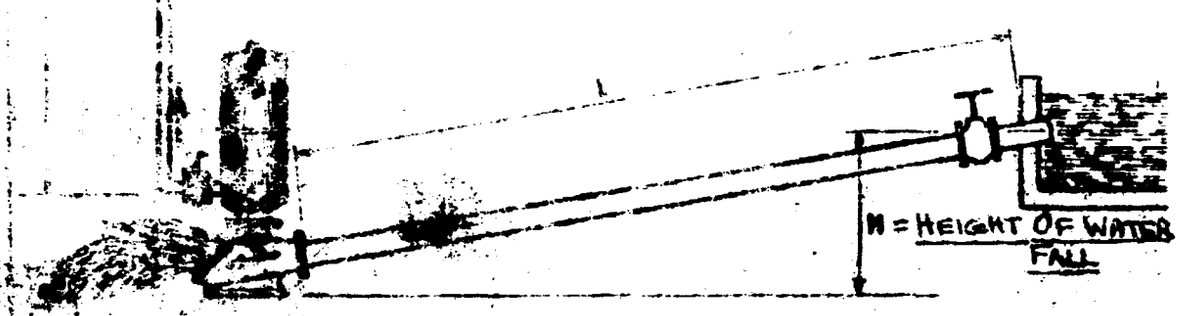


FIG. NO. 14 :- HYDRAULIC RAM

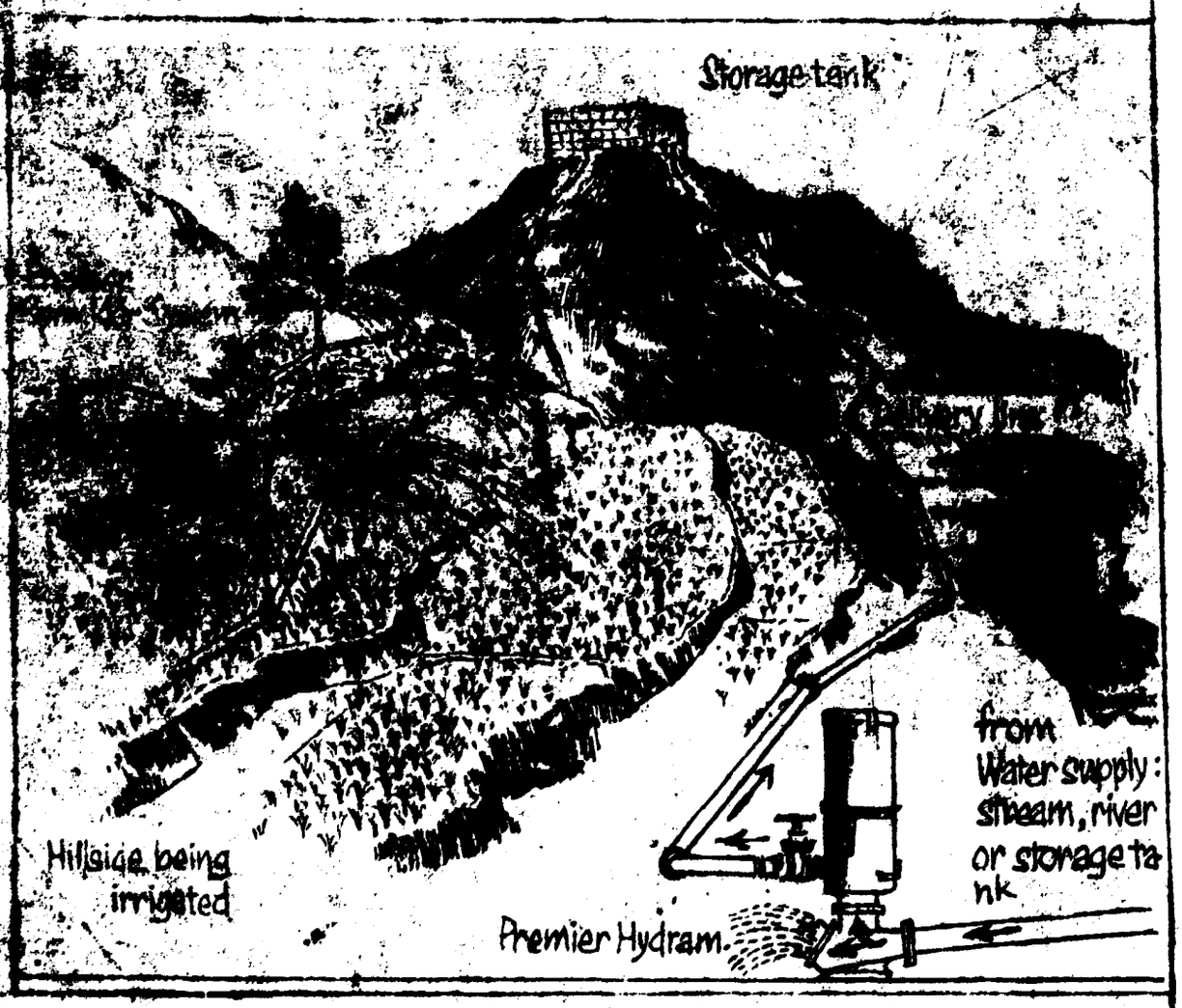


FIG. NO. 15 :- HYDRAULIC RAM WITH SPRINKLER IRRIGATING TERRACED FIELDS

This instrument does not require electric power or engine power to work it. It requires only perennial streams with high gradients to create hydraulic pressure to lift the water. The efficiency of this implement can be as high as 70 to 80% and water can be lifted to a height 30 times the height of water fall.

The following are the advantages of the hydraulic ram:-

(1) It does not require any other external power such as an oil engine or electricity.

(2) It operates 24 hours a day and water lifted can be stored.

(3) The maintenance cost is very low as it has no rotating or resiprocating part.

(4) The water from storage tank can be carried to the fields through open channels or more profitably and efficiently be used for sprinkler irrigation.

The principle involved in the hydram is that the energy of the flowing water is used by means of hydraulic pressure in the cylinder to lift part of the water to a greater height. Depending upon the high gradient and the quantity of water flowing, normally 3 to 25% of water flowing through the ram can be lifted. Thus it utilizes the momentum of a relatively large flow of water under small head to raise a smaller quantity of water against a large head. The water from a stream is fed into the hydraulic ram which gets energy from this flowing water and lifts a portion of it to a higher level.

The initial cost which seems somewhat high at first sight is quickly made up by the saving gained through not using expensive diesel fuel or electricity.

Typical Examples

3,000 ft. (1) above sea level	Size - 2"x1"	cost of tank 3000	cost of ram 4600	Capacity 7000 gc per 24 hs	acres 2.5 (5)
4,500 ft. (2) above sea level	" "x2" Two units arranged in battery	4000 (US$ 10,000)	45,000	35,000	15 (30) and drinking water to village
4,500 ft. (3) above sea level	" 8"x4"	50,000 including sprinkler and tank (US$ 15,000)		70,000	30 (60)

These actual trial examples prove utility of hydraulic Rams in hill areas where terrace cultivation is followed.

The sprinkler irrigation should be recommended where the levelling of land is not possible or where the irrigation water is to be highly economised and for raising of cash crops particularly for export quality goods like fruits and vegetables. The water can be stored in plastic lined earthern tanks. The hydraulic Ram to be sucessful must have:-

H = 15ft. minimum

L = Hx8

h = up to Hx30

Gallons per minute raised Q = $\frac{\text{Available drive water W say 400 gpm xHxr}}{\text{20 hx (Effiency)} \div \text{h or 100 ft.}}$

efficiency = (L/H or 100/20= 5) = 0.75

$$Q = \frac{100 \times 20 \times 0.75}{100} = 60 \text{ gallons per minute approximately}$$

Typical Efficiencies for L/H ratio are

L/H -	2	4	6	8	10	18	25
EFFY -	0.85	0.80	0.75	0.65	0.60	0.45	0.40

RECOMMENDATION NO. 6

THE USE OF SOLAR ENERGY

There is plenty of sunshine in Yemen. The solar energy could be used for heating homes, for heating water etc. thus saving valuable fuel. Efforts should now be made in utilizing solar energy.

The detailed information is given in Appendix NO. 12, part 11 under the captaion availability of power in Yemen

On 15/1/78 an International Conference on the use of solar energy has been held in New Delhi, India attended by about 1,000 scientists including, 300 delegates from other countries. The minutes of this conference and the papers presented there may be very useful as they will give the latest information on this subject. It is recommended that there minutes be obtained.

RECOMMENDATION NO. 7 Bone-Digester

It is recommended that the 'Bone - digesters' be used to produce bone - mill manure (Figure NO. 16--)

Thousands of animals are killed in Yemen for food purposes. The bones are not at present being used. Bone-mill is an excellent manure for fruit trees and vegetable crops. Ordinary bones are hard and cannot be crushed and made into powder.

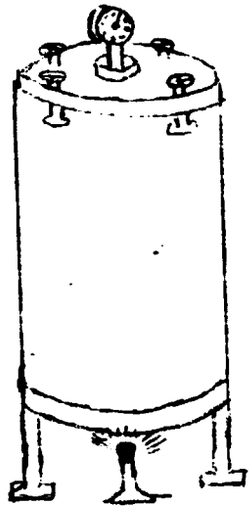


FIG. 16-BONE-DIGESTOR

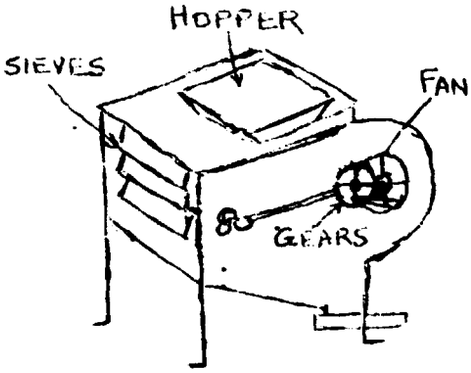


FIG. 19- WINNOWER.

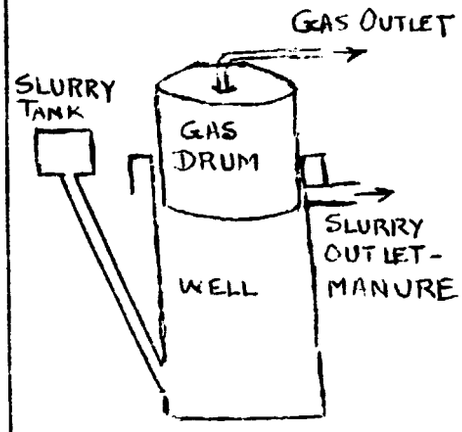


FIG -17. BIO-GAS PLANT

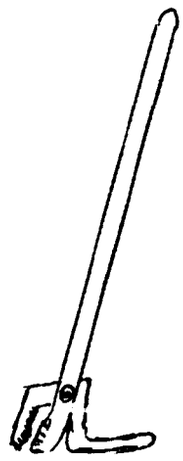


FIG. 20-COTTON-STALK PULLER

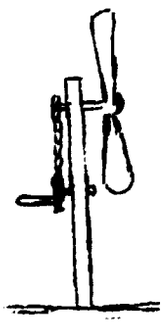


FIG. 18-WINNOWING FAN

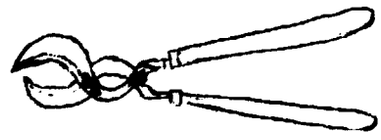


FIG. 21-SECATEUR.

Hence they are digested in a pressure vessel which makes them brittle and can then be easily ground into powder and sold to farmers or even exported. The bones can be collected from butcher's shops or slaughter houses, by the Rural Development Associations in Yemen and can be processed by them on cooperative basis.
It is estimated that out of an estimated 16,000,000 animal population in Yemen at least 20% are killed every year giving 800,000 A[illegible]
Taking average weight of bones per animal as 25Kg. 800,000x 25 = 20,00,000 Kgs. of bone out of these even 50% is collected gives about 10,00,000 Kg. of Bone-mill.

RECOMMENDATION NO. 8 BIO-GAS PLANT

(Figure NO. 17---)

Since there is quite a large population of cattle, sheep and Goats, camels, donkeys in Yemen, in many areas where temperatures are high, the animal refuge (dung or Excreta) can be processed in simple bio-gas plants. In these plants a small well 5 feet in diameter and 8 to 10 feet deep is used to put the slurry of the animal refuge and the methane gas produced by bacterial action is collected and used as fuel for cooking and heating water. The residue that comes out of this plant is useful manure having high nitrogen content. Thus no manure is lost and fuel in remote areas is made available. The bio-gas plants, therefore may be given trial in Yemen.

RECOMMENDATION NO. 9 - WINNOWING FANS AND WINNOWERS

(Figure NO'S 18 and 19)

If the winnowing fans are used it will not be necessary to wait for natural wind for winnowing (separating grain from chaff from the threshed material).

Hand operated, pedal driven, bicycle driven winnowing fans or for large farms the sheet metal winnowers are now available.

RECOMMENDATION NO. 10 - COTTON STALK PULLER

(Figure NO. 20)

In the Tihama region where cotton cultivation is being practiced a simple cotton stalk puller as shown in the figure can be used as a labour saving devise to uproot the cotton plants when all the cotton has been picked up. The cotton plant has deep tap root system and requires great efforts to pull it out of the soil. The use of the cotton stalk puller does the work with less effort and with more speed because of the mechanical advantage gained through the use of a lever like a nail puller.

RECOMMENDATION NO. 11 - Secateur

(Figure NO. 21---)

For prunnig coffee plants the double-lever French secateurs be used as their use requires less effort and labour. To improve the quality of present day coffee in Yemen and bring it to the level of famous old day 'Mokha' coffee efficient prunning of coffee plants is necessary.

RECOMMENDATION NO. 12 - Hand seed-drill and wheel hoe

(Figure NO'S 22 and 23)

To introduce hand-seed-drill and hand wheel hoe for sowing and interculture on terraced fields. These are light implements and could be carried on the hill slopes. The planet-junior type implements are useful for vegetable gardens near cities.

Wherever necessary two men - one to pull and one to guide the implemer may be used or a single animal can also be used to pull the drill and the hoe.

RECOMMENDATION NO. 13 - Fodder Cutter

(Figure NO'S 24-----)

There is shortage of fodder in Yemen. Sorghum stalk (Dura) is fed to the cattle.

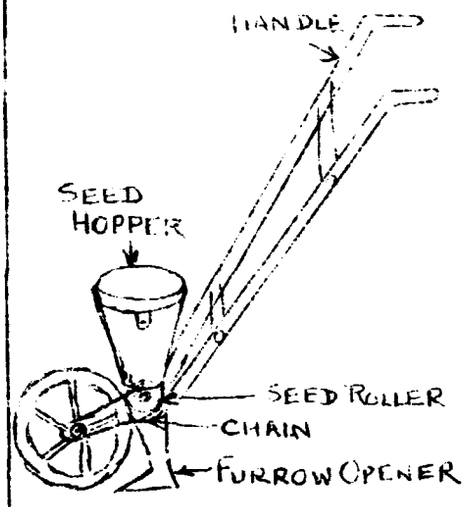


FIG. 22 - HAND SEED-DRILL.

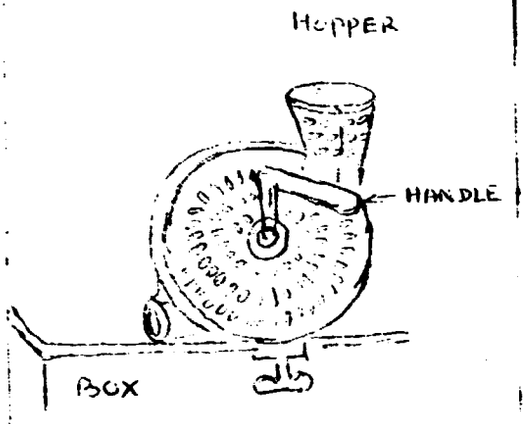


FIG. 25 - MAIZE OR CORN SHELLER

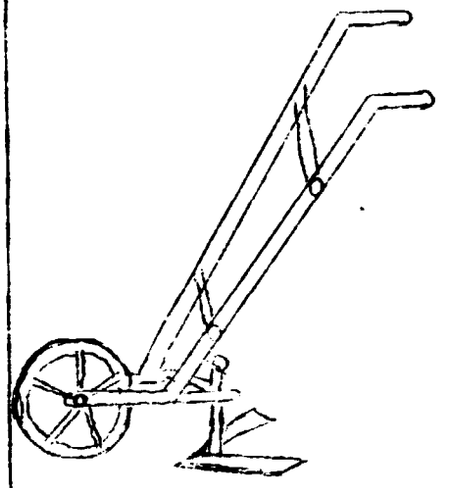


FIG. 23 - WHEEL-HOE.

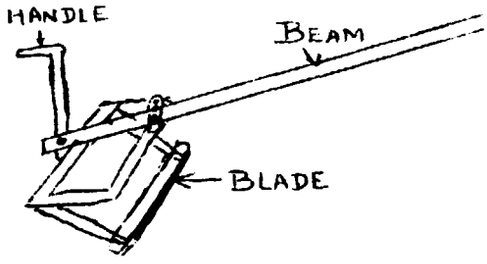


FIG. 26 - STEEL BLADED HARROW

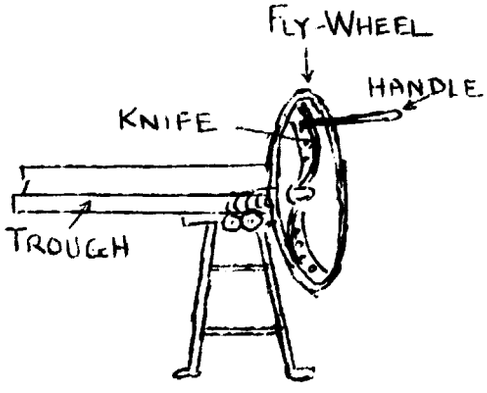
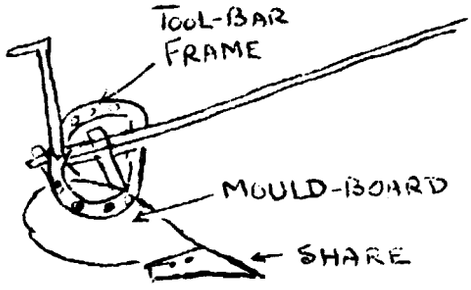


FIG. 24 - FODDER-CUTTER



- MULTI-PURPOSE TOOL-BA
FIG. 27 WITH PLOUGH

Much of it is not eaten by the animals because it is hard. Animals eat only the leaves and the top soft portion. To make the best use of the available fodder it is suggested that it may be cut in to small pieces of ½" inch length either for direct feeding or for making a silage. In remote areas an hand operated machine be used but in valleys a tractor-mounted machine can work on custom or hire basis, cutting the fodder at great speed. This will allow the existing tractors to be used for a longer period in the year making them more profitable.

RECOMMENDATION NO. 14 - Maize or Corn Sheller

(Figure NO. 25)

Maize or corn is an important crop in Yemen, but the individual area may be small. Hence small and simple hand maize sheller which could be fixed on a wooden box can be used. If the area is large or it is contemplated to use the machine on a co-operative basis, the pedal operated or power operated machines can be used. By using any of these machines clean grain is obtained as against beating with a stick when it is mixed with chaff and needs to be cleaned later on.

RECOMMENDATION NO. 15 - Steel-bladed Harrow

(Figure NO. 26)

In Yemen, the wooden plough used by the farmers is essentially a cultivator doing shallow cultivation of 5 to 6 inches. The steel bladed harrow will be able to cover 3 to 4 times more area than the wooden plough. It is a light implement which could be carried on the hill terraces. The length of the steel blade can be kept from one foot to two feet according to power available or according to the moisture content of the soil. This adjustment has been provided in the implement. This implement may be termed as an animal driven scarifier . This is a labour saving implement.

RECOMMENDATION NO.16 - Multipurpose tool bar with plough, ridger,and a 3-row seed-drill

(Figure NOS 27 28 and 29)

This implement is recommended for medium sized farms in valleys. All the three attachments can be fixed as desired, on the tool bar. At present dura (Sorghum) or wheat is sown by a wooden plough with one tube attached to it. With the tool bar implement and a specially designed seed bowl as shown in the figure Three rows can be sown, thus saving labour at peak hours of sowing. With the ridger attachment water cahnnels or furrows and ridges for sowing Potatoes, tomatoes and other vegetables can be made.

RECOMMENDATION NO. 17 - Single row cotton planter with Fertilizer attachment (Figure NO. 30----------)

These are available for animal traction and also for tractor mounted operation. The placing of seeds and fertilizers is done accurately at the distance desired and in quantities required. This will be very useful implement in the Tihama or in other places where cotton cultivation will be introduced. The fertilizer being in short supply in Yemen and being imported needs to be caredully and sparingly used. The fertilizer attachment can do work satisfactorily. It is expected that with the introduction of this precision implement the cotton production will increase

RECOMMENDATION NO. 18 - Small turnwrest Mould board plough

(Figure NO. 31----------)

The smallest size amongst them is recommended. This will be useful in terraced fields as well as in valleys. The direction of the mould board can be changed at the end of the furrow. It can be pulled by a pair of cattle or by one camel.

RECOMMENDATION NO. 19 - Steel bladed hoe and AKOLA HOE

(Figure NO'S 32)

These are very useful for intercultivations of field and vegetable crops.

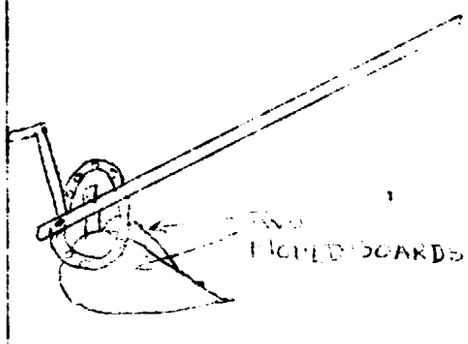


FIG. 28 - TOOL BAR WITH RIDGER ATTACHMENT

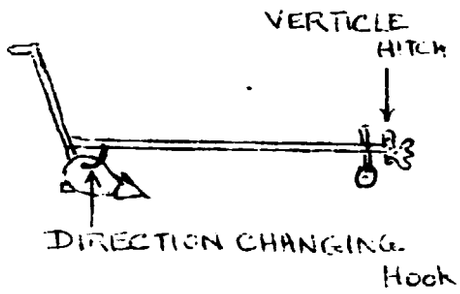


FIG. 31 - SMALL TURN-REST MOULD BOARD PLOUGH

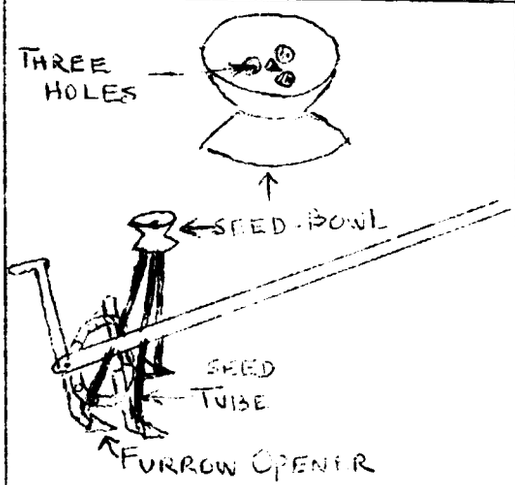


FIG. 29 - TOOL BAR WITH 3-ROW SEED-DRILL

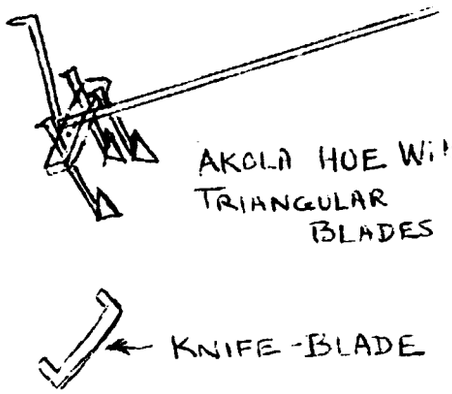


FIG. 32 - AKOLA HOE

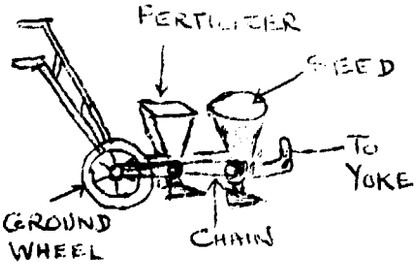


FIG. 30 - SINGLE ROW COTTON PLANTER WITH FERTILISER

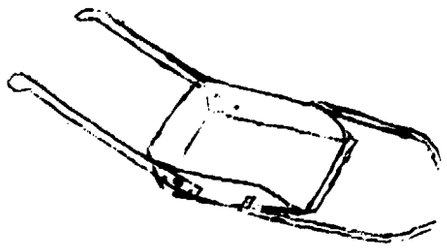


FIG. 33 - SOIL-SCOOP OR SCRAPER

The length of the steel blade can be 6,9,12, or 15 inches as desired and according to the distance at which the crop is sown and its stage of growth. For hard soil particularly in cotton growing areas the three time Akola hoe with sharp triangular blades is recommended. These are labour saving devices and can do about 3 to 4 times more work of weeding than the human labour.

Moreover for dry-land farming they are useful as they create a soil-mulch on the soil, breaking the capillary tubes and stopping the flow of moisture to the top of the soil, thus saving or conserving the moisture.

(The Steel bladed hoe is exactly like the steel bladed harrow shown in Fig. 26 but small size)

RECOMMENDATION NO. 20 - Soil Scoop or Scraper

(Figure NO. 33)

This is an useful implement for soil conservation and for levelling the land. For Yemen the capacity should be small 1 to 1½ cubic feet as the cattle are small. The soil should first be ploughed and the loose soil can then be carried to shallow areas where it is to be dumped. This is also a labour saving device as compared to the use of human labour.

RECOMMENDATION NO. 21 - Tractor Mounted fodder cutter

(Figure NO. 34)

The use of this has been described under the Recommendation NO. 13. A stationary power driven fodder cutter can also be used. It could be worked by tractor power by using pulleys and a belt. For agricultural this is a very useful. Various sizes are available to suit horse power and the drive. The length of cut can be adjusted.

RECOMMENDATION NO. 22 - Tractor with off-set Implements

(FIGURE NO. 35)

These are commonly used in Italy and other hilly countries in Europe and are useful in orchards. In Yemen they will be useful in banana and date-palm plantations and also on lower terraces. The advantage is that the heavy tractor does not go very near to the terrace edge but only the implement works there therefore there is less danger of the terrace wall collapsing with the weight tractor.

RECOMMENDATION NO. 13 - Combine harvester for wheat

(Figure NO. 36)

With the increasing shortage of labour at peak hours of harvesting time the use of power driven machines for harvesting and threshing is bound to increase. Not all areas in Yemen are on hill terraces In the valleys the land is fairly level and the farm plots big enough and there is no reason why the combine harvesters cannot be used. Probably so far their use has not been known to the farmers. If demonstrated they would become popular. Tractor mounted, trailed or self-propelled combine harvesters in various sizes are available to choose from. They can be used on custom hiring basis by the Agro-Service centres or by the farmers on co-operative basis . There is a great future for these machines as one standard combine harvester can do 4 acres of wheat harvesting, threshing, winnowing and bagging per hour . All these operations in quick sucession and very efficiently. For four acres to carry all these operations by human labour would require 5 to 10 days. Moreover the cost per acre or per hour will also not be much and the farmers would come forward to pay say 200 YR's per hour to get their crop harvested and threshed.

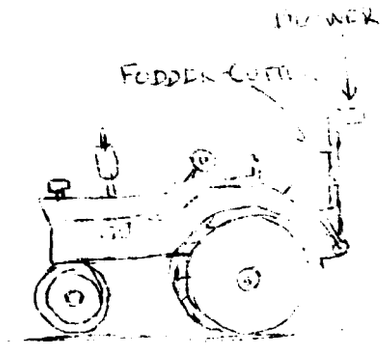


FIG. 34 - TRACTOR MOUNTED FODDER CUTTER.

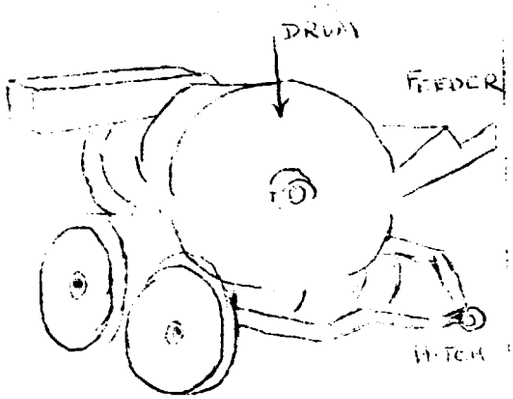


FIG. 37 - TRACTOR POWERED WHEAT THRESHER.

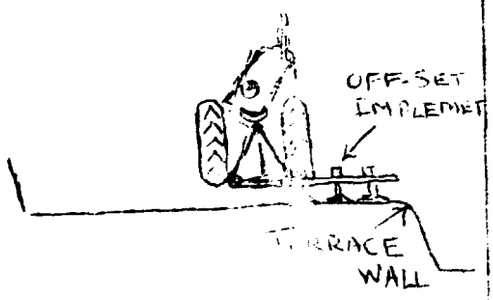


FIG. 35 - TRACTOR WITH OFF-SET IMPLEMENT.

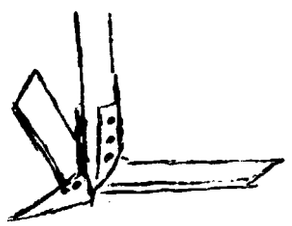


FIG. 38 - SCARIFIER BLADE.

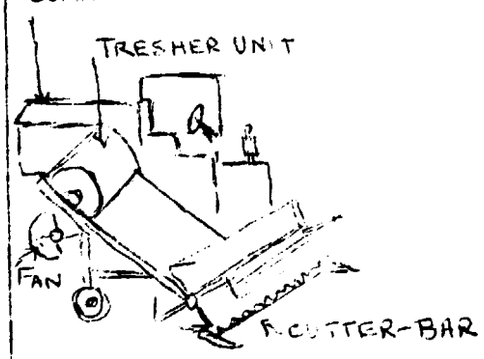


FIG. 36 - COMBINE HARVESTER

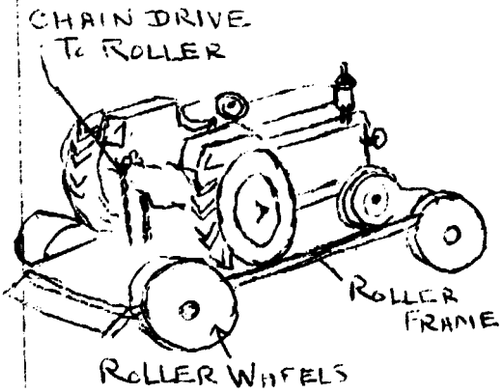


FIG. 39 - ROAD ROLLER USING TRACTOR AS PRIME-MOVER

Smaller machines for hilly or slopey areas are also available On some machines there is adjustment on the cutter bar to self align itself according to the level of the land.

RECOMMENDATION NO. [illegible] - Tractor powered wheat or dura thresher (Figure NO'S 37)

Where the combine harvesters cannot go, the power operated threshers can be used. In addition to threshing the grain they also cut the stalk in to fine pieces making the stalk more palatable to the cattle as a fodder.

Machines only for threshing or both for threshing and winnowing are available.

RECOMMENDATION NO. 25 - Scarifier

(Figure NO. 38)

For soil conditions in Yemen, the use of scarifier in place of heavy mould board plough is recommended as it will help conservon the soil and will give more area per hour, thus reducing the labour. Where the land is too much infested with deep rooted weeds, the deep-ploughing may be practiced but normally shallow cultivation to a depth of 5 to 6 inches is enough.

RECOMMENDATION NO. 26 - Road-Roller using a tractor as prime mover (Figure NO. 39)

Roads, one of the major items in infrastructure, are being constructed in Yemen. The highways can be constructed by the regular machines, but the connecting roads in rural areas can well be constructed by using the road-rollers which are specially designed and on which a tractor is mounted to give power. After the road work is done the tractor can be used for other agricultural operations.

The Rural Development Associations can undertake this work and a tractor can be hired from one of the farmers. This will also give more tractor hours for the farmers making its use economical.

So far the more important recommended implements, tools and machines have been described. The less important useful implements are listed below:

RECOMMENDATION NO 27 - HEAVY DUTY CULTIVATORS

Where it is necessary to plough the land deep as in Yemen, heavy duty cultivators or tillers seem to be best suited. They may have 11 to 16 tines depending upon the power available. The tines are usually double spring loaded to reduce shocks by stones or roots. These cultivators cover larger areas and work the land to about 4 to 5 inches thus not allowing the soil erosion if heavy rains fall. A depth adjusting wheel is provided if necessary. The tines should be made of good quality steel and the shovels of high carbon steel, heat treated for long wear. Standard three point hydraulic linkage for catagory I or II is usually provided by the manufacturers and matching tiller should be used to suit the horse-power of the tractor.

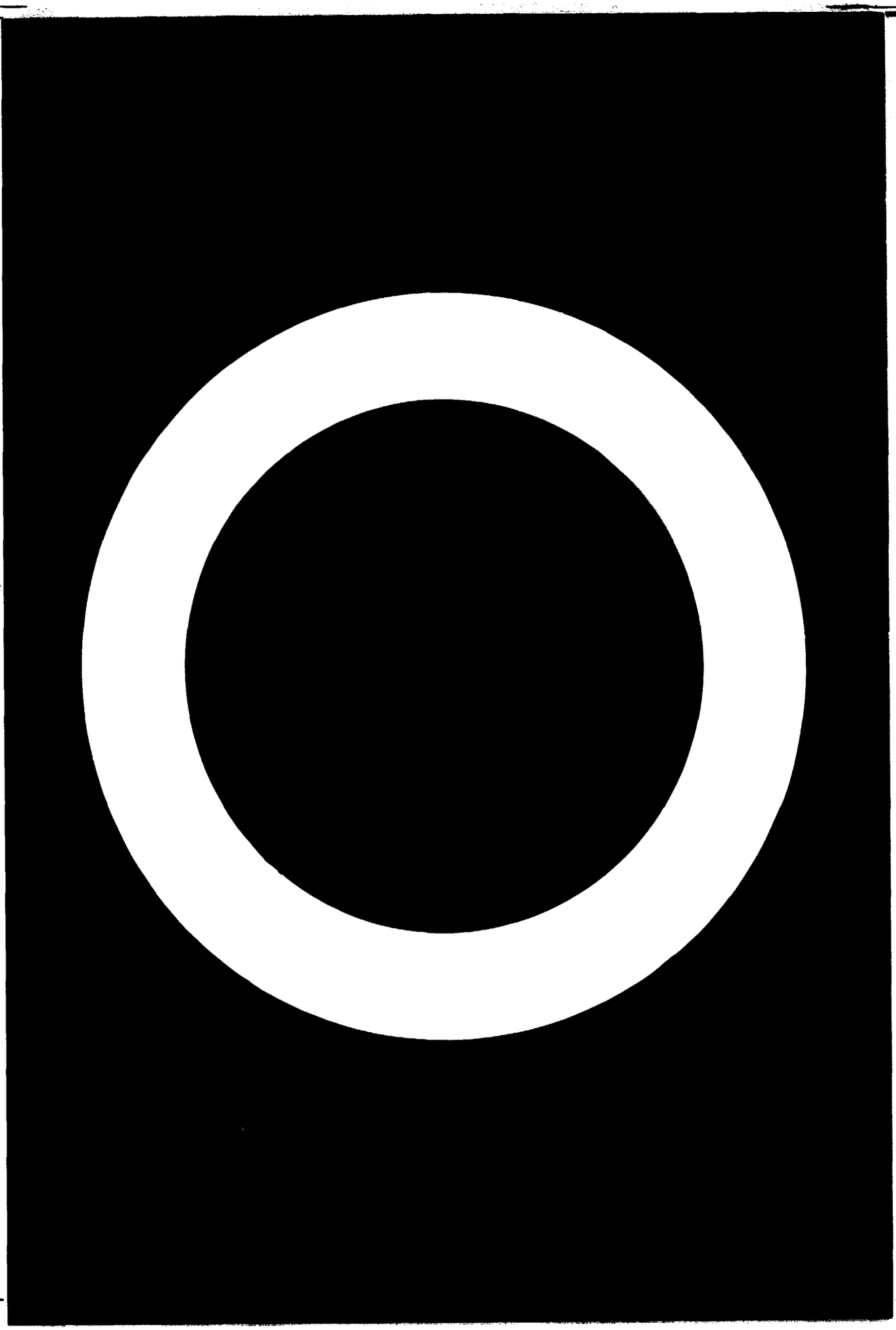
On this cultivator or tiller a seed-box can also be used for sowing wheat, barley and sorghum.

The seed box may also have a fertilizer compartment and appropriate tubes to carry the fertilizer in the furrows.

RECOMMENDATION NO. 28 - Small ridger plough for making ridges and furrows

RECOMMENDATION NO. 29 - Single animal mould board plough

RECOMMENDATION NO. ~~3~~ 4 Bullock Breed, Shoeing and Nagpuri Yoke (Figure NO'S 11,12, and 13). This is recommendation NO. 4



(a) It is necessary to breed a dual purpose cattle both for milk and draught purposes. As an example the ONGOLA Breed from India has been suggested but any other suitable breed be selected.

(b) It is advisable to use castration of bulls by using simple Burdezzo Castrator. The bullocks then can be well trained and are more tractable.

(c) To increase the working life of bullocks at least by one to two years steel shoes as used in India and other south-east Asian countries be used on the hoofs of the cattle. If produce from scrap in Yemen, they would hardly cost one Y.R. per foot or four YR'S per animal. As the prices of bullocks are increasing year after year, it will be economical to use shoes to increase working life.

(d) It is recommended to introduce in place of the local yoke like the NAGPURI Yoke from India so that greater use of available bullock power is made.

All these suggestions have been discussed in detail in Appendix No. 12 part 11 under paragraphs dealing with Animal power.

RECOMMENDATION NO. 30

The following is the list of other implements which are worth testing in Yemen in the 11 phase:-

- Seed - treating drum
- Seed cleaner
- Sprayer
- Duster
- Soil-gum
- Prunning and grafting knife
- Hedge Shear
- Fruit Plucker
- Seedling Transplanter for nurseries
- Cream separater - Alfa- laval
- Butter churn
- Butter worker
- Small incubator for poultry
- Poultry feeder
- Centrifugal Honey extractor

- Bund former
- Terracing blade
- Leveller with steel prongs
- Two-row and three-row seed-drills
- (with fertilizers attachments)
- Stone threshing roller
- Olpad thresher
- Tractor driver seed cum fertilizer drill
- " " " " " planter
- Low-lift high volume pump
- Potato planter
- Coal-dust pallet making machine
- Sulphur dusting drum for tobaco cultivtivation
- Tractor operated bore hole anger for planting tree-seedlings for afforestation programme
- All the above main recommendations consisting of 26 items and the other less important recommendations have been carefully selected to <u>suit soil and climatic conditions</u> in Yemen and more with a view to carryout agricultural and allied operations <u>more efficiently</u> and with <u>less labour</u> and less drudgery - The field trials of the prototype samples of all these implements when obtained under the propsed UNIDO technical assistance scheme of the workshop to be established at Sana'a will indicate which of this implements are useful and how far.

ANNEX No. 1

ORIGINAL JOB DESCRIPTION

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

UNIDO 3rd JUNE 1977

REQUEST FROM THE GOVERNMENT OF YEMEN ARAB REPUBLIC FOR SPECIAL INDUSTRIAL SERVICES INTERNAL

JOB DESCRIPTION

SI/YEM/75/811/11-01/31.9.E Rev.1

POST TITLE - Expert in the Production of Agricultural Implements

DURATION - FOUR MONTHS

DATE REQUIRED - As soon as possible.

DUTY STATION - SANA'A with travel within the Country

PURPOSE OF THE PROJECT - To advice the Jumaan Factory at Sana'a in production, expansion, factory reorganization and product diversification, modernization and development of production potential through training, new machinery or equipment installation and improved production techniques with special reference to the manufacture of deep water pumps, agricultural tools and implements and spare parts.

DUTIES - A team of two experts (A mechanical engineer and a foundry engineering expert) will be attached to the Jumaan Factory at Sana'a. They will work as a team in close co-operation with the management of the factory and in consultation with the team Leader of the Industrial Promotion and Advisory Unit in the Department of the Ministry of Economy.

The mechanical engineering expert will be expected to:

(1) Study in detail the present production process and the general conditions in the factory, including a study of the machinery and equipment used, the raw materials and the quality of products of the factory and suggest improvements on the organization of the factory and the general production process.

(2) Assess the existing and potential demand for agricultural tools and implements and for hand tools required for construction and industrial purposes.

(3) Examine the availability of the raw materials, capital, manpower and skills required for the local manufacture of these products.

(4) Formulate recommendations on any additional items (Agricultural implements: hoes, spades, axes, pitch forks, rakes, rippers, scoops, ploughs, sprayers, harrows, other hand tools: hammers, pliers, spanners, screw drivers etc. and spare parts) which could be locally manufactured through expansion of the factory.

(5) Prepare a short and long term production programme to provide for an expanded production of deep water pumps and other suitable products and make an estimate of such a programme.

(6) Assess the technical assistance required to assist the factory in the proposed production programme, recommend ways and means of implementation including UNDP assistance..

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further actions which might be taken.

QUALIFICATIONS -A mechanical engineer with extensive experience in the manufacture of agricultural implements and tools with special reference to production planning, product diversification and production expansion.

LANGUAGE - English; Arabic an asset

BACKGROUND INFORMATION - The Jumaan Factory in Sana'a has a small privately owned foundry producing 225 deep water pumps of 4" size and also 75 of 3" size per year. The domestic demands for these pumps is estimated at 1500 pumps a year. The factory also manufactures standard weights from cast iron of which about eight tons have been produced since the factory started its operations in 1972. The factory faces a problem relating to melting furnace operations.

There are also promosing possibilities for other products such as agricultural implements if the factory is recognised and the existing furnace operations are improved. On the other hand it might be necessary to replace the existing melting furnace; furthermore, additional equipment and machinery would also improve production and quality. In order to realise these objectives, the proprietors of the factory, supported by the authorities in the Ministry of Economy, have requested the services of two qualified and experienced specialists to assist them.

APPENDIX NO. 2

A Copy of a letter for Amendment
by the Director General
(Industries)

YEMEN ARAB REPUBLIC
MINISTRY OF ECONOMY
Tel. 2368-5010
P.O. BOX 607
Date- November 16th 19

TO

Head of Loans and Technical Assistance Department
Central Planning Organisation.

Dear Sir,

This is regarding the UNIDO Project NO. SI/YEM/075/11-01/31.9.E.REV.1, under which you have already made available to us, the services of an expert in the production of Agricultural Implements. We are keen in implementing the project.

Originally it was thought to improve and expand a privately owned workshop (Jumaan Factory) in Sana'a, but the Government after reconsideeing the matter and with a view to have long term development now proposes to establish a small workshop under its control either in the Industrial Estate at Sana'a or at any other suitable place for carrying out the work of identification, improvement, modification, testing and manufacture of small agricultural implements and small allied tools so very necessary for increasing agricultural production in this country. The other duties of the Expert in Production Agricultural Implements remain the same as envisaged earlier. It is hoped that the UNDP/UNIDO will concurr to this partial amendment considered necessary by the Goveernment. Please convey our concurrence to UNDP.

With our best wishes to you in all your endeavours.

sd._____

cc: The Resident Representative
U.N.D.P. Sana'a, Yemen Arab Republic

Director General Industrie
Ministry of Economy.

APPENDIX NO. 3

A Copy of the EXPERTS LETTER TO UNIDO REGARDING THE AMENDMENT

8th November 1977

Dear Sir,

I came here recently as an expert in the Production of Agricultural Implements under UNIDO project (SI/YEM/75/811/11-01/31.9.E REV.1).

In the Job Description 6 terms of reference have been mentined out of which one relates to foundry and the other five to agricultural implements and tools. The original intention of the Government was to improve or expand the Jumaan Factory (which is a small foundry owned by a private individual). From the discussion I had with the Ministry of Economy, the Director General Industries mentioned that the production and identification of agricultural implements need not be tied up with the private workshop. It is also understood that this private firm was offered two sheds as a special case, in the Industrial Estate at Sana'a. At first they agreed to take these but backed out. Hence it seems that this private workshop improvement has been dropped out by the Government. In any case for agricultural implements, except for pumps, no foundry is required. For improved ploughs, harrows, hoes, sprayers, garden tools a general purpose machine shop is required.

(A) On the same lines as a "model project concept for UNIDO Technical Assistance", given me during briefing at VIENNA(Demonstration Pilot Engineering Workshop for assembly and manfacture of agricultural tools, animal drawn implements, hand operated machines and allied simple metal products with repair and maintenance activities). The terms of reference Nos 2 to 6 pertain to these:

With the change in the thinking of the Government in respect of the Jumaan Factory, it seems the Government wants to have a workshop under its direct control for identification, improvement and production of agricultural implements and tools.

Such a trend is already visible in the Government's policy as they have taken four sheds in the Industrial Estate for production of articles and equipment required for schools under the Ministry of Education. Similarly it is likely that provision of one or two sheds in the Industrial Estate for the Agricultural Implements production may be made.

.../

The need and scope for introducing agricultural implements and tools in Yemen is tremendous. Most of the farms are on the hillside terraces and small in size. Virtually no work on agricultural implements has been carried out in Yemen and is the least developed on this respect. I have requested MR. M. Nizer the Director General of Industries, in the Ministry of Economy who is in the overall charge of the project to write to UNDP for the marginal changes proposed by them so that UNIDO'S approval may be obtained. He is likely to do this after return from Tunis where he has gone to attend a meeting for about a week. When he returns, I will follow it up.

In the meanwhile I thought to keeping UNDP informed of the marginal changes proposed and have started my work to cover item Nos 2 to 6 in the terms of reference and a workshop scheme as indicated in portion marked A on pre-page

Thanking you.

Yours sincerely,

D.N. Kherdekar

APPENDIX NO. 4

DETAILED REVISION OF THE DUTIES

OF TERMS OF REFERENCE OF THE

EXPERT IN PRODUCTION OF AGRICULTURAL IMPLEMENTS.

(1) To prepare a project for establishment of a Demonstration pilot Engineering workshop for assembly and manufacture of agricultural tools, Animal drawn implements. Hand operated agricultural machines and allied metal fabricated products with repair and maintenance Activities".

( ) To Assess the existing and potential demand for agricultural tools and implements and for handtools required for construction and industrial purposes.

(3) To Examine the availability of raw materials capital manpower and skills required for local manufacture of these products.

(4) To Formulate recommendations on additional items (gricultural implements: hoes, spades, axes, pitchforks, rakes, rippers, scoops, ploughs, sprayers, harrows, other handtools: hammers, pliars, spanners, screwdrivers etc... and spare parts which could be locally manufactured in the above pilot workshop under the Government.

(5) To Prepare a short and long - term production programme to provide production of improved agricultural implements (and not deep water pumps alone) and other suitable products and make an estimate of such a programme.

(6) To Assess the technical assistance required to assist the Government by way of a pilot workshop in the proposed production programme, recommend ways and means of implementation including UNDP/UNIDO assistance.

(7) To Prepare a pre-feasibility study of a small Foundry

APPENDIX NO. 5

Exract from "Lima declaration and Plan of Action on Industrial Development and Cooperation". The United Nations Industrial Development Organization's Second General Conference at Lima, Peru, 12-26 March 1975 Page 18 and 19 --

" IV, The Least Developed, Land locked and island developing Countries.

(62) The least developed land locked and island developing countries present a set of problems which require special measures if these countries are to attain an acceptable level of economic development Recalling General Assembly Resolutions 3201 (s-vi and 3202 (s- vi) on the declaration and programme of Action on the Establishment of a New International Economic Order, industrialization in these countries must take place at a more rapid pace than average.

Concerted action and special measures of assistance from other countries and international organizations are necessary to mobilize a greater volume of resources to make possible launching of innovative projects in these countries and the laying of a sound basis for the promotion pf their industrialization through projects and measures such as:

(a) Specific, urgent measures to establish the necessary conditions for industrialization: infrastructures inventories of natural resources, and the technical and financial assistance required for the exploitation of these resources;

(b) The establishment and financing of complete industrial estates and pilot plants based as much as possible on the use of available local resources;

(c) The creation of integrated production units such as agricultural machinery plants, appropriate engineering industries and repair and maintenance services;

(d) The implementation of an appropriate agearian policy as an essential basis for the promotion of integrated rural development schemes involving the establishment of small scale production units to meet both the needs of internal markets and export requirements;

(e) The development of crafts and cottage industries including artistic crafts;

(f) Assistance for systematic studies of their industrialization potential;

(g) Speedy examination and establishment of infrastructures permitting the harnessing and full utilization of water resources and the establishment of agro-industries with special emphasis on the countries affected by drought;

(h) Preferential treatment within the context of international agreements for industrial products and processed commodities from these countries as well as setting up joint enterprises under regional Cooperation;

(i) Special aid and assistance to the least developed, land-locked and island developing countries in the establishment and development of adequate means of transport and communications;

(j) Urgent measures to increase the import and export capabilities of the least developed countries and to help offset the disadvantages of the adverse geographic situation of the land-locked countries, particularly with regard to their additional transportation and transit costs;

(k) In addition to priority assistance from UNIDO and other international organizations in all fields, additional favourable financial and technical assistance with exemption from counterpart requirements, where appropriate, should be given to these countries through bilateral and multilateral channels to accelerate their industrialization in conformity with their national policies and development plans.

APPENDIX NO. 5

EXTRACT FROM THE ANNUAL REPORT OF THE EXECUTIVE DIRECTOR INDUSTRIAL DEVELOPMENT BOARD OF THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION FOR THE YEAR 1976

(Published in May-June 1977)

Chapter III Policy Co-ordination - Least Developed Countries - Pages 53-55.

"65- The Second General Conference of UNIDO called, in resolution ID/CONF.3/Res.1, for the establishment of appropriate institutional machinery within UNIDO as a means to supplementing the industrialization endeavours of the least developed, land locked and the island developing countries. This was done in the structural reorganization of the UNIDO Secretariat which took effect at the beginning of 1976. As part of the policy co-ordination programme, the Least Developed Countries Section assists in formulating policies and strategies for developing technical co-operation programmes and likewise in elaborating and reviewing projects proposals within such programmes for the countries concerned. The section also assists in cooperation with the Governments and Intergovernmental organizations Relations Section (Division of Conference Services, Public Information and external relations), in mobilizing financial resources, with the object of expanding the programme of aid to these countries in the field of industrialization. Finally the section monitors activities throughout the Secretariat that are designed to benefit the least developed countries, in order to ensure that theyform an integrated co-ordinated whole.

(66) With the help of a task force established within the Secretariat to consider special measures and policies in favour of the least developed countries, a working paper was prepared and circulated for comments to the Government of all the least developed countries. It is hoped that in this way a better appreciation will be obtained of the needs and priorities of the least developed countries and the extent to which the suggestions of the UNIDO Secretariat accord with the development plans and policies of the Government concerned.

(67). In parallel with this approach, a portfolio was prepared of project proposals covering a number of industrial sectors. The proposals, many of which are described only in general terms at this stage, are currently under review in the least developed countries. Such proposals as are endorsed by the government will then be considered for financing under the various sources of funds already av available to UNIDO or from other sources which may be developed as a result of contracts with potential donors outside the United Nations system.

(68). Some tangible results can already be reported. The Government of Afghanistan has requested the implementation of three projects included in the portfolio. The Government of Nepal has suggested that prepartory missions should undertake feasibility studies with regard to several projects proposals. Discussions by six missions of Secretariat staff, which visited 19 of the least developed countries, have led to the tentative submission of a number of further projects for detailed examination with a view to their subsequent implementation. A project is already under implementation in the Lao People's Democratic Republic for low cost prefabricated wooden bridges using local forest resources. This project is based on a technology successfully developed in Kenya and similiar projects are under active consideration in Nepal, the Sudan and Uganda.

(69). It is widely recognized that the land locked and island developing countries, in consequence of their geographical situation, face special problems in their effort towards industrialization. An investigation is being undertaken in identifying the specific needs of this group of countries for technical assistance and elaborating appropiate action programmes. A consultant has been retained to assist in this task.

(70).- Several of the least developed countries have been contacted regarding the possibility of a assistance in the rehabilation or fuller utilization of existing manufacturing facilities. A review has been made of feasibility studies undertaken in the past in these countries to check whether further action might now be desirable, in which case the Government concerned has likewise been contacted.

In connection with the feasibility studies with textiles, food, wood and marble industries several governments have expressed interest in receiving assistance from UNIDO to locate potential foreign investors.

71. In the Sudano- Sahelian zone, two feasibility projects have been formulated and approved for financing under the UNIDO regular programme of technical assistance; these relate to the bulk blending and begging of fertilizers and the formulation of pesticides. In addition a UNIDO/OCAM/ECA mission visited Niger and Senegal in connection with proposals to establish pilot projects for Agricultural machinery and implements.

72. In 1976 some 43 projects were approved under the regular programme allocation of $ 550,000 for special activities for the least developed countries.
In these projects emphasis was given to the fields of agro-industries, appropriate technology, training and plastics in agriculture (cf. present Report, Chapter vii para 36).

73. An intergovernmental expert group meeting on industrialization of the least developed countries was held at Vienna from 15 to 24 November 1976. The meeting was organized in cooperation with the Investment Cooperatives Programme office and the Industrial Planning Section (Industrial Operations Division). Among the participants were 26 officials at a senior level from the Governments of 20 of the least developed countries, representatives of public financial institutions and representatives of various United Nations agencies.
The discussions and exchange of views that took place during the meeting will help the Secretariat to prescribe the basic elements of UNIDO technical assistance to these countries during the next few years,to be implemented in cooperation witho other multilateral and bilateral institutions parallel with the duty programme arranged for this meeting, an investment project exchange was organized by the Investment Cooperative Programme Office (cf. present report, Chapter iv, para 30).

74. Contacts have been initiated with various d donor countries through the permanent Missions to UNIDO in order to obtain information on their existing and planned activities in providing bilateral aid for the industrial development for the least developed countries. With the aid of this information, the Secretariat has been able to identify areas of cooperation between UNIDO and donor countries providing further technical assistance to the least developed countries. Many Governments have indicated their readiness to UNIDO to collaborate in this way. Some Governments are already looking into a number of project proposals, the details of which have been provided by UNIDO; these are the projects which the authorities in the least developed countries have already selected in principle for implementation if suitable arrangements can be made. Furthermore, the Austrian Government has made a contribution in kind, estimated to be worth $ 300,000 for the implementation of two projects in the Lao People's Democratic Republic; the Government of Switzerland has contributed $ 250,000 to finance a project in Rwanda. The cost of transporting the Austrian donated equipment to the Lao People's Democratic Republic has been financed under the UNIDO General Trust Fund. Visits have been made to discuss with other potential donor Governments the possibilities of obtaining additional finance for specific projects.

75. In the interest of programme Coordination with other agencies of the United Nations and with the aim of identifying areas where joint action is desirable in providing assistance to the least developed counteies, contacts have been made with FAO?ILO and UNCTAD. (These organizations also participated in the expert group meeting described in paragraph 73 above). UNIDO participatedwith UNCTAD in an exploratory mission to Bangladesh. Similar missions to other least developed countries are envisaged. Arrangements for joint action by ILO and UNIDO in Ethopia have already been initiated.

76. The activities undertaken by this new Section in 1976 and those planned for the near future should for the most part, be regarded as constituting a preparatory phase in the efforts of UNIDO to comply with the recommendations contained in the Lima Declaration and Pla of Action which relate to the least developed, the land-locked and the island developing countries. The objective has been to lay a sound foundation for an intensified programme of assistance to these countries to reinforce their own efforts towards industrialization, tailor made to deal with their special problems.

APPENDIX NO. /

NAMES OF PERSONS CONTACTED

MINISTRY OF ECONOMY

(1) His Excellency Mohammad Abdul Wahab Al- Jubari
Minister of Economy

(2) His Excellency Abdul Rehman Ali Al-bahr
Deputy Minister/Under Secretary to Ministry of Economy.

(3) Mr Mohammad NIZAR
Director General, Industries Department

(4) MR. Abdul Rehman Al-Morair, Director implementation.

(5) MR. Hussain A. Hamdani

(6) MR. Mohammed Hamada

INDUSTRIAL PROMOTION AND ADVISORY UNIT

(IPAU)

(1) MR. Fuad Abdel Halim
IPAU Industrial Engineer.

(2) MR. Said Darkazanli.
Industrial Economist.

(3) MR. B.K. Chowdhry,
Cost Accountant and Financial Management.

UNITED NATIONS DEVELOPMENT PROGRAMME

(1) MR. T.R. Malhotra, Resident Representative

(2) MR. B. Khader, Deputy Resident Representative.

(3) MR. Ali Redwi, Assistant Resident Representative.

(4) MR. M.Y.M. Selim, Programme Officer

(5) MR. Cornelis Klein, Programme Officer

(6) MR. James J. Cleary, Administrative Officer.

(7) MR. Sat Pal, Administrative Secretary.

CENTRAL PLANNING ORGANIZATION

(1) DR. ...W. ...riki, Deputy Chairman C.P.O.
(2) MR. Anwar ...razi.
(3) MR. R...shid
(4) Miss Asma

MINISTRY OF AGRICULTURE

(1) MR. Muhmod Suilman Attiah, Director of Office, Regional Arab Organization.
(2) MR. K...il M...nsour, Leader IRDB/UNDP Project
(3) MR. R. M...lik Irrigation Engineer.
(4) DR. EL Omari Statistician
(5) DR. R. Smith Project Manager, central Agricultural Research and Training Organization OUSEIFERA F...rm, Taiz.
(6) MR. M. Kunhi Workshop Maintenance Supervisor, Hodeidah
(7) MR. EL. Lakany '-Agronomist

INDUSTRIAL ESTATE SANA'A

(1) DR. Ali Zabara, Chairman
(2) MR. Abbas Al-Mahdi, Deputy Director, General
(3) MR. Ahmed Al-Abdi, Assistant Engineer.
(4) MR. Munawar Ali Khan Lodhi, Management Advisor.
(5) MR. H.K. Patel, Office Expert in Industrial Engineering.

BILATERAL PROJECTS

(1) DR. J. ZSCHINTZSCH, Project Manager German Plant Protection Project (Federal Republic of Germany), Shoub, S...na'a. P.O.B. 26, Phone 5970.
(2) MR. Jim Williams, Project Manager, Agricultural Mechanization Centre, (British Govt. Project) Taiz.

APPENDIX NO' 8

BIBLIOGRAPHY

(1) Lima Declaration and Plan Action on Industrial Development and Cooperation- March 75 UNIDO Publication.

(2) Annual Report of the Executive Director, of Industrial Development Board 1976- UNIDO Publication.

(3) Small-Scale Industries in Arab Countries of the Middle East, 1970 - UNIDO Publication.

(4) Industrial Estates In Europe and the Middle East. 1968- UNIDO Publication.

(5) Initiation and Implementation of Industrial Projects in

(6) Report on Small Scale Industries in Yemen, 1971 by MR. J.M. Gajewski - UNDP/UNIDO.

(7) Compiled Report on UNDP/FAO Highlands farm Development Project

(8) Report on the Mission to the Yemen Arab Republic,1969 by MR. Toni Hagen, Consultant to the Administrator, UNDP.

(9) Information Paper NO. 9 - 1971 Report on Agriculture in Yemen issued by UNDP, Sana'a MR. Toni Hagen.

(10) A (preliminary) Proposal for a feasability study for manufacture of water pumps in the Yemen Arab Republic by Middle East Marketing Research Bureau Ltd. Nicosia, Cyprus, Aug. 77

(11) Technical Services for Small scale industries, 1970 UNIDO Publication.

(12) Information Paper NO.15 - by UNDP Sana'a MR. Toni Hagen, Report on status of UNDP and its specialised agencies Programme in the Yemen Arab Republic.

(13) Stasticial Year Book - 1976 (Sixth Year), by Stastic Department Central Planning Organization, Prime Ministers office Yemen Arab Republic.

(14) Survey of Agricultural Potential of Wadi Zabid (Economic feasability report - Tesco - Viziterv- Vituki- Budapest 1971 AGL = SF/YEM - 1) P. 19

(15) Mohamed M. Abu El-Khair- Assistance to leather industry (SM/YEM/75/013 YAR UNIDO, Vienna - 1976).

(16) Minor Irrigation by MR. Narayanan, FAO 1 [illegible] UNDP Report to Govt. of Yemen Arab Republic

(17) Montane Plains and Wadi Rima (MPWR) Project 1976 prepared by Land Resources Division, Ministry of Overseas Development, U. (In two volumes)

(18) Annual Reports of UNDP. Assistance other than UNDP.

(a) [illegible] Project USSR- 1965-70
(Land Reclamation 1000 hectars

(b) Agricultural Centre (Sana'a) Federal Republic of Germany- 196[illegible] introducing better seeds, utilizing fertilizers and pesticide

(c) Guneisha Soil Project - 1965-71-
German Democratic Republic wells mini dams, piped irrigation on 764 acres.

(19) Fruit and vegetable growing in Taiz and Ibb Governorates (by MR. S.Y. El-Bastal, the Horticulturist, Central Agricultural Organization and training Project- Taiz-Yemen Arab Republic Horticultural Section - UNDP/FAO July 1974.

(20) Report on Development of Farm Mechanization in the Yemen Arab Republic with emphasis on irrigation crops including Horticulture in the Tihama plains, by MR. B.r.d. Osten-Wurnitz F.A.O Consultant Project. YEM/73/011/AGON June 76 to March 76.

(21) Mechanization of agriculture by MR. C.M. Downing U.K. chapter ix, p. 11 to 129, Information Paper NO. 9, UNDP.

(22) - Yemen Year Book- 1974 MR. Alexander Bartelink published Federal Agency for Economic cooperation.

(23) Encylopedia Brittania.

(24) Summary of activities of the German Plant protection Project (P.O. Box, 26, phone 5970) by DR. J. Zschintzseh at Shoub Sana'a.

(25) A note on Phase 1 and phase 11 of the U.K. Govt. Agricultural Mechanization Centre at Taiz.

(26) Relevent Extracts were also taken from the following papers presented at the First Five Year Plan Conference of Y.A.R. held in Sana'a from 29th Nov. to 2nd Dec. 1977- all these papers/handouts were in English.

(i) A statement by FAO Representative

(ii) Text of the address by H.E. Abdel Aziz Abdul Gehanim Member of the Command Council and the Prime Minister.

(iii) Text of the Speech by Lieutenant Colonel Ahmed Hussein Al-Ghashmy, President of the Command Council and the Commander-in-chief of the Armed Forces.

(iv) Modern Administration in the Yemen Arab Republic.

(v) Opening statement by MR.. Winfred Boell, Head of the German Delegation.

(vi) Statement by DR. Basim Hamdush, chief Development Planning Division, Nations Economic Commission for Western Asia.

(vii) Address of Sheik AR Nuaman, Secretary General of the Federation of Industrialists in YAR.

(viii) Statement regarding the Industrial Bank of Yemen.

(ix) Working paper on Agricultural Credit Bank.

(x) Statement on Gen'l Industrial Estate Authority.

(vi) Summary tables of The First Five Year Plan of YAR.

(27) Foundry Equipment Literature and Catalogues loaned by the Industrial Estate Authority, Sana'a.

(28) A comprehensive note on Industries in Yemen by MP. B.K. Chowdry I.P.A.D.

(29) THE First Five Year Plan 1976-77 to 1980-81 a Comprehensive Compilation prepared by the Central Planning Organization the Prime Ministry office - June- 1977

(30)- The First five-year plan 76-77 to 80-81

1 Volume 1 - Evaluation of the Period of the three-year development.

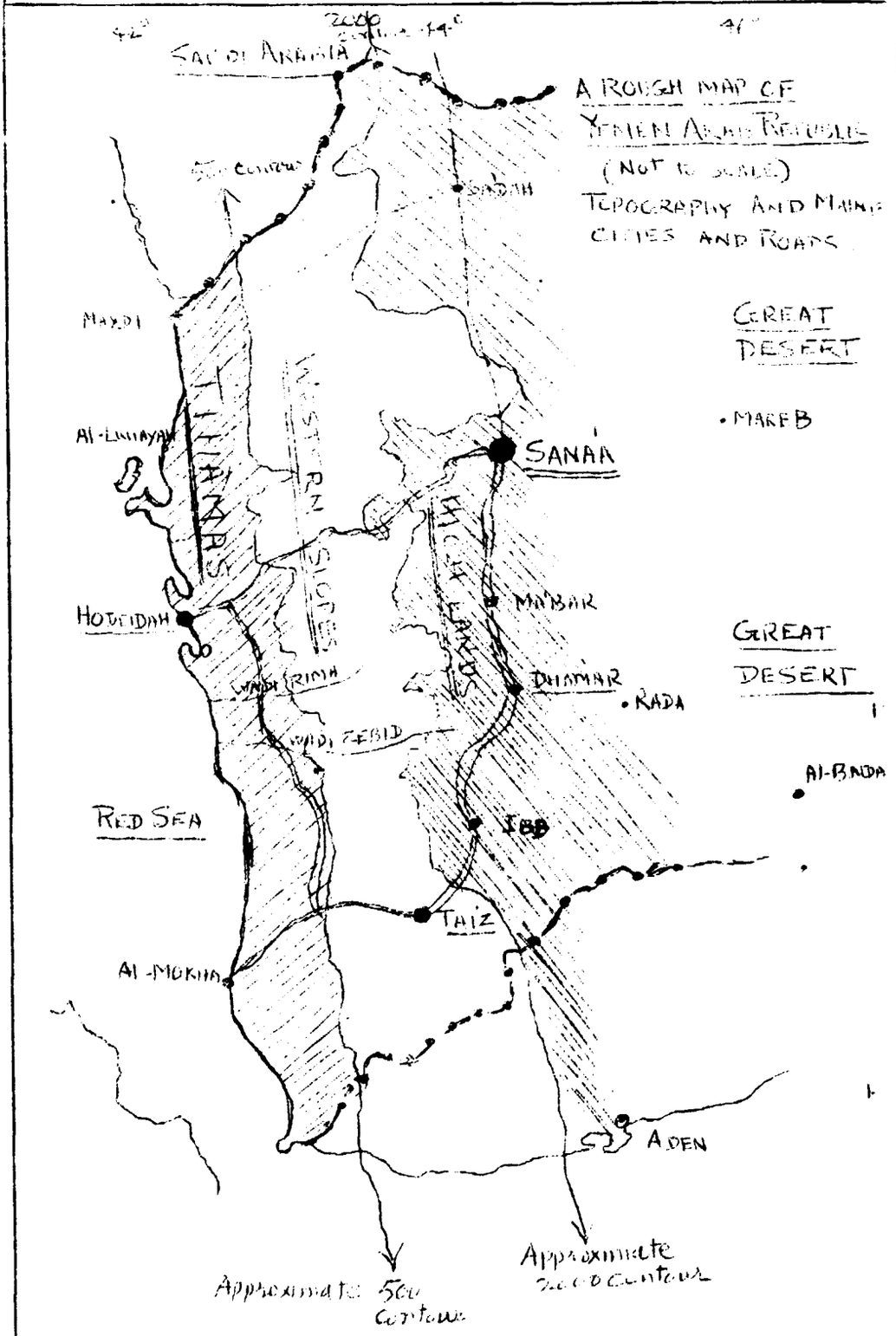
(31)- Volume 11- Analysis of the status Quo

(32)- Volume 111 - The General Objectives and Strategies the objective of sectors and departments and their strategies.

(33)- Volume 1V - Material Objectives.

(34)- Volume V - Description of projects

APPENDIX NO. 9 - MAP



APPENDIX NO. 10

ABBREVIATIONS, WEIGHTS AND MEASURES AND METEOROLOGICAL DATA

(a) ABBREVIATIONS

- YAR= Yemen Arab Republic
- YR = Yemeni Rial.
- YRS= Yemeni Rials
- CPO= Central Planning Organization
- UNDP - United Nations Development Programme
- UNIDO- United Nations Industrial Development Organization
- FAO - Food and Agricultural Organization
- WHO - World Health Organization
- ECWA - Economic Commision for Western Asia
- IBRD - International Bank for Reconstruction and Development
- IDCAS - Industrial Development Centre for Arab States
- ILO - International Labour Organization
- IPF - Indicative Planning Figure
- ISO - International Organization for Standardization
- LDC - Least Developed Countries
- m/m - Man Months
- SIS - Special Industrial Services
- ESCAP - Economic and Social Commision for Asia and the Pacific.

(b) WEIGHTS AND MEASURES

Linear - 1 dra = 67cm
1 yard = 91.44cm
1 dra = 0.73 yards
1 inch = 2.54cm
1 meter= 100 centimeters (cm= 1.492dra
1 meter= 1.09 yards
1 yard = 1.36 dra
1 yard = 3ft.=36 inches
1 mile = 1609.347 meters

Area - 1 libna = approximately 45 m^2
1 maad = 0.37 ha
1 acre = 0.405 ha
1 hectare= 10,000 m^2 = 220 libna (ha)
1 libna = 100 sq. dra
1 ha = 2.47 acres
1 maad = 100 libna = approximately 1 acre

Volume 1 kada = 40 liter
1 Nafer= 0.625 liter
1 litre= 0.025 kada
1 litre(1) = 1.6 nafer
1 hectolitre = 100 litre=22 Englishgallons
=26.4 US gallons
1 US gallon = 3.79 litre
1 English gallon = 4.54 litre

Currency - 1 Yemeni Rial = 40 buksha
= 100 fills
4.45 YR = 1 US$

Conversion from Centrigrade (C°) to Farhenheit (F°)

$0^{\circ}C = 32^{\circ}F$

$100^{\circ}C = 212^{\circ}F$

$C = \frac{5}{9}F - 32$

$F = \frac{9}{5}C + 32$

Weights

1 Metric Ton = 1000 Kilograms
1 Kilogram (kg) = 1000 grams = 2.2 English pounds (lbs)
1lb = 0.45 kg.
1 hundredweight (cwt) = 112 lbs = 50.8 kg
1 kg = 1.79 rattle for sugar, coffee, and tea.
1 rattle = 0.59 Kg.
1 okieh = 28 gram
1 kg = 35.7 okieh
1 rattle = 20 okieh = 560 grams
1 rattle = 16.5 okieh = 462 grams
1 frasla = 22.5 rattle = 10.4 - 12.6 kg.
1 Kg = 0.031 to 0.043 kadas for various crops such as wheat, sorghum, maize beans etc. therefore
1 Kada = 23.3 to 33.3 Kgs for above mentioned different crops.
1 Kada = 64 nafer
1 Nafer = 0.156 Kada.

(Source Yemen Agricultural Hand Book West German Publication).

(c) Metereological Data

(Source p.24 MR. Narayanans Report on major irrigation) 1963-66 (And into bracket from Yemen Agricultural Handbook 70/73).

Description	Sanaa		Taiz	Hodeidah	Remain
A.Temperatures	degrees centrigrade				
(1) Mean Annual	16.5	---	24.3	29	
(2) " Max.	(17.4)	---	(24.3)	(29.4)	
(3) " Min.	7.6	---	18.8	24.7	
(5) Absolute highest	31	---	37.6	40.7	
	5.6	---	10.2	15.5	in 1963-66
B.Relative humidity					
(1) Annual Av at 8.0h	39%		51.5%	66%	
(2) " " at 14.0h	23%		42%	58.5%	
(3) " Av	31%		46.3%	62.43%	
	(41.2)		(42)	(58)	
(4) Min Monthly Av	9%		27%	51%	
(5) Max. Monthly Av	62%		79%	76%	

(c) Wind Velocity (Knots)			
1) Annual Av. at 18.00h	3.8	5.7	9.3
2) " " " 14.00h	8.7	10.7	16.5
3) " " ----------	6.2	8.2	12.9
(d) Air Pressures Millibars			
1) Annual Av at 8h	780.2	886.6	1003.9
2) " " " 14h	776.3	886.2	1005.9
3) " " -------	778.3	887.4	1007.1
(e) Clondiers			
1) Annual Av at 8hrs	1.8	2.2	2.9
2) " " " 14 hrs	3.8	4.5	2.8
3) " " -------	2.8	3.4	2.9
(f) Rainfall			
1) 1963 to 1966 or 68	395 mm	540 (526.7)	153mm
2) No. of days of precipitation	75	88	24
3) Max. Rainfall on any one day	40mm	83 mm	108mm Extraordinar high Dec 1964

APPENDIX NO. 11

GLOSSERY

The following glossery of useful English- Arabian words has been compiled from various sources such as Information Paper No. 9. U.N.D.P., Bornstens Report on Sociology German Yemen Year Book, MR. Batal's report on Horticulture and has been classified under various headings such as Agriculture Implements Agriculture, Horticulture? Engineering Deneral etc. The Glossery will be useful for any non-Arabian speaking worker in Yemen, though it must be mentioned that long term projects the working knowledge of Arabian language will always be helpful and the Arabian language should be learnt.

(1) GENERAL IMPORTANT WORDS

(1) Insha'allah - God Willing
(2) Salam-ale-cum - A way of greeting meaning may you have peace.
(3) Ale-cum-Salam- The reverse reply
(4) Sabah El kheire - Good Morning
(5) Marhaba - Hello
(6) Keef Halak- How are you ?
(7) Mabsout- I am fine
(8) Min Fadlak- Fadlan- Please
(9) Ahlan/Ahlan sahlan (reply) Welcome
(10) Shukran- Thank you
(11) Afwan- I beg your pardon
(12) Mafish - Excuse me
(13) Ta'al - Come here
(14) Rooh- Go away
(15) Outal - Holiday
(16) Kteer- Too much
(17) Kaleel- Few

Where ? - Wein
Enteh - You
Ana - I am
La - No
Nam - Yes
Antadir - Wait
Gehif- Stop
GudIla - Drive on
Alwa - Alright
I do not know Arabic
Ma'asalamah - Goodbye
Suk - Market

Rajal - Man
Imra'ah - Child
Gehali - Expensive
Jareedah- Newspaper
Khareeta - Map
Lista - Menu
Soura - Picture
Mustashfa - Hospital
Daydalieh- Pharmacy
Mallak - Barber
Addesh Hada ? How much is this?
Wein Al bareed - Where is post
Finjan - Cup
Sahn - plate
Milaqa - Spoon
shay - Tea
Bun qahwa- Coffee
Asal - Honey
Zubda - Butter
Mukh - Brain
Dajaj - Chicken
Lahm - Meat
Baqari - Beef
Ghanam- Mutton
Samak, hut- Fish
Zayt, salit - Oil
Samn - Butterfat
Yurt, qutib - Yoghurt
Halib - Milk
Jubn - cheese
Laban - Skimmed sour milk
Baidh- Eggs

AGRICULTURAL AND AGRICULTURAL IMPLEMENTS

(1) Farmer -
- Good Soil - Atriba Saliha
-Bad Soil- Atriba Keir Sal
- Plough - Mihrath, Sahb, batleh, hali
- Cattle - Igil
- Donkey - Himar
- Goat - Geanam
- Sheep - Kab'sh

- Camel - Geamal
- Money - asal
- Terraces - Madrajat
- Leveller - Houda Maharr, Masabb
- Leather water bucket - Dallua
- Spade - Magrafa
- Axe - Matraka
- Sickle - Sharim
- pitck fork - Mahfar
- Winnowing - Yzari

Grinding Wheel-Mathan

- Mud Stove - Shula Tannur
- Butter churn - Kusaa

Bird - Osfoor
Tree - Shajara
Vegetable - Kudra
Pick-axe - fass
Hatchet - Sikin
Rubber bucket - Salla
Threshing floor- Mazara (stone paved- Al jurn)
Grinding Stone - Masakh
Seed store - Madfan
Seed cleaning basket - Mankhal
Bee-hive - Khalia

Government Departments

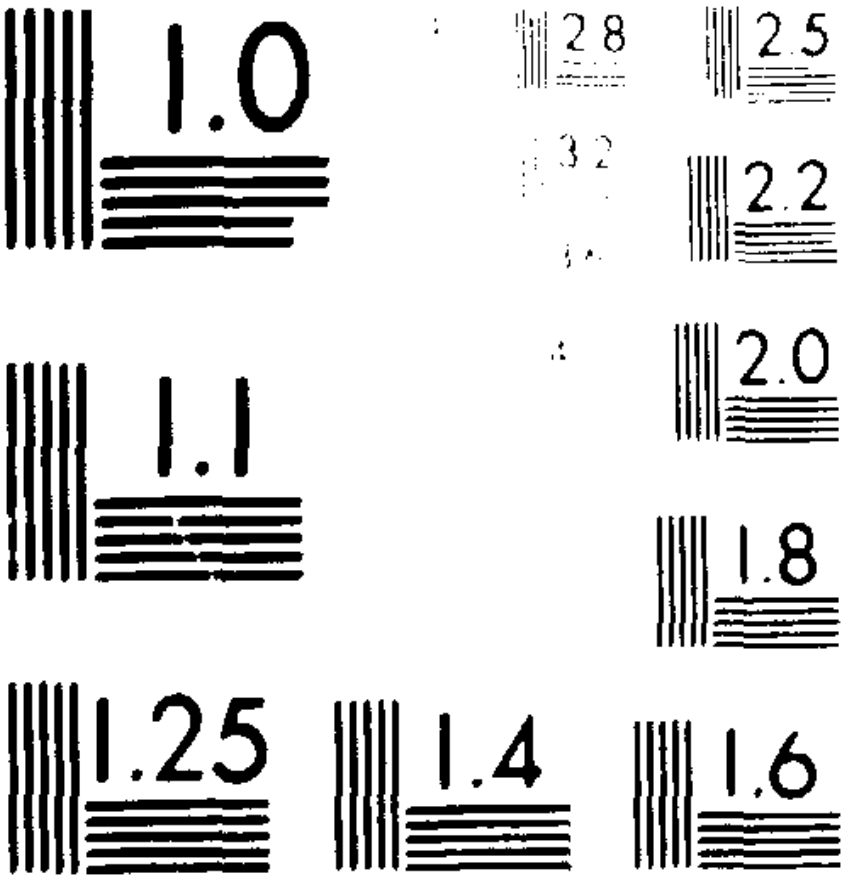
- Ministry of Economy -- Vajara Ittesat
- Ministry of Agriculture --- Vajara Jarat
- Central Planning Organization --- Al Jahaj Ar Markazi lil taktit
- Department of Industries ----- Idarat Al Senaa
- Industrial Estate -----Al majammaat
- Embassy ------ Al Senaiah
- Consultaitve Assembly ------ Majlis Al- Shoorak

CROPS

English	Latin	Arabic
Cereals		Labb
- Sorghum	Sorghum vulgare (Andropogan Sorghum)	dura, bayda wa hamra
- Sorgo or sweet sorghum- variety of sacharatum		
- Maize (corn)	Zea mais	Hindi, rumi
- Wheat	Triticum Sp.	buri, Ma'ada
- Barley	Secalis cereale	Shari
- Rice	oryza sativa	ruz
- Lucern	Medicago sativa	fish fish
- Horse grain		
- Sesame	Sesame indicum	Simsim gilgilian
- Tobacco	Nicotiana rustica (Nicotiana Tabacum)	
- Cotton	Geossypium hirsutum	
- Coffee		
- qat		qat

FRUITS

- Apple -------	Pyrus malus	tuftah
- Apricot-------	Pumus aromonica	barquq
- Banana	Musa Sp.	muz
- Dates (dried)	Phoenix dacty lifera	tamv
- Dates fresh	" "	rajiz
- Fig	Ficus carica	balas arabi
- Grapes	Vitis vinifera	anab
- Lemon	Citrus Sp.	Laymin, lim
- Mandarin	Citrus reticulata	yusfi
- Orange	" Sinensis	Burtuqum, tufah
- Peach	Prunus persica	firsik
- pears	Pyrus communis	anbarnd anjas
- Pineapple	Aranas comosus (anassa sativa)	Ananis
- Pomogranak	Rumic granatum	rumman
- Pomogranak		



- Raisins		Zabib
- Almonds	Prunus amygdalus	Iawz
- Peanut	Arachis hypogea	habbal-aziz
- Pistachio	Pistacra vera	fustug halabi
- Walnut	Juglans regia	Jawz

- Dumkin - Possibly Muskill - problem Saab - difficult
- Khalas - finished - intaha Kull - all, total, complete
- Mardum - ground - Jambia - dagger
- Bukra - tomorrow - Mallish - Do not worry
- Sarac - quick - Sabbak - Blacksmith
- Najjar - carpenter -
- Mahandes - engineer - Burad - fitter
- Lahham - welder - Mers - gear
- Borhi - nut, bolts Mesmar - nails
- Zaf-fah - lever Tara - pulley
- Glawos - screw

SPICES

- Basil	Ocimum Basilicum	raynan
- Coriander	Coriandrum sativum	Kuzbara
- Chilly	Capsicum frutescens	bisbas
- Cardaum	Elettaria cardamomum	hayl
- Cinnamom	Cinnamomum P.	girfs
- Clove	Syzgium atomaticum	zirr
- Cumin		kammun
- Ginger root	Zingiber offcinale	zanjabil
- Termeric		
- Mint	Mentha virdis	nama
- Parsley	Petroselinum sativum	baqdanus
- Mustard	Sinapis alba	khardal
- Salt		milh
- Sugar	Saccharum officinarum	sukkar
- Saffron	Crocus sativus	zafran

APPENDIX NO. 1:

PART 1- Quick Survey of Indigenous Agricultural Implements, tools and domestic appliances

PART 11 AVAILABILITY OF POWER IN Y.A.R.

CONTENTS

THE CLASSIFICATION OF YEMENI FARMERS

	Types of Implements
(1) 5 % Small Farmers Mostly doing tenant subsistance farming	Improved animal driven and manually driven implements and tools.
(2) 25% Medium Farmers Mostly growing cash crops	A combination of animal driven and power driven equipment
(3) 2 % Large Farmers Mostly the Government Farms, reclamation schemes, co-operative socities, custom hiring centres etc.	Mostly power driven modern equipment

If the above classification which seems to be reasonable is accepted we will have to give close attention to all the three categories mentioned above so that no sector is left out or neglected and accordingly plan to have projects to identify, modify, manufacture or import agricultural implements in Yemen.

In preparing this chapter in the report all the three categories mentioned above have been kept in mind.

To tackle the problems of category (1) and (2) above it is necessary to make as detailed a study as possible of the Yemeni Indigenous implements, ten hand tools to form the basis for future work. Hence this chapter on the survey of such implement and tools.

So far about 4 animal driven agricultural implements ten hand tools and about eight other miscellaneous items have been identified and included in this chapter. The diagramatic sketches of these have been given along with a brief description. the source from which the information on some of them has been given in the brackets. It is proposed to collect all these tools and implements at the workshop which is proposed to be established at Sana'a as indicated in the Appendix NO. 1 for making further scientific study regarding draft required, capacity, possibility of improvement etc. The dynamometers and other instruments would be used for this purpose. The efforts will be made there to improve or to modify them. The models will be collected from various regions in Yemen as there is bound to be differences in the designs. Such a collection of implements and tools, not only indegenous but also imported from other countries would be useful for research workers, students in agricultural schools, Government officials and future manufacturers of agricultural implements.

PART 1

A QUICK SURVEY

OF INDIGENOUS (LOCAL) AGRICULTURAL IMPLEMENTS, HAND TOOLS AND DOMESTIC APPLIANCES USED BY THE YEMENI FARMERS AND VILLAGERS.

Before proceeding on giving recommendations to the farmers, the land less labourers and the villagers on the use of modern agricultural implements, it is necessary that we should know what types of implements and tools, he at present uses. It is not necessary for us at this stage to know the numbers of each but only the types, their uses, advantages and drawbacks etc. Then only our study on mechanization of agriculture in Yemen Arab Republic will be systematic and scientifically based. To proceed without this preliminary and basic study will be improper and it will not be correct to out-right reject these implements and tools by merely saying that they are primitive.

Primitive though they look by the modern standards, there may be some good points in them. Some of them have been used and developed for centuries under practical field conditions as they exist in Yemen ie. small terraced fields, the danger of soil erosion, necessity to conserve water etc. The illerate farmers may not be able to expalin such good points or advantages but a scientist should be able to find them out by properly studying these indigenous implements.

Moreover by studying these simple implements we will be able to know what his needs are, and what he wants by way of new implements and then we can think of how to satisfy his needs. Another reason why it is necessary to study these indigenous implements is that we may be able to improve the implements by the use of better materials that are now available, or to modify them to make them more useful or even to use their good points in suitably designing tractor drawn implements. Though they are simple implements they have withstood the test of time. Some of these implements and operations may need changes in the context of changing social and economic conditions in the rural areas.

The need to include domestic and other appliances under this study has been felt because some of the operations like cleaning grain, grinding cereals, and proper storage of grain at farmers level, comes under the post-harvest-technology. It is closely related to the agricultural production and we cannot disassociate them from implements proper.

The butter-churn and the bee hives come under subsidary work for the farmers often recommended now a days in mixed farming. The question of cooking ovens and Tannurs (stoves) are particularly important in Yemen because of great shortage of domestic fuel, the necessity to conserve it and the urgent need for afforestation. Hence these have been included in this survey.

Though modernization is the necessity and the aim, one cannot modernize the agriculture overnight because millions of farmers are involved. Then there are other problems like shortage of power, small mature farms, the danger of further soil erosion etc.

If we can substantially improve one of the local-indegenous implement to the satisfaction of the farmers, it will create confidence in him and in future he is more likely to listen to our other recommendatinns. Hence making an attempt at improving any one of these simple implements is an important job. For instance if we can design an attachment for automatically sowing seeds and fertilizer, which could be fixed on the indigenous wooden plough and which could cost about 50 to 100 Yemeni Rials. It will be welcomed by the farmers as he will have to purchase only the attachment and simultaneous dropping of fertilizer a little away from the seeds is likely to give him more yield.

Here it is necessary to emphasise that the idea is not to stick to old implements at all costs but only to find out their characteristics, utility, disadvantages etc. so that in their place something new and really useful could be suggested. The word 'mechanization' of agriculture should not be confused with 'tractorisation' alone. There can be mechanization of agriculture without the use of big tractors. We should, therefore, have a balanced view on mechanization and whatever is useful to the farmers by way of hand tools, simple animal drawn but improved implements, and to the required extent modern tractors also should be considered for recommendation. Considering the present situation in Yemen, the mechanization of agriculture will be achieved, if we can supply improved implements to the farmers by classifying them in the estimated proportion at least for a period of 15 to 20 years as shown below. After this period the position may be reviewed and the percentages changed accordingly

PLOUGHS

In any field large enough wooden ploughs known as *hali* or *batleh* are used. They are yoked to cattle (a pair of cows or bulls), donkeys or to a single camel. Usually two ploughings are given and the seed is sown at the second ploughing. If the rainfall is less first ploughing and sowing is done at the same time. This leads to loss in conserving moisture. The wooden plough has a chisel pointed steel tip or share. The plough is the only field implement that is used by the farmers. The plough and the yoke costs about 150 Rials. Mostly hard wood Acacia is used for its construction.

The plough covers about 0.35 to 0.70 hectare in a day of six hours. The bullocks or oxen are comparatively of small size hence less capacity. The ploughing is done between November and April. Sometimes the land is ploughed several times which helps in receiving and retaining the rainfall.

The plough breaks and stirrs the soil to a shallow depth of 15 cm and the land is left in cloddy condition to prevent soil erosion by wind or water. Under spate irrigation, the ploughing time depends on floods. However land is ploughed once during the pre-flood period and once again when the land is sufficiently dried. It is said that the farmers calculated cycles by stellar constellations. The position of the star *al-naysan* determined the time for last ploughing.

Fig. NO. shows the sketch of the wooden plough with a steel or chisel tip. Fig. NO. shows how a plough is yoked to the bullocks and is drive by the operator.

The camel driven plough is more or less similar to the plough described above. Only one camel is yoked by means of two long ropes and an evener rod attached to the plough beam. Fig. NO. shows a sketch of a camel driven plough.

These ploughs are in reality cultivators and are multipurpose implements used for ploughing, cultivating and also for sowing seeds. Being light in weight they can be easily carried on hill slopes or on terraces. Though the Yemeni farmer does not use any harrows, the land is ploughed several times thus making a fine enough seed-bed for sowing seed.

The top-most terraces of the steep mountains sides are often so narrow that cattle-driven ploughs cannot be used in them and such land has to be cultivated by hand tools such as hoes.

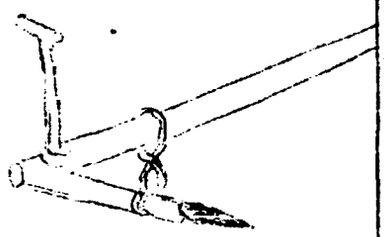


FIG. 40 - YEMENI PLOUGH

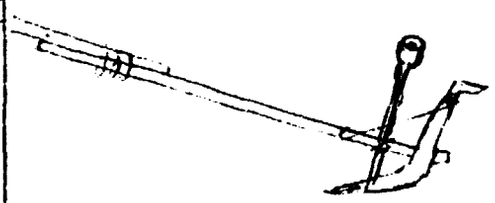


FIG. 43 - PLOUGH SEED DRILL

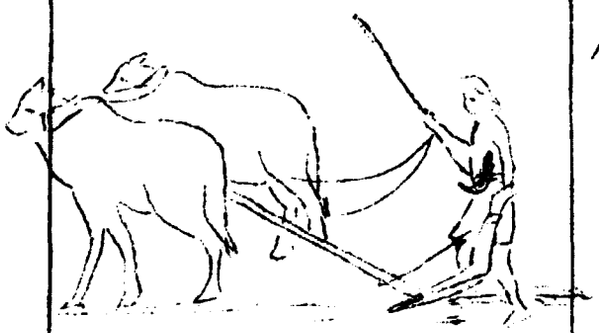
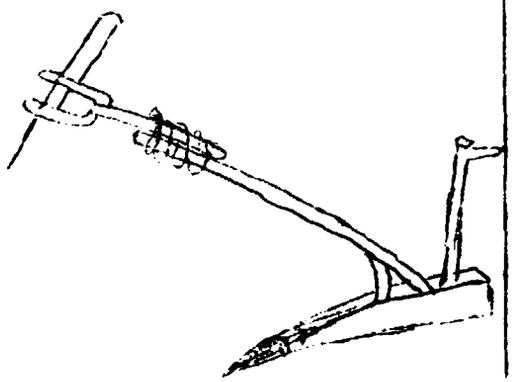


FIG 41 - YOKED PLOUGH



SOURCE
(A SKETCH OF AN OLD PLOUGH IN NATIONAL MUSEUM, SANA'A)

FIG. 44 - ONE PIECE PLOUGH

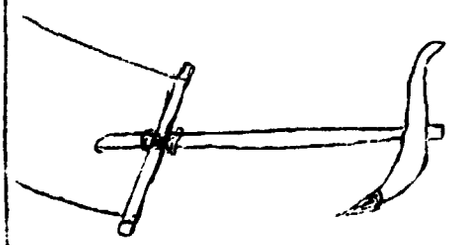
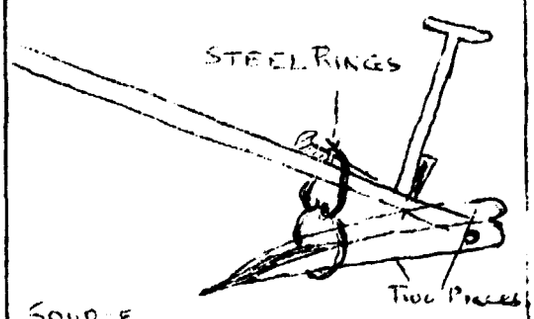


FIG. 42 - CAMEL PLOUGH



SOURCE
(A FULL-SCALE MODEL OF A PLOU
IN THE NATIONAL MUSEUM SANA'A)

FIG 45 - DOUBLE PIECE PLOU

There is also an interesting full scale model of a wooden plough at the National Museum at Sana'a. Probably in earlier days more thick wood was available to make a single piece plough body. Please see figure NO. Later on only small diameter logs of wood was available and this design of the plough came into existence please see Fig. NO. The body is made up of two beams of wood joined together by a steel ring which in turn is joined by a 'U' shaped steel piece to the beam. The wooden wedges are used as joiners.

SOWING

The seeding operation is performed by dropping seed down a spout which passes through the centre of the wooden plough as shown in Fig. NO. er is placed at the back of the ploughs. The funnel is joined to the tube or the seeds are scattered by habd in the furrow behind the ploughand covered by pushing the soil by foot. The cereals are often interplanted with cow-peas or field beans.

In highlands the planting is begun about two weeks after the spring rams. The farmers traditionally establish this date by the position of the star al aleb at the beginning of May.

Since only recently the use of artificial fertilizers has been introduced in Yemen and there is need to sow seed and fertilizer simultaneously.

If enough moisture is available or there is availability of irrigation water, the cereals often interplanted with cow-peas or field beans. These are mixed with the cereal grains and sown through the same drill. Later in the season the plants are thined out and weeds are removed and used as animal fodder.

LEVELLERS

The levellers used by the Yemeni farmers are called Maharr . They consist of wooden boards pulled by cattle, donkeys or camel. They are used for levelling and consolidating the soils. While operating the driver stands on the board adding weight to it. Fig. NO. hows an implement.

Wherever the fields are too small and narrow, where animals cannot be used, the farmers use a smaller implement called Mu abb. It is also used for preparing small bunds of earth around the plots for irrigation purposes. Fig. NO. s ows this type of implement

THE HARROWS

The harrows are not used but by stirring the soil several times the same effect as harrowing is obtained and the soil is made fine enough for the crops to be sown.

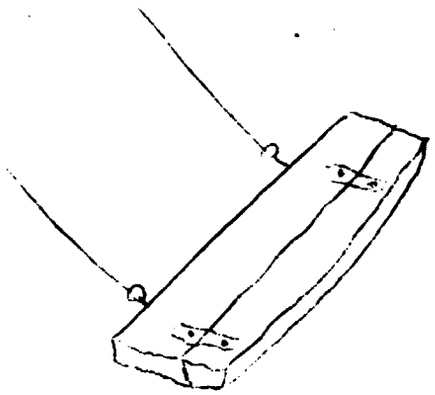


FIG. 54 - LEVELLER

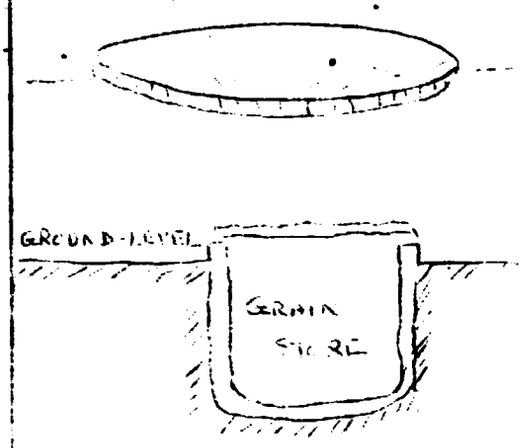


FIG. 57 - STONE THRESHING FLOOR AND GRAIN STORE (ALMA

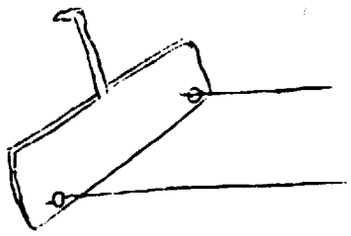


FIG 55 - LEVELLER - 2 MAN Operated

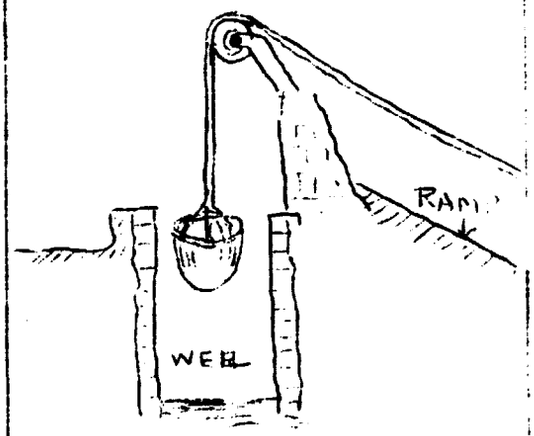


FIG. 58. WATER LIFT (DALLUA)

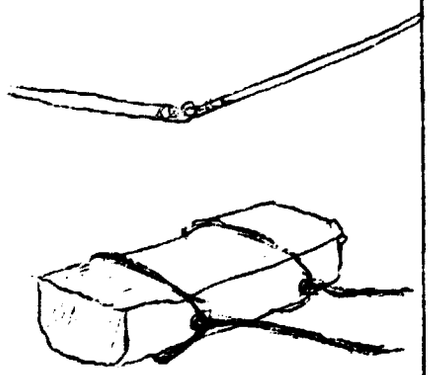


FIG. 56 - FLAIL AND STONE FOR THRESHING

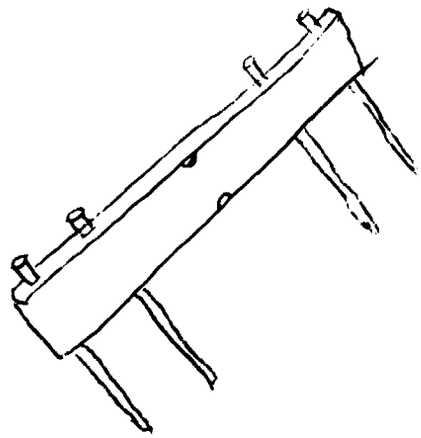


FIG 59 - YOKE (FOR Cattle)

HARVESTING

The harvesting is done by a sickle made by the village artisans. The sorghum cobs are harvested (cut) by sickle. Afterwards the stalk is cut off a few centimetres above the ground wit a sickle called Sharin, tied in bundles and piled in conical stag to dry for later use as fodder.

The stumps or roots left in the ground are collected for being used as fuel.

THRESHING

The threshing of Sorghum and wheat is carried out by means of animals by trampling under their feet on a stone paved threshing floor, which is owned by a village. All crop harvested is carried to this threshing floor. The crop is piled on it and the animals are made to walk on it. By pressure of animal's hoof the grain is separated. The threshing floor is called Al- juon which is use in common with the entire village. The grains are left to dry for some time and then threshed. Please see Fig. NO.

For small areas and crops like maize, a flail or a stick is use for beating the crop spread on a cloth (Fig. NO.).

In some areas a big stone is pulled or dragged behind the animals on the piled up crop for threshing. Now a days traotors are worked on the pile on contract basis for threshing, at 30 to 49 Rials an hour. (Fig. NO.)

WINNOWING

Is done by throwing the threshed material in the air, thus separaitng the grain from the husks or cahff by natural wind or sometimes by using special winnowing baskets.

A 2, 3 or 4 pronged pitchfork is also used for throwing the threshed material up in the air to separate straw grain or it is dropped by hand as shown in Fig. NO. .

The small mud ovens known as Manifam in which wood is used as fuel, please see Fig. NO. .

The Tannur to make rutties or flat bread is a pit underground with lines at various angles scratched inside to hold the raw bread till it is baked. Coal is used as fuel. The dough for bread is flattened by hand and then flipped and stuck on the inside of the tannur where it is baked for few minutes till it is slightly brown. Please see FIG. NO. .

FIG. 60 - WINNOWING OPERATION

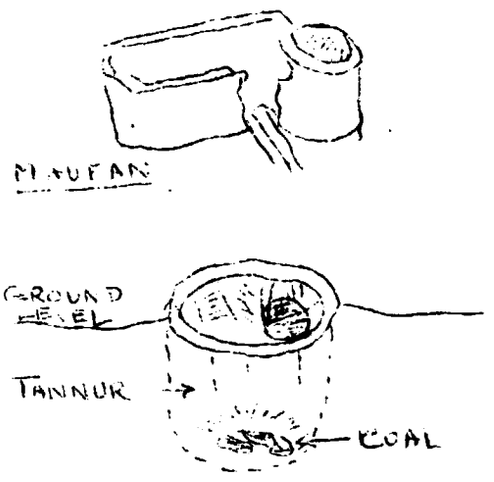


FIG 63 - MUD OVENS

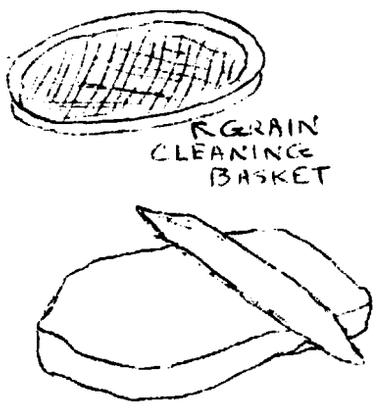


FIG. 61 - GRINDING STONE AND (MANKIALS)

FIG. 64 - BUTTER CHURN (MATHAN)

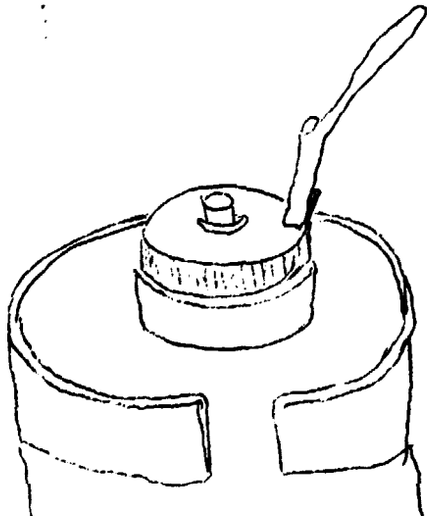
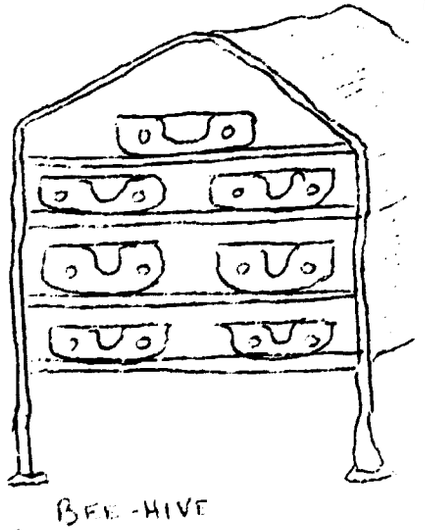


FIG. 62 - GRINDING WHEEL



BEE-HIVE

FIG. 65 (KHALIA FOR ASNL)

The dough is prepared by soaking the millet grains in the water overnight and rolling it several times on the roller stone called Masakh as shown in figure No. (mishaqah).

The rural families also have in addition a bigger f grinding stone called Mithama FIG. NO. for cereals and seeds Here no part of the germ layer is removed in the milling hence more nutritions than imported white flour. The typical Yemeni bread id flat round loaf, only slightly leaven. Its flavour is best when it is fresh from the oven, because it contians no mil or fat and dries out quickly. It is called Ruti.

GRAIN STORAGE

The grain is stored in an earthern pit dug in the groun in the farm house. It is called al-madfan. Each family usually possess this and is an excellent storage system which keeps the grain protected from humidity and insects for a long period (Fig. No.).

BUTTER MAKING

Milk forms small but regular part of the diet in the mountain areas. Whole fresh milk is rarely consumed except when given to infants or small children. Cows, goats or sheep's milk is usually left to sour in a hollw gourd after which the fat is separated by shaking vigourously for about 20 minutes. The butter fat is called Samn, it is heated over fire to obtain Zubda or Ghee. It fetches high price and farmers usually sell a large part of it and keep only a small part for own consumption To replace samn they buy sesame oil or oth r imported vegetable oils. (1.25). The butter is called Laban.

Indigenous Bee-hive

The Yemeni Bee-hive is made of layers of nine wooden oval cylinders stacked on frames clear of the ground and roofed with dura stalks or flattened tins. The box size is roughly 4ft. x 2ft and inches each cut and hollowed from a single piece of fiens wood and fitted with lids one of which has two holes The boxes are arranged in a pile of four pairs with the ninth on the top and the assembled pile is kept off the ground by lar stones wooden poles and covered lenghtwise with mattings. There are thus nine colonies of bees to each hive and on an average each farmer cares for about 40 hives. (please see figure NO.).

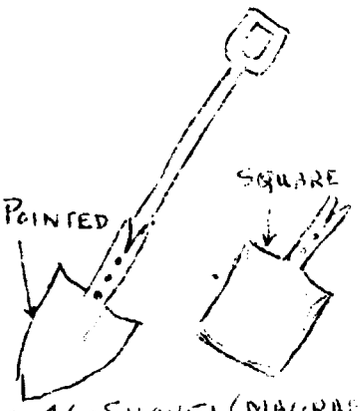


FIG. 46 · SHOVEL (MAGRAFA)

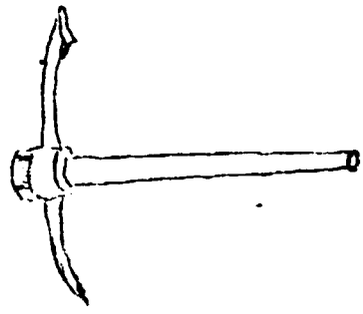


FIG. 50 · PICK-AXE (FASS)

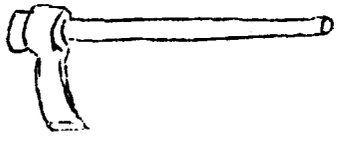


FIG. 47 - AXE (MATRAKA)

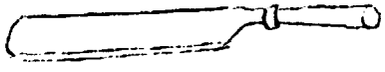


FIG. 51 - HACHET (SIKIN)

FIG. 48 · SPADE (MAGRAFA)

FIG. 52 - SICKLE (SHARIN)

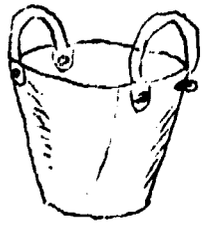


FIG. 49 · RUBBER BUCKET (SALLA)

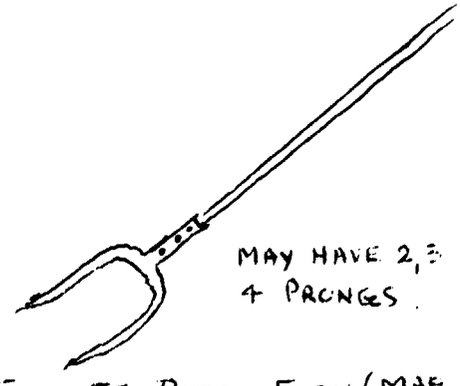


FIG. 53 · PITCH-FORK (MAF

The beekeeping is the occupation of a surprising number of farmers in the fertile wadis of the middle heights and the Tihamas. The techniques employed obviously date back to very ancient times as does the form of the hive construction. It is common to see a large number of bee-hives in the villages. The colonies of bees seemed to flourish and no history of any trouble or disease traced.

The production is about four bottles of honey from each hive. The hive costs about 600 to 800 rials and its life is 20 years. The farmers understand the reasons for their techniques which by modern standards are inefficient and the use of modern but simple equipment could well make this activity more efficient and paying.

PART 11 - AVAILABILITY OF POWER IN YEMEN ARAB REPUBLIC

(1) HUMAN POWER

Human power in Yemen compared to other developing and the developed countries is also in short supply for a combination of various reasons. This affects both agriculture and industry. The human power is in short supply in respect of both quality and quanity.

(1) Out of a total population of 6.5 million people in Yemen about a million are working in other nearby countries.

(2) This one million force consists of young males (20 to 40 years) leaving very young or very old or women in Yemen for farm works.

(3) The general health standard in Yemen is rather low due to malnutrition, lack of medical facilities in rural areas with the result that heavy manual work for say eight hours is not possible here. It is interesting to note the prefecence of the people for sedentary jobs such as in offices or shops or as merchants and traderswhich does not require much of maual work. There is greater incidence of tuberculosis, byzallariach and other diseases due to water population. The Government is taking better steps to improve nutrition and to provide better medical facilities.

(4) Due to Social System Mostly males work in farms and factories leaving out nearly half of the population. With the growth of education this is changing slowly.

(5) Unlike in other Asian countries the labourers here do not carry 'head-loads'. Most of the earth shifting or construction work alone by using a rubber bucket of rather small size (1 cub. ft.)and carrying it on the shoulder. The head load system carrying the load in steel baskets is more effiecient both in respect of carrying the load to a longer distance and of greater volume.

(6) The working hours in Yemen are such that about 5 hours work is done per day as compared to 8 hours in other developing countries. Most of the afternoon time is no-work time.

"MR. Beskok observes in his Report on Afforestation as follows.

" The construction of gradoni terraces, digging holes etc. was done by labourers. Owing to debility and under-nutrition of Yemeni workers and the short working days the averages are below the general averages in other countries.

In Taiz the working day was five hours in Ausseifera farm from 7 to 12 and included ½ hour break at 10 . 10 am. "

(7) Lack of education and vocational training further contributes to the efficient use of labour.

(8) With the change of commercial or market from subsistance farming the position of rural labour is likely to deterioate further.

Considering all these factors it will be cleat, that the position of human labour in Yemen is rather low both in quantity and quality. There is urgent need to take corrective steps for this but the magnitude of the problem is such that the decisions and actions can only be 'taken at the highest level because so many envoirnmentak, social and economic problems are involved'.

On an average one human being developes about one tenth horse power but because of the limitations, of health, working hours, customs etc. mentioned above it may be assumed that in Yemen, it will be one twenthieth horse power. Further considering migration of labour and non-utilization of female labour the working population may be assumed at 40% of the total populations On the basis about 1,625,000 labour force at one twenthieth horse power is therefore 81250 (horse power). Compared to other developing countries of equal population this figure is almost one fourthindicating a very serious problem that needs urgent action on many fronts.

Keeping this important thing in mind only the labour saving implements and machines have been recommended both for farm and factory work.

The effect of 'Quat Ching' on labour hours is known to the Government and from the following paragraphs it is evident that some sitable action is being contemplated to offset ill effects of qat.

(SOURCE -- The phenomenon of "Qat" chewing Source Vol.11 Analysis of the Status Quo p.25. para 6 C.P.O. June 77.)

In this respect the physiologic effect on man is not important, as this phenomenon may not be very different from other addictions which have become established habits with all peoples of the world such as tobacco, tea, coffee and others, but the economic effect, in particular on the working power and especially in respect to the length of the productive day, is the factor that really influences development. On the other hand, the allocation of agricultural areas and that effort spent on cultivation of this crop delay the possibilities of increase of cultivation of economic and food crops, the country is in urgent need of. Also the spreading of this habit and consequent continously soaring price of the Quat lead to the increase of prices of all other products.

Neverthe less, this phenomenon has some economic positive points, such as its constitution of channels for the transfer of the buying power from the city to the countryside which produce this crop and therefore participation in the self-development of countryside.

The policy followed in this field must be of utmost flexibility and prudence, and we must adopt economic incentives, whether by encouraging cultivation of substitutes, even by granting government aids, or inciting to abandon it, even by means of improving indirect taxation.

ANIMAL POWER IN YEMEN AGRICULTURE

The farmers in Yemen use mainly cattle (both cows and oxen), donkeys and camels for agricultural purposes.

The cattle are mostly Zebu type. The bulls are rarely castrated. The use of cows for draught purposes is wide spread. The cattle undertake a variety of tasks- ploughing, levelling, seeding, building bunds and diversion channels. The cows weigh about 250 to 275 kg. and the bulls 450 kg. The cows are kept for production of milk and Ghee (Purified butter fat obtained by boiling butter) and also for draught purposes. The feeding cost averages between 2 to 4 YR's/ a day. The purchase price of a strong pair of bulls may be as high as 4,000 to 5,000 YR's. Hence the practice of sharing or hiring of draught animals is wide spread. A pair of bulls with driver costs about 20 to 25 YR's per day to hire in the slack season for bund repairs and levelling and up to 30 to 40 YR's/ per day for cultivating during peak seasons of ploughing and sowing.

On an average a farmer owns 1-2 cows, 1-2 bulls, 6-10 sheep and goat and 1-2 donkeys. In certain areas like Wadi Rimah, the share cropping of live stock is common. The sharecropper retains a proportion of cattle production, usually all the milk and jhalf the offsprings.

The livestock are traded at most markets. This gives the farmers ready cash. The trade is brisk, if there is shortage of fodder.

There is usually one stud bull per village but systematic breeding has only recently been undertaken. There is need to develop a dual purpose breed like DEONI in India which is useful both for milk and draught. This particular breed comes from sorghum growing area, is light in weight but strong and may be tried for breeding in Yemen. Fig. NO. shows a bull belonging to this breed which won first prize in all India Competition recently.

The indigenous cattle are small to medium sized thoracic humped Zebu type, having short upright horns and laterally placed ears. The Yemeni Zebu could be described as a ' mini' version of the East African boran cattle which appears to be well adapted to its envoirnment. Its small size and nibleness enables it to forage along the terraces and rocky hillsides and with its equable temperament it also makes an excellent tractable work animal. Being small in size and weight, it has less power.

The condition of the healthy animals existing on poor and rough fodder like sorghum stalk and grazing on hill sides is of a remarkably high standard and when supplementary food is provided there is evidence and reputation of high productivity in milk and meat. Even more important is the ability of this breed to withstand for long periods the high temperatures and high humidities found in both coastal and mountain zones. Its thermo regulatory mechanism appears to be really remarkable in relation to the variations of climate and environment to which it is subjected and under which conditions it continues to thrive. This is an important point in its favour and logically it suggest that there is an excellent material available in the country for undertaking selective breeding work.

The cattle feed themselves by foraging on stony hillsides supplementated by sorghum stalks and leaves. There is need to introduce hand operated circular fodder cutters to save a large part of sorghum stalk that goes waste. In the valleys and the plains, tractor mounted fodder cutters doing custom cutting of sorghum stalk is worth trying.

The sorghum and millets are carefully preserved by the Yemeni farmers for use in the dry season. Lucern is grown under both rainfed and under irrigation.

The ploughing and the handling of the working bulls and oxen on the terraces is mostly done by older men assisted by women. The light wooden ploughs are well handled, the yoking is good and no sores or neckgalls are seen as a result of ill-fitting equipment. The animals are tractable and the work is carried out with minium fuss. Skillful ploughing leaving a small margin on the terrace is the general rule with the animals working effortessly obviously not under any steers.
By and large the animals carrying pack equipment are also well handled and it is only ocassionally that misuse of working animal is seen and inevitably when they were in the hands of town youth In the mountain towns, the livestock are housed at night in the lowest storey of the houses or special sheds. In general the live stock are well treated and well cared for by the Yemeni farmers and a great deal of attention lavished on the work animals and it is fascinating to watch the practice of wrapping Lucerne or some other succulent leaf around the sorghum stalk and then feeding each individual stalk by hand to the individual animal.

The animal traction is destined to continue to play the major role in agriculture for a long time to come.

In the Tihamas the holdings are much larger and of a communal or tribal nature. With the onset of the early rains the Tihamas people push up the Wadis with their livestock and hire themselves out to assist in the ploughing and prpparation of land.

THE CAMELS

The camels are the main beast of burden providing the best of transport in the Yemen at all altitudes and under all types of conditions. They are the single humped camel common to the Near East and North Africa (camelus dromelarius). In the Dhamar district some very fine specimens of black camels can be seen. They are used for ploughing and drawing water from wells. They are particularly noticable for their tractability and the "rapport" between them and their owners. Indeed they seem to have remarkably equable temperament and there is a mutual respect and almost affection between them and their owners.

Once away from the main highways which are very few it is necessary to revert to animal transport as the only practical means of reaching the mountain dwellings. For long distance trasport the camel caravans are highly organized having their own ancient paths and being a highly organized and profitable business of hiring.

THE DONKEYS

For transport the stunted 'ubiquitons donkey is convenient for most small holders and particularly for women. Without donkey the life in rural areas would become very difficult indeed They are used extensively for riding, carrying packs of manure, wood carrying watee tanks, for pulling well sweeps, ploughing, harrowing, soil preparation and a legion of other duties. But most of them are stunted. Attention needs to be given to their proper feeding and breeding.

In addition to the agricultural jobs, these animals will continue to be the main means of country's transport for at least 15 to 20 years to come till rural roads are built.

THE LIVESTOCK POPULATION

(Source: Extract from Table NO. 25, NO. of Livestock 1961-1974 Statistical Year Book 1975-76 - by Central Planning Organization 000 heads.)

Year	Cattle	Sheep and Goat	Camels	Horses	Asses Donkeys
1961	1280	11160	53	3	-
1966	1200	10972	75	3	572
1970	813	8769	52	3	511
1974	900	10000	100	4	600

From the above table the working animals in Yemen are under in 1974;

(1) Cattle - 900,000
(2) Camels - 100,000
(3) Donkeys- 600,000

Total - 16,00,000

According to Table NO. 18 published in theabove mentioned stastical year book the total cultivated land in 75-76 in Yemen is 15.15 ha.

That means there is approximately one working animal per hector of land in Yemen. A pair of Yemeni bullocks is estimated to give about 0.50 HP being small in stature and weight. One pair of donkeys may also give the same HP (Horse Power) and also one camel. For measuring the horse power of these animals no dynamometer trials have so far been taken. The above are only estimates. The trials will be taken when the scheme mentinned is implementated.

Considering on an average that one animal gives about 0.25 HP the farmers in Yemen have 16,00,000 = 400,000 HP available from animal source. This equivalent to 8,000 tractors of 50 HP.

The importance of cattle population or animal population can be realised from these figures of total of available HP of 400,000 equivalent to 8,000 tractors of 50 HP.

It is also estimated that there are about 3,000 tractors of 50 HP in Yemen out of which about 2,500 are in working order. The tractor population is likely to increas rapidly to high first cost of animals and ever increasing cost of feeding them. Tractors of suitable horse power, with matching implements and correct sized tyres should however be used to make the best use of the tractors. This is dealt with in detail in the chapter on mechanization in Appendix No. 17. However the tractors in next 15 to 20 years as explained earlier would be helpful for only 25% of farms in Yemen mostly owned by the Government, big landlords or on co-operative or custom basis.

The rest of the 50 to 75% of the farmers may have to use durin this period animal driven or manually operated tools and implements for their agriculture and rural transport.

To make the best use of the available animal power it would be necessary to improve them be scientific breeding, by making better fodder and feed available to them, by using improved yokes, by castration of bulls, by shoeing the cattle as is done in India to increase their life and by using improved and new designs of implements. These factors have been discussed below:

(1) BREEDING OF DUAL PURPOSE BREEDS

OF cattle has been mentioned in the previous pages. For both milk and draught, a breed like Deoni from India can be tried. It is from that part of India, where the main cattle feed is sorghum as in Yemen, it is a comparatively light breed, is strong and agile and the climate in that part of India where it is used is also hot and humid.
Because of these similarities in weight, feed and climate this breed has been suggested as an example. A photograph of this breed tajen from the FAO Journal 'Animal Health' is given at Fig. NO.

(2) Better Fodder - Fodder is in short supply in Yemen. Sorghum stalk and leaves, and where irrigation is available Lucer are the two fodders that are usually given. The dry sorghum stalk is usually not relished by the cattle. They eat the leaves and the top portion of the stalk and the other portion is wasted. To avoid this waste it should be cut in small pieces of 1 to 2 cm. by means of a hand operated or power driven fodder cutters If possible for dairy cattle a silage can be made out of such cut stalk. The milch cattle could be given small proportion pf cotton seed or cotton seed cake to get better fat percentage in their milk.

(3)Castration of Bulls now a days is a very easy process by means of the burdezzo castrators.
The bulls, after castration become more tractable even for inter cultivation, for weeding and for preparing soil mulch to conserve the moisture between rows of palnts. In Yemen castration is not followed probably because of want of the burdezzo castrator.

(4) Use of Improve Yoke - The yokes used in Yemen are quite good form neck galls on the bullocks, an improved yoke like NAGPURI yoke may be introduced. A stock of this type of yoke is given in Fig. NO.

(5) Shoeing the Cattle - This method is invariably followed in the case of working bullocks in India. This increases the life of the bullocks as their hoofs are protected from wear and tear by stones, clods and stumps. The lower portion of hoof is rather insensitive and steel-plates or shoes can be nailed in it. This operation is required to be repeated after each two to three years. It will hardly cost 10 YR's for each shoeing a bullock including the cost of steel shoes, nails and labour. The work can probably be done by a viallage buture after a little training.

(6) Using new and improved implements has been discussed in detailed under the recommendations.

SOLAR ENERGY

Since all Arab countries are situated in Arid and semi arid zones, which are characterized by high solar radiation, the use of solar energy by photovultaic or thermo dynamic conversion would seem to be a particularly promising field for Research and Development at National Sub regional and regional levels.

Solar Cells are commonly used in space crafts (photo voltaic devices). Until recently the direct evnversion of solar energy in to electrical energy using the photovoltaic effect has been for to cost earlier $100 per watt

now $ 20 " " produced.

Still this is high because conventional energy costs are less the $ 1 per watt.

But there is a possibility of considerable reduction. Further research and development is necessary by Arab States jointly or individually.

Solar Pump - The first experimental model has been into operation in Dakar (Senegal using a 12m^2 (130 sq. ft.) collector and pumping 1135 litres (300 US gallons of water per hr. This has been further developed and latest models are in operstion on s lsrge scale in Mexico and Brazil using a turbines instead of a piston engine and producing electricity up to 33

[illegible]

These are remarkable achievements compared with original piston engine model, which was able to produce only 1 KW/hr. There is possibility in near future to produce only 150 KW/hr.

Although these engines are still rather expensive, their adaption and installation could be beneficial in certain areas of the Arab region for Production of electricity and the pumping of drinking and irrigation also for desalinution of water and heating buildings in Sana'a.

MR. J.M. Goajewski, UNIDO Expert on small scale Industries who visited Y.A.R. in 1970-71 (Project NO. YEM-111-A (ID) has recommended in his report for carrying out feasability studies on Solar heater and for production of solar heaters. The great number of sunny days even in winter offers possibility of using solar energy for water heaters, even for heating flats and houses during cooler days especially in Sana'a area.

Recently MR. Winfried Boell Head of German Delegation to First Five Year Plan Conference (2th Nov. to 2nd Dec. 77) in Sana'a mentioned in his address.

"Since fossil fuels are not produced in this country, the idea to use the abdundant potential of wind and solar energy should further be pushed forward to its soon realization".

ECOLIAN ENERGY (Wind - Power)

The development of wind energy technologies for electric power generation and water pumping should have a promising future in some areas in Yemen Particularly in connection with maintenance free systems for remote areas. Most of the terrace farms in Yemen are located on the Westward and southward slopes of the mountains and in some places the wind velocities are adequate for using Austrialian type windmills. Particularly they may be used for supply of drinking water to villages.

The wind velocities (in knots) 1963-66

(Source - MR Narayanomans Report on Minor Irrigation)

	Sana'a	Taiz	Hodeidah
(1) Animal Average at 8.00 hrs -	3.8	5.7	9.3
(2) Annual average at 14.00hrs -	8.7	10.7	16.5
(3) Annual Average --------	6.2	8.2	12.9.

The wind Speeds in Zabid

(Source - Table 7 - Stastical Yearbook 1976 - C.P.O.)

YEAR		MONTH	m/sec.
1970	Min	Nov.	0.4
	May	July	4.6
1971	Min	Dec	0.5
	Max	May	4.3
1972	Min	Sep	0.2
	Max	Aug	3.7
1973	Min	Jan.	0.6
	Max	July	3.9

The first cost of wind mills is more but the working cost and the maintenance cost is less.

PETROL AND NATURAL GASES

Except in the Yemen ARAB REPU BLIC there are certainly most important energy sources at present availa ble in the Arab States Regions but in Yemen the Petrol and Diesel has to be importe from other countries.

HYDRAULIC POWER

is also not available in Yemen since there are no big perennial rivers.

BIOLOGICAL ENERGY

Such as production of methane gas by using cattle-dung in Bio-gas plants may be given trial in some areas in Yemen. This works on the principle of anerbic fermentation and the gas which can be used for cooking and lighting is produced by bacterias. The residue after the gas is produced is a good manure having high percentage of nitrogen.

FIREWOOD AND VEGETABLES WASTES

are useful as small energy supply for domestic use. In view of the rapid disappearance of the few woods and forests in its use is also very much restricted.

Coke, Coal, peat or lignite are not available in Yemen and has to be imported.

In short as far as availability of power or energy, the position of Yemen is very negative and great attention will be give to this problem.

APPENDIX No. 13

AGRICULTURE SITUATION IN YEMEN - A Study

CONTENTS

AGRICULTURAL AND INDUSTRIAL SITUTATION IN YEMEN

(1) INTRODUCTION ---- Before one begins to make recommendations on the use of agriculture implements and machines for YAR it is necessary to study both the Agricultural and Industrial situation in Yemen to arrive at correct conclusions and appropriate recommendations. Therefore these two studies were undertaken. Both these are vast subjects but in the present studies only such relevant information which has direct or indirect bearing on choosi designing and manufacturing agricultural implements such as, power, land holdings, rainfall and climate, irrigation availability of raw materials, labour, capital, power demand, repair facilities, cooperative use, joint ventures etc. have been covered.

The soils have been cropped for anumber of centuries. It is certain that Yemeni Agriculture is amongst the oldest in the world (Nile, Tigris, Euphrates, Ganges, Yangtse etc) with historical records as old as 200 B.C. The tradition extends even further into the past asserting that the Yemeni's are descended from the Patriarch Qahtan (Gaktan) and Adnan, grandsons of Noah. It can safely assumed that agriculture was established in the Yemen about 5000 to 6000 years ago. The first agricultural settlements would almost certainly have been in the fertile wadi bottoms where there is perennial water. As population increased, more land was required for agriculture, the terrace system would start and would gradually extend up the mountain sides as more labour became available and more lands were needed to feed the expanding population. Isolated by desert and sea and secure in their rugged mountainsm the Yemenis suffered nc disasterous invasions and no interruptions to thier stead agricultural expansion. One can assume, therefore, that most of the agricultural lands would have been depleted of fertility during this long period. The Yemeni farmer is aware of this. He carefully conserves the farm yard manure and ask and spreads them on land at planting time.

Because of the vagaries of climate the Yemeni farmer has always bee conscious of the need to conserve moisture. The terrace shstem partly serves this purpose by enabling rainfall and runoff water to be spread evenly over the fields through a system of parallel furrows. This careful husbanding of runoff from rocky slopes and of direct rainfall on the feilds has certainly checked soil erosion ans conserved soil on slopes for thousands of years.

The farmers by experience learnt how to conserve moisture. The terraces and border ridges serve divert runoff water into the levelled plots to be cultivated. The ridge and furrow cloddy surface promotes the water intake and controls wind and water erosion. The concentration of water on cultivated plots permits early planting in moist soil with a reserve of moisture to carry the crops for several weeks should rainfall fail for a short period.

Wherever possible, the source of information has been indicated. If not, the arrived figures are only estimates based on background information. Both these studies cover every conceivable aspect of situations both in the agricultural field as well as in the industrial field and would be useful for any future work.

The bibliography of various reports studied is given in Appendix No. As much up to date statistical data as possible has been collected and quoted mostly from the reports and publications brought out recently by the Central Planning Organization of the Government of Yemen Arab Republic and from reports of the experts under the United Nations.

(2) GEOGRAPHICAL SITUATION OR LOCATION

The Yemen Arab Republic lies between latitudes $12^{o}40$ - $17^{o}26$ north and longitudes $42^{o}30$ - $46^{o}31$ east and located on south-west edge of the Arabian Peninsula. In Arabic it is called AL-Jumhuriyah al-Arabiyah Al-Yaminiyah The country is bordered by Saudia Arabia in the north, the Peoples Democratic Republic of Yemen in the south and south east and the Red Sea in the west. East of Yemen is the great Arabian desert, the Yemen quarter of Rub-al-Khali The border is not clearly defined.

(3) BRIEF HISTORY OF THE COUNTRY

The very name of Yemen is derived from the the word "ymn" which means 'Prosperity'. In ancient times Yemen was a well developed and propperous countryand was sucessfully a seat of MINAEAN (13^{th} to 7^{th} century B.C.) and SABAEAN (9^{th} century to 115 B.C.) Kingdoms and Himiarite civilization (115 B.C. to Ad 525). The remains of great Queen of Sheba are to be found in the north-easte part of the country. To the medieval Arab scholars it was known as "al-Yaman as Saida" . To the Greeks as "Evdaimon Arabia" and to the Rom as "Arabia Felix", both meaning "fortunate Arabia because with sufficientrainfall and good climate Yemen is quite unlike other parts of Arabia which usually is regarded as a desert area. The soi here are of volcanic origin and rainfall is enough to carry out cultivation. Because of diversity in topography there is diversity in vegetation.

The settlement in Yemen started in 2245 B.C. Oldest known inscriptions date back to 10th century B.C. Contacts then existed with Greece, Percia, and Ethopia.

In the year 628 A.D. the people were converted to Islam. The Ottoman Turks assumed control in the sixteenth century and remained, with brief intervals until 1904, when the Iman Yahya, after a revolt gained recognition from the Ottoman Sultan as as independent ruler.

The country achieved full independence in 1918 and its border with Saudia Arabia were established by a treaty in 1934. Yemen was admitted to United Nations on 30th September 1947.

The country was declared a Republic following a military coup in 1962 and Imam Mohamed El Badr, the ruler was overthrown and fled to Saudia Arabia. A devastating civil war between the Royalists and the Republicans lasted for seven years. In 1967 a new coup brought an independent and moderate Government to power and in May 1970 a coalitic Government was formed and from then on the real march to modernization started.

The North Yemenites are devoted Moslems who observe the teachings of the Holy Koran. The country, its population and its traditions csn only be understood by a study of Islam. Islam is the official religion of the Yemer Arab Republic.

Isolation -

Though it is one of the most ancient countries in the world, it remained isolated from the modern world until the beginning of the 20th century. This is one of the main causes of its under development. In fact the major developments have come after 1970. Until 1962, it was an area either forbidden or difficult to access. This medieval period was followed by a seven years of civil war and a severe draught of 5 years which reached its peak in 1970.

(4) HISTORY OF AGRICULTURE IN YEMEN AND FARMERS

Achievements and nature

Yemen has in many ways a unique agricultural Envoirnment possibly equalled by very few countries in the World. This is because of its varied topography, climate and soil.

The dry farming techniques followed by the Yemeni farmers in the Taiz and Ibb Governorates are equal to the most advanced methods used in the western world. The ox-drawn wooden plough with steel chisel point breaks the soil to a minium depth of 20cm when the land is furrowed after the crop is removed. The land is left in a cloddy condition, resistant to both wind and water erosion. Under this cultivated layer at a depth of about 20cm consistently a more compacted layer of soil is found into which water penetrates freely and which falls as rain or which is diverted to the terraced fields as runoff from higher lands.

The small number of animals owned by each farmer mean that a great deal of attention can be and is lavished on the individual animals. Particularly this is so in the case of cattle and camels and it is fascinating to watch the practice of wrapping Lucern or ,some other succulent leaf around a dura stalk and then feeding to individual animals.

The camels are known for their tractabili and the Rapport between them and their owners, Indeed they seemed to have a remarkably equable temperament and there was a mutual respect and almost affection between them and their owners. The animals (cattle) are tractable and work is carried out with minium fuss. Skillful ploughing, leavin a small margin on the terrace is the general rule with anim als working effortessly and obviously not under stress.By and large the animals carrying pack equipment were also well handled and it was only occassionally that misuse of working animals could be seen and inevitably when they were in the hands of town youths. In general the livestock(cattl and camels) are well treated and well cared for by their Yemeni owners.

" The one redeeming feature is the many excellent terraces which curtail erosion. The Yemeni farmer puts to admirable use whatever flow he can harness by the limited means at his disposal. It is the large floods which he has been unable to control".

(MR. Narayanans Report on Minor Irrigation F.A.O.)

"It is interesting to note that the eastern part of Yemen has an ancient history of irrigation.

The dam reputedly built by the Queen of Sheba more than 2000 years ago is in this region at Marib. This is said to be one of the most ancient works of irrigation in the World.

The Yemen has also contributed in its own way to the development in introduction of a new crop to the world. Coffee was found growing in a natural stage in Ethopia but it was the Yemeni farmers who first grew it as a cultivated crop and the word coffee is derived from the Yemeni Arabic word Quava. The Mokha coffee was very famous in the world.

From the abobe discussion it would be clear that Yemen was not all the time least developed country. It became so by various historical factors such as isolation, civil war, drought and the geography and given the technical assistance and time it can develop into a progressive country. The utility of studying this brief history is that it banishes the inferiority complex and creates confidance and the desire for progress.

His Excellency MR. Abdel Aziz Abdul Ghami, Member of the Command Council and the Priminister of YAR has remarked in his address to the International Conference on the First Five Year Plan held in Sana'a on 29th November 1977 that

"Nevertheless, I cannot conceal our pleasure when we heard the speeches affirming to us that our plan was well designed and integrated and congratualsing us on our sucess in the field of planning; a fact which increased our self confidence and optimism which are our most urgent need at this stage of our struggle to catch up the modern progress of human civilization".

Regarding the desire for the progress and readiness to work for it, deriving encouragement from the history the following remarks made in his address at the above mentioned conference by His Excellency Lieutenant Colonel Ahmed Hussein Al- Ghashmy, the President of the Command Council and the Commander in chief of the Armed Forces are well ilustrative of the indomitable spirit of the Yemeni People:

"In this connection I must admit that our people are highly ambitious. Its ambition surpasses by for all its available abilities and potentiaalities. Nevertheless I see no fault in this confident ambition.

I believe that you all agree with me on this point especially when you realise that the ambition of our people does not stop at the limits of wishful thinking, but rather our ambition is coupled with constant and perserverent work.

Our ambition is no doubt a quality that we inherited from our ancestors who established the greatest cultures and who travelled for and wide carrying the banner ofright-eounesness and good, and the flame of light and civilization.

Ambition is a praiseworthy and legitimate quality, and if our ambition is a little exaggerated, the reason is that our people have lived under the cloak of utter backwardness, and in complete isolation, deprived of the most elementary aspects of modern life, throughout many centuries".

(5) TOPOGRAPHY AND NATURAL REGIONS

Topographically Yemen could be divided into four natural regions, each having its distinct climate and vegetation. Hence there is a great diversity of soils, climate and crops which influence the economy of the country For natural regions please map in Annexure

(1) THE COASTAL LOW-LANDS OF TIHAMA

This region covers an area of 30-60 Km wide stretching along the Red Sea from Bab-el-Mandab in the south, far into Saudi Arabia in the north. The elevation ranges from sea level to about 200 m. at foot hills. It is palin or slightly indulating and intersected by dispersed wide shallow wadis draining from the central mountain range into the Red Sea. The seven major wadis are Mawr, Sordud, Siham, Rima, Zebid, Risyanand and Mawza. The Wadis are seasonal water courses which frequently end in the sands before reaching the sea. In Tihama one finds intermittent patches of cultivated fields and extensive chains of sand dunes.

(2) The upper Tihama or foot hills and Middle height of the central mountain region are situated between Tihama and central highlands within the elevation range of 200m. to 1500m. above sea level. The landscape is very rugged cu by deep wadis running through narrow gorges which have very steep and long slopes and gives canyon-like appearance.

The region is also known as mountain Tihama. The eastern slopes lie between 1500 to 4500 ft, above sea level. The stream erosion has carved the crystalline volanic a nd limestone rocks into a variety of formation. The wadis to the south and east of Taiz drain into the Gulf of Aden.

(c) THE CENTRAL HIGHLANDS - This region comprises of the higher reaches of the central mountain range exceeding 1500m. elevation above sea level. Which extends from Ibb in the South to Saudia Arabia in the north. A chain of highest land is found between Ibb and Sana'a where mountain peaks fr equently exceed 3000m. including Yemen's highest mountain NABI Shu'yab (3760m.). These highlands form the Best cultivated part of Yemen and is said to support nearly 75% of the country's population.

(d) THE EASTERN SEMI-DESERT PLATEAU

Gently slopes towards east and forms rolling country dropping to an elevation of 1000m. where it finally borde the Empty Quarter - Rub-el-khali. This zone may be regarded a transitional area where temperature conditions give way to semi-arid and arid desert conditions.

(6) CLIMATE

(Source- Statistical Year Book - 1976)

Yemen is located in the northern stretches of the tropical climatic zone with two rainfall maxima, following over head run one in April-May, the other in July and Sept. and a long dry almost rainless period of four to five months during the late autumn and winter. Rain bearing winds blow from southeast and southwest. Amount of annual rainfall depen mainly on altitude varying from desert condition on the coast plains up to 1000mm. at 1500m. and higher elevations on weste and southern facing mountains of Ibb District. The rainfall steadily decreases from south to north. This decrease is very sharp and rapid from the central mountain range to the East. Cosiderable variations also occur in short distances in the same regions as one moves from exposed mountain to the shelte ed wadis. Rains are always nearly in heavy showers, frequently with hail.

The coastal low lands of Tihama generally received less than 400mm. rain.

The mean monthly temperature does not vary considerably. The relative humidity is high and due formation along the coastal strip is common. Winds generally blow from south-west abd north-west with high velocities and causes sand movement in the coastal belt or soil erosion in the cultivated fields of inner lands.

The rainfall in the foot hills os over 400mm. and concentrated around August and September. It increases by altitude in the middle heights reaching over 600mm. in Taiz and with two peaks in April-May and July- August- September. The temperature is moderate all the year round in the middle heights. The absolute minium temperature recorded in Taiz is 10.2°C. The relative humidity is lower in winter and higher in rainy months of spring and summer daily fluctuations are considerable, mid days being drier. Main wind direction are east in winter and spring and west in summer and autumn

In the central highlands annual rainfall is said to be over 1000 mm.On the exposed slopes of the most southern end (Ibb district).It decreases at first rapidly, then gradually to the north. The mean annual rainfall is about 800mm in Sana'a and 200mm near Saudia Arabian border in thenorth The sheltered high plateaus of Yarim and Damar are semiarid distribuition of rainfall is unreliable in the north and annual variation is considerable. Full metherogicla records of this region are available only for Sana'a Airport. They indicate the temperatures around freezing point are frequer during the winter. The relative humidity is low.

No meterological data is available for eastern semi-desert plateau. It is generally known as a low rainfall region reaching desert conditions in the east where itjoins the Great Arabian Desert.

The meterological data on rainfall, temperature, humidity and wind velocity id given in Appendix No. 11 just to give an idea of the climate in general. In about 4 to 5 years time exact data from centres will be available, till then this can be a general guide.

(7) GEOLOGY

The country lies over a complex metamorphic rocks probably pre-cambrian in origin, consisting chiefly of mica, shists, guersses, quartzites and marbles across which run intrusions of massive granite and basaltic dykes.

Overlying those are Jurassic beds and teriary rocks consisting of cretaceons sandstones, volanic tufts, basalts and andesites. The most recent are the alluvial formation of the plains in the centre of the country and coastal plains of Tihama.

(8) ADMINISTRATIVE DIVISIONS

Yemen Arab Republic is divided in to Ten Governorates (Provinces or Mouhafaza)

(1) Sana'a
(2) Hodeidah
(3) Taiz
(4) Ibb
(5) Hajja
(6) Sa'ada
(7) Dhamar
(8) Beida
(9) Mahwit
(10) Marib

Each Governorate is divided into several Quada (distri ts). There are 48 Quadas.

Each Quada includes a number of Nahiyahs. There are 165 Nahiyahs.

There are in all 15418 villages in Yemen. Mahalah is a group of houses subordinate administratively to a village. There are 14384 Mahalahs.

Ozlah is set of villages whode major inhabitants belong to one tribe headed by a Sheikh. There are 1680 Ozlahs.

(9) AREA OF YEMEN - Approximately 200,000 Km square.
POPULATION - 6.5 million mostly concentrated in foot hills, central midland and highland regions.
About 90% of the people are rural and directly engaged in agriculture.

The population of 10 Governorate centres (cities) is 350831 (152239 Female and 198592 males)

(10)SOILS

Tihama - soils are composed pf material that is transported by wadis (gravel and silt) or by wind (sand and loess which is a brown mixture of clay, silt and sand). These loess like soils are susceptible to waterlogging in rainy season or wind erosion in dry season. In upper Tihama alluvial soils are good for agriculture.

The highland soils of the terraced fields are largely the result if weathering and are good for agriculture but are vunerable to water erosion. It may also be rapidly exhausted under intensive cultivation where little or no fertilization is used.

One of the most striking features of Yemeni agriculture is the comparatively narrow range of crops grown in spite of quite a wide range of envoirnmental conditions. This can be partly expalined by Yemens isolation from other agricultural communities and to the absence of institutions concerned with introduction of new crops. However, the great age and stability of Yemeni Agriculture and frequent trade contacts with neighbouring countries suggests another explanation for this phenomenon. Perhaps the narrow range of crops may be due to a restrictive soil envoirnment. The wide distribitution of finely divided calcium carbonate in the loess like soils and the universally high plateau (about 8.3) may well be limiting for many crops either directly through low solubilities of essential plant nutrients under these alkali conditions. The absence of leguminous crops, except for alfa-alfa and field beans (phaseolus) is especially noteworthy. It should however be possible to extend the rangee of leguminous crops by introductions from other counries with similar pigeon pea (Cajanus cajan) in parts of Taiz and Ibb districts which have a seven month growing season (april-October), Lubia (Dolichos lablab) cow pea (Vigna sinenis) and the Kordofom pea (Chitoria). There are doubtless many other climatically adapted pulse and fodder species that could be successfully introduced to the Yemen.
However, it is feared that a great many otherwise suitable varities and species may not thrive because of the calcarec soils.

It is believed that nutrient deficiencies may be widespread in Yemen. Certainly Zinc (Chlorosisoncitrus), Potash on banana copper, cobalt, manganese and boron should be considered as belonging tot the catagory of trace elements whose low solubility at ph 8.3 may make them unavailable in sufficient quantities for thrifty plant growth.In addition the solubility of iron, sulphur and potassium may be sufficiently depressed as to cause nutrient deficiencies, especially in tree crops.

(11) AGRICULTURAL LAND USE (75-76)

(Source Table 17 and 18 - Stastical Year Book 1976)

Total area of the country 200,000 Km square

(1) Total area of 10 Governorates - 20,000,000 hectars
(2) Cultivated area - 1515000 hectars
(3) Marginal areas, forest and shrubs and others - 50885 hectars
(4) Out of item No. 2 above
(a) Rainfed area - 1285000 hectars
(b) Flood irrigation 120,000 "
(c) Perennial - 73000 "
(d) Wells - 37,000 "

Table 17 - Agricultural land use by Governorate 75/76

Area: 000 Hectars

Governorate	Total area	Cultivated	Marginal area	Forest @ shrub	Othe
1. Sana'a	8000	400	600	100	6900
2. Hodeidah	3500	235	500	450	2315
3. Taiz	1200	250	100	500	350
4. Ibb	1300	300	50	400	550
5. Hajja	1700	130	250	50	1270
6. Saada	1800	600	200	000	1540
7. Dhamar	1000	100	200	100	600
8. Beida	1500	40	100	000	1360
TOTALx	20,000	1515	2000	1600	14885

Mahwit and Mareb Geov., are included in their previous Govs

Table 19 - Area and production of cereals 69/70 = 75/76

Area: ooo Hectars Production: ooo Tons

Year	Barley		Wheat		Maize		Millet Sorg	
	area	prod	area	prod	area	prod	area	prod
1969/70	145	160	35	--	4	9	1200	680
1970/71	140	154	30	33	16	32	1230	984
1971/72	143	178	50	54	50	80	1100	1020
1972/73	143	164	50	50	50	80	1100	900
1973/74	191	230	70	71	52	84	880	720
1974/75	170	220	65	78	60	107	1950	1570
1975/76	180	235	70	90	62	104	2040	1608

	Barley		Wheat		Maize		Millets Sorghum	
	area	prod	area	prod	area	prod	area	prod
San'a	55.2	65	19.4	20.8	1	1.9	544	378
Hodeidah	-	-	-	-	7.2	9.7	617	431
Taiz	9.5	13	4.3	5.8	24.8	40.7	241	276
Ibb	48	78	26.9	40.3	22.8	43.9	225	235
Hajjah	18	21.4	6.5	8.1	4.1	4.9	173	123
others	44.3	57.6	12.9	15	2.1	2.9	241	150

Table 20 - Area of Production of pulses, vegetables, and fruits

Area: ooo Hectars Production: ooo Tons

Extract and Conclusions

75/76 Fruits		Potatoes		Vegetables		Pulses	
area	prod	area	prod	area	prod	area	prod
12.3	65	6.8 in Taiz and Ibb	86	20	193	74.5	91

Table 21 - Coffee

15	7.5	4.8
No. of trees	Area	Production

Table 22 -

Sesame		Tobacco		Cotton	
Area	prod	Area	Prod	Area	Prod.
9.72	5.5	4.6	5.6	29.5	27

Rapid increase from 1969/70

Table 23 - 17438 was cottonse
9800cotton lint

AREA AND PRODUCTION OF MAJOR CROPS -75/76

(Source Table 19 of Statistical Year Book -76)
and Table 20 , 21 , 22 ,and23

1 SORGHUM AND MILLETS	(Area (in Hectors)	Production (in Tons)
1 Sorghum and Millets	20,40,000	16,08,000
2 Maize	62,000	104,000
3 Wheat	70,000	90,000
4 Barley	180,000	235,000
5 Fruits	12,300	65,000
6 Potatoes	68,000	86,000
7 Vegetables	20,000	193,000
8 Pulses	74,500	91,000
9 Coffee	75,000	48,000
10 Sesame	972,000	55,000
11 Tobacco	46,000	56,000
12 Cotton	29,500	27,000 (17438 Cotton Seed) (9800 Cotton Lint)

Analysis of the data indicates that

(a) The cultivation of sorghum and millets has almost doubled both in area and production since 1969-70 to 75-76

(b) There has been general increase of 40to60% approximately in the case wheat , barley and maize during that period

(c) There has been very rapid increase in the cotton cultivation since 1969/70 when the area under cotton was only 5000 hectares and the production was 2000 tons only.

(12) LAND HOLDINGS AND LAND TENURE

LAND HOLDINGS

Exact figures not available hence by deductions

Total population - 6.5 million

65,000,000 one million may be tenant or or small holder farmers = 1,000,000 each farm consisting of hectars

Total cultivated land is about 1,500,000 (more correctly 1,515,000) Therefore farmer may have 1.5 hectars and most of it may not be in one block and may also be terraced.

Most midland farmers own their small farms. Tenant shore croppers get ⅓ in irrigated and ½ in rainfed.

The following Reforms in Land Tennure have been suggested in vol. 2 of the report on Montane Plain and Wadi Rima report.

"The success of the programme envisaged depends on changing the system of shore cropping and for providing reasonable security of tennure. The present system of share cropping is a positive disincentive to investment by the farmer in agricultural inputs designed to raise production, because the farmer retains only 40% of any increased yield. Moreover the stigma attached to management through having to assess and collect the shares is not conducive to good future working relations. Instead, it would be better if a fixed cash rental could be levied simultaneously with the water charges, the rent to be assessed according to the value of the land and the likely number of irrigations (It should be noted that fixed rents were successfully introduced on the Abyan scheme in South Yemen.) In the event that the concept of fixed cash rents proves too radical an alternative would simply be to reduce the proportion of the crop due to Government to below 25% and also exempt fodder and tree crops from share-cropping provisions. In any case the farmers should be consulted throughout, and their agreement sought before a major change is effected, the proposed farmer's committee should prove a suitable vechicle for consultation.

It is also recommended that the share croppers be afforded reasonable security of tennure while simultaneously retaining for Government the ultimate sanction of eviction in the event of misdemeanours of a serious nature. A form of contractual leaseholds known as a life tenancy has proved valuable under similar circumstances elsewhere. This tenancy would come up for review annually, but would automatically be reviewed unless the tenant were guilty of persistent bad husbandry in the broadesr sense. Eviction of life tenant could then be effected following a series of official warnings with the agreement of proposed farmer's committee. Tenants would have the right to nominate their preferred successors. The lease would define clearly the rights and duties of the tenant and the management, subletting, division of holdings and persistent absenteeism would all be forbidden.

It would be preferable if tenants were not permitted to hold tenancies of more than one holding of 4 ha. each ".

The size of the land holdings also affects use of machinery. The following extract from

Yemen Agricultural Handbook

by MR. Alexander Barterlink (Federal Republic of Germeny) 1974. (P.71-72) Clarifies this.

"Tractor users in Yemen are generally unaware of three major factors that must be considered before tractor cultivation can be justified. These three factors tremedously affect the operational cost which must be then weighed against the likely benefits.

(1) Overall tractor running costs per hour including visible running costs and including (Fuel lubricant and labour) invisible fixed costs- (Depreciation, interest and Maintenance).

(2) Tractor cultivation cost per Hectare

(3) Effect of field dimensions on operating costs - The final factor that affects the actual overall cultivation cost/hectare seems from the fact that a large amount of productive time can be lost in turning at the end of rows etc. The field efficiency is thus a measure of the percentage of productive time that the unit actually spends on cultivation and not on turning etc.Thus the field efficiency of 75% would mean that 25% of the tractor operating time is wasted in turning etc. This alone would result in a further 25% increase in cultivation cost/hectare. Below are some typical Field Efficiencies for different Field Lenghths.

Field length --------	Approximate field Efficiency
300 - 400 meters	90%
175 - 225 " -------	75%
less than 100 meters	less than 50%

Thus it can be seen that the cost of cultivating the sizeof field typically encountered under the terraced farming system in Yemen is simply not economic approaching double the cost of conventional field size cultivating. If tractor cultivations are to be considered under irrigated conditions, field layput should keep this dimension effect in mind.

Farm units are about 5 to 8 ha.

More than half of cultivated land is share cropped. The basis of all terminal arrangements is Quaranic Land which, barring total crop failure, seeks to ensure the share cropper a fair measure of subsistenance. The system still works reasonably by well in dryland and single-spare irrigated areas, where cropping is so precarious that fixe' rents could cause serious deprivasion in dry years, but it is a disincentive to innovabion for commercially oriented farmers who are developing land under pump or perennial irrigation. Moreover no tenant has absolute security of tennure in law.

The proportions of the crop retained by share cropping tenants varies according to the catagory of the land:-

Rainfed -------- 50%
Wadi irrigated-------- 33.3%
Pump irrigated-------- 25%

on pump irrigated crop the pump owner is entitled to 50% of the crop and 75% if they are owners of the land because of inheritance law there is fragmentation of holdings. Plots of 0.5 ha are common.

(13) MAIN AGRICULTURAL DEVELOPMENT PROJECTS IN YEMEN

(1) WADI ZABID PROJECT

Brief Description of Projects -

UNDP/FAO Survey of the Agricultural Potential of the Wadi Zabid YEM/1 - 1st project in undertaking investigations of land water potential of the area - 2 years-2phases - original conception too much emphasis on big dams and reservoirs. Extension of one year to complete ground water survy - by Hungarian Consultative firm TESCO deeper ground water aquifers proved considerable subsurface resources. Tesco presented a number of alternatives for development of both surface and ground water resources Kuwait fund available. Preliminary agronomic studies indicate the expected improvement in crop production (from 12,000 hectars to 15,750 hectars) could not support a high level of investment for surface water utilization

(2) HIGHLANDS FARM DEVELOPMENT PROJECT YEM 9

Especially cereals - until 1969- virtually confined to Tihama (Lowlands) now policy is changed - dry farming centre in Ibb.

Provide a focus for improvement and modernization of traditional Yemeni farming system, by identifying major bottlenecks - wheat sorghum and soya beans.

(3)MIDLANDS FARM DEVELOPMENT PROJECT YEM/12

Taiz province more favourably placed for Agricultural development, favourable soil conditions and an average rainfall of 400 to 600 mm. Large portions of all wadis in the area have perennial cultivation under irrigation. The terracing that is characteristic of Yemeni agriculture makes the best use of the steep hillsides (75 terraceswithin 24 hectars of land) helping to retain water. The farming population 400,000 is also receptive to new farming techniques. All these factors account for high production potential.
Governments own farm Ausseifra Farm - Turba and Rahida formers interested in fertilizer

The midlands is particularly suitable for growing fruits and vegetables. Banana plantations are not intercultivated. Potato, pawpaw Sorghum (dura) bullrush millet (dukhn).

(4) LOWLANDS FARM DEVELOPMENT PROJECT YEM/11

Tihama a semi-arid coastal plain- introduction and extension of commercial crops - rainfall scanty and production from rainfed farming extremely low. A centuries old system of spate irrigation has been developed in the seven major wadis and recently there has been a rapid expansion in the use of ground water irrigation.

Sorghum and Bullrush millet wells 25 meters but pumping uneconomic unless high value cash crops are grown. At the same time, Yemen is short of foreign exchange and the development of readily exportable cash crops or the production of products currently imported forms an important aspect of the Government's proposals for agricultural development.

Pilot demonstration area at North Gumeisha 1970 water lifting very costly. The project is adjacent to a large-scale commercial and highly mechanised farm which is being run under bilateral aid programme. This provides examples of what practices can be adopted on small farms 22 hectars.

The work here will be coordinated with Agric. Expt. al Station at Wadi Zabid.

(5) UNDP/FAO FARM AND NUTRITION PROGRAMME YEM/13

School feeding programme is a great sucess. There is a shortage of high protein commodities, hence supplying vegetables of the season, fresh meat, pulses broad beans etc.

(6) Pilot project for growing coffee - Mokha coffee famous . but no prunning, no fertilizers no quality control, lack of market and Quat growing but quat is a perishable product 3,000 tons coffee to Italy annually. Qat gives 3 to 4 times more cash.

"Undoubted coffee yield can be considerably increased by proper prunning etc."

FAO coffee expert who has travelled extensively in the areas concerned is very optimistic on potential impact of coffee project for socio-economy of rural population.

(1) Beni Sweman irrigated terraces at higher elevations Sana'a area.
(2) Wadi Haima A olia- Taiz
(3) Kishran - irrigated terraces - Taiz

(7) WADI SORDUD - Land reclamation Project - Started in 1965 originally envisaged 10,000 hectars reached 2,000. Out of these only 400 ha. (1969) reclaimed out of which 150ha. cultivated by project authority while the remainder given to 250 tenant farmers on 50% crop sharing.

(8) Jumeisha Project German Democratic Republic 66 on 564ha piped irrigation, 16 from Hodeidha drilled 14 wells 200 meters apart in straight line and 140 meters deep, each including casing and diesel pump. Now being developed in the extension centre.

During the First Five Year Plan period the agricultural research, training and extension centres will be extended to almost all important areas and for different crops.

(14) COOPERATIVE MOVEMENT

It is amazing to see to what a degree, rural areas and communities have embarked on self help in building feeder-roads, schools, and hospitals: dug-wells for water supply etc and in making finances available for development projects.

The UNDP/FAO nutrition project has already proven its great catalystic potential for such integrated rural development.

There are good cooperatives working in the country. Special mention should be made of Yemen's Rural Development Association (R.D.A.). They work on democratic principle and on co-operation. This is an extremly interesting concept as they can also handle large projects including investments and since it is based on local initative, it could be used to the advantage in some public investments involving external finance.

Although the term "co-operatives"sometimes had ideological overtones and is consequently looked up with scepticism, the benefit of cooperative activities is being recognized. The Hujaria Development Board encourages self-help in all spheres. It depends on contributions in cash and kind from the farmer members. Similar boards are envisaged is and around Taiz, Rahida and Makbara. Hopefully the organization will cover the whole Taiz Governorate at a later stage. Meanwhile, the Hujariya Development Board provides as effective channel for reaching the individual farmers.

The spirit of co-operation is probably ingrained in the Yemeni people because for centuries they are sharing cattle with other farmers.

15. AGRICULTURAL FINANCE

The Agricultural Sector is considered the main sector in Yemen, contributing about 50% of the total product. This contribution is expected to diminish with the growth of the other economic sectors, such as Industry, the transport and other sectors.

A study of the available official stastics shows that the Agricultural sector has grown at an average rate of 6,7% during the past seven years, whereas the total product growth rate for the same period was about 7.9%. Notwithstanding the fact that agricultureal practices in Yemen date bach to ancient times, the Agricultural sector is considered the most backward sector. This is proved by the proportion of labour engaged in agriculture in Yemen, which is 73.3% of work force in the country and that the Agricultural Sector's contribution to the total local product amounts only to 50%.

This situation reflects clearly the meagre incomes of rural categories which are as low as one-third of other catagories incomes.

Agricultural Sector contributes 80 to 90% of the total exports of the country. On the other hand the agricultural products constitute about half of imports. Yet stasticts indicate that there is a serious deficiency in agricultural production which falls short of meeting the local consumption needs as the imported agricultural products reaches sixteen-fold more than the exported agricultural products.

The cultivated land in Yemen is estimated at around 1.5 million hectars and constititues about 8% of the total area, 15% of this cultivated land is irrigated mechanically and the rest naturally, by rainfall.

It is worth mentioning that the Agricultural sector was not alloted sufficieht part of the investments, for the Agricultural sector fixed captial constitutes less than 13% of the country's total fixed capital assets. For this reason it was necessary to create a specialised organization for Agricultural financing.

AGRICULTURAL CREDIT BANK

The Government created a specialised organization "the Agricultural Credit Bank" for agricultural financing by Law No. 31, (1975).

Objectives

(1) Offering Loans for financing agricultural and allied projects.
(2) " " for irrigation, forestry, animal production.
(3) Marketing of agricultural and animal products.
(4) Trading in Materials and Machinery for various purposes.
(5) Establishing agricultural industries.
(6) Support to Co-operative movement.
(7) Dealing in the agricultural machinery, equipment and production requirements to alleviate the burden of the farmers.

Targets

Total Loans Target 250 million YR'S from 76/77 to 80/81

(1) Water and Wells Development ----- 30.8 M/YRS
(2) Agricultural Machinery ------ 60.4 M/YRS
(3) Land Reclamation and farming ------ 11.9 " "
(4) Agricultural Industries, storing and marketing Etc. Etc. ------ 11.4 " "

The branches will be opened at other places under expansion programe . For want of locally trained experts at present , the foreign experts are being employed but steps have been taken to train local people both in the country and abroad.

During 76- 77 - short term loans were given for poultry , cotton cultivation, beekeeping and medium term loan for Agricultural Machinery (6801446 YR)

Future Plans includes the following possible projects:-

(1) The formation and creation of drilling companies to utioize the underground water scienfifically.
(2) Establishing Agriculture schools.
(3) Developing agricultural research centers.
(4) Supporting the agricultural pesticide machinery.
(5) Establishing teaching institutes for maintenace and operation of agricultural machines .
Etc. etc.

(Source 1st F.Y.P. Conference Paper).

(16) AGRO- INDUSTRIES

Attention has already been drawn to prospects for production and processing of tomato and oil seeds (especially sesame). These prospects are considered further here, because, though doubtful economic propositions, interest has already been shown in their early implementation. It is important, if this interest is to lead to investment that the YAR Government is aware of its implication. In principle the choice of toamto and oil seed is sound.

1974 Import of canned tomato 1200 T.YR 5M.
" of vegetable Ghee - 18000 T. YR. 40 M.

The demand in 1980 is expected to rise substantially. The main problem is the familiar one of the high price of the local commodity compared with imports.

It is particularly on this last issue of the attitude of Government to the infant industry that the Govt. advice is needed. The inescapable fact is the world market is grossly oversupplied.

Oil seeds - large potential market for edible oils and for oil cake in Yemen. (Hail Sa'id An'am Company ghee factory in Taiz).

The oil seed production in Tihama is confined to sesame and cotton seed the former being extracted locally in small hand-driven presses while the latter is either processed centrally in Hodeidah or Sana'a ori is exported as cotton seed.

It seems likely therefore, that cotton seed oil will remain the second edible oil of importance for forseeable future. With all cotton gins existing or envisaged operating at full capacity, the total of milled cotton seed should be about 20,000 T/ YR. M.P.W.R. P. 127 128.
Both sesame oil and cottoned oil are suitable for the production of ghee substitute.

(17) IRRIGATION

Yemen can be divided into four natural regions.-

(1) The Tihamas
(2) Foot hills and Middle hights - Taiz
(3) Central highlands - Sana'a, Dhamar, Ibb.
(4) Eastern slopes - and wadis, semi-desert Plateau.

Each of these regions has a distinct climatic, topographical and vegetational characteristics.. These features also influence the water resources and their utilization.

(1) The Tihamas have tropical conditions of high humidity and oppressive heat. The precipitation is low or scanty. The shade temperature is 32°C in summer and 24°C during the winterwhile the humidity is 60 to 80%. Average rainfall annualy is 100 to 200mm and increases to about 300mm on the foothills. Except in the foot hills, direct precipitation plays little part in contributing water for cultivation. Irrigated agriculture of any significance is limited to the immediate neighbourhood of the main wadis. The drought resistant bullrush millet (dukn) is the only crop that is grown rainfed.

The direct precipitation in the Tihamas plays little part in contributing the ground-water. The scant rain, falling on a hot sandy surface, soon evaporates. However in the foot hills, the rainfall angsments the water to a signifacant extent.

The eastern section of most of the Tihama wadis carries a small perennial flow and these are used to irrigate cereals, bananas and papayas.

The floods coming down the wadi courses provide the main water resource for irrigated agriculture. The floods are of short duration and are torrential. These floods are waters are at present used by the farmers by diverting them on to land to be cultivated by means of temporary earthen and brush dykes across the wadi bed. The waters are channelled on to the bunded fields, which are flooded and cultivated. These temporary dykes or weirs are called 'ogams' locally. They are erected in series, down the wadi course, each one coming into operation after the one above it has been knocked out by the flood. Therefore, in the years of small floods only the upper fields get the waters. Usually the ogams destroyed by floods, or deliberately cut open, cannot be put back into service the same season.

The main wadis are Mour, Sordud, Siham, Rimah, and Zabid, and there are also a number of small minor wadis. (Risyan and El Fil) all east flowing.

Most of the catchment lies in the mountain range where the slopes are high. Due to indiscriminate felling of vegetation for use as domestic fuel, the slopes are gradually being demuded.

The one redeeming feature is the many excellent terraces which curtail erosion. The Yemeni farmer puts to admirable use whatever flow he can harness by the limited means at his disposal. It is the large floods that he has been unable to control.

The annual runoff on the western slopes is about 2 billion M^3. Assuming a requirement of 2 m depth of water per hectare including all losses, it is possible approximately to establish the potential for irrigation from runoff water at 200,000 hectares of land in Tihamas. The perennial flow could possibly irrigiate about 5,000 hectares.

IRRIGATION OF WELLS IN THE TIHAMAS

A large amount of percotation of runoff takes place into the permeab,e soils and flow seaward, throug h deep courses. These waters can be recovered through wells. Earlier wells were dug for domestic use only but with the availability of deep well pumps now many wells are being dug and used.

One great obstacle to the speedier development of irrigation farm wells is the expensive operation of drilling, casing, and providing pumps. The present costs are
One encouraging sign is the tendency towards cooperative ventures in agricultural development. The water level ranges from 15 to 25 m. and the yield about $36m^3/h$. for a draw down of 1m. This amount is sufficient to irrigate about 12 acres on the open channel system. The more sophiscated development of wells to the depth of 75 to 15 m. as in Jumaisha, yields $80M^3/h$.

(2) THE FOOT HILLS and MIDDLE HEIGHTS

These vary in elevation from 200m to 1500 m. Temperature and humidity conditions here are sub-tropical and rainfall fairly heavy about 600 mm/a. In the middle heights the wadis flow through deep gorges with slopes. In some cases the flow is perennial.

This region is best endowed in respect of water resources. There are a number of springs which yield water for irrigation. The ground water level is high 2 to 12 m below ground. The yield of shallow wells is good, and is generally 100 to 120 gal/min. Natural vegetation is more abundant and the area is less arid than the rest of the country (taiz).

The region is travessed by a great number of streams. Wadi Risyan, Wadi El Fil, Wadi Sudan, Wadi Tiban and Wadi Bana'a are some of the important wadis of the region. The last three are south flowing. On wadi warazan the ex-Iman had a masonary weir but now sunk.

Springs and Kazaghas or Swamps

The springs are around Ibb and Taiz and need cleaning. The Kazaghas are swampy lands farmed by the spring waters. Many such areas exist around Taiz and Yeum. These swamps serve a useful purpose by acting as reservoirs and storing water irrigation of lands lower below. Such swamps are seen at Hedran west of Taiz and at Haima north of Taiz. Haima is the bigger of the two and water released irrigates at least 200 ha. " "The springs of Dhulmal near Yerim spread out and create a swamp. The waters then flow down through rocky gorges before joining Wadi Bana'a.

No use is being made of these waters because the lands adjoining the place of emergence of these streams or 'Wail' as they are locally called are at a level higher than ca be commanded by gravity. A low weir placed at the gorge across the combined stream would create a reservoir from which the water could be pumped for irrigation.

The ground water resources here promising.

(3) CENTRAL HIGHLANDS - range from 1500 to 3700m (Sana'a, Ibb and Dhamar). Annual rainfall is 400mm in Sana'a to 1000 m in Ibb. The soils in the area are deep and often of rich volanic type. They vary in texture and colour according to the nature of the parent material.

Direct rainfall is sufficient to raise only one crop. The temperature and humidity are low. The main source of water for irrigation is provided by the many springs which give rise to small perennial streams, called 'gails'in the local terminology. The gail at Hadda near Sana'a and the gail at Wadi Hajar in gate orchards. The other gails are at El Beyadi, Rahmat Humeid, Ajwad etc. all int the vicinity of Sana'a. Such gails abound in the highland region. An inventory together with systematic measurement and recording of the flow of these gails, would help in planning their fuller utilization.

The ground water constitutes the main stay for irrigated agriculture in the highlands. A great number of shallow wells exist which yield to the order of 4 to 6 1/S. The use of pumps is on the increase. The Government at this stage should give thought to the question of controlling indiscriminate exploitation of the ground water resources. As a priority measure, the Beni Husheish region deserves attention for large scale development of ground water, on account of its proximity to Sana'a and its good ground water potential

(4) Semi-desert Plateau and Rolling Country

Eastern Wadis of Yemen. The rainfall is scanty. The wadi flows disappear in the sands of Rub-El-Khali the great desert to the east of Yemen.

"It is however interesting to note the eastern part of Yemen has an ancient history of irrigation. The dam reputedly built by the Queen of Sheba more than 2000 years ago is in this region at Marib. This is said to be one of the most ancient works of irrigation in the world". The main wadis in this area are Jouf, Abid at junction with wadi Jou and Harib and Wadi Beihan(at Asylan)

Table 18 - Cultivated land source by Irrigation [illegible]
Area:- ooo Hectars.

Governorate	cultivated land	rainfed	flood	perennial	wells
Sana'a	400	375	-	20	5
Hodeidah	235	105	100	5	25
Taiz	250	221	10	18	1
IBB	300	219	-	20	1
Hajja	130	115	10	5	-
Saada	60	60	-	-	-
Dhamar	100	92	-	5	3
Beida	40	38	-	-	2
TOTAL	1515	1285	120	73	37

Mahwit and Mareb are included in their previous Govs.

(18) SOIL and WATER CONSERVATION

The present farmers are industrious and through th ages have developed a remarkably elaborate and carefully constructed system of field terraces, which must be unique in the middle east region for its excellent and country wide spread.

Yet it is time now that greater attention is paid to the important subject of soil and water conservation as it affects agriculture and forestry. It is necessary to recapitilate how and why this problem has arisen in this country.

The envoirnmental history of the arid and semi-arid countries in the Middle East region all exhibit the same trendd.At an earlier age of abundant natural vegetation , protecting rich,parmal soils, well watered from perennial flows, the agricultural and pastural communities were much less popular and could live and produce in harmont with their envoirnment. In those far off days when the Queen of Sheba ruled Yemen, the country was reputed to be green and well watered. Then as population increased more and more land was cleared of its native vegetation for agricultural expansion pushing higher and higher up the hill slopes from the valley lands as each new generation passed.

On the steep slopes elaborate terracing had to be carried out to stop the soil being washed away, and the above the cultivated lands increasing herds of domestic animals came to reduce one thick vegetation which gave cover against rain runoff and soil erosion. Wars and pestilences periodically upset the stable conditions and livlihood of those earlier communities and there must have been periods where the agriculture fell into decay, terraced crumbled and the fields thus supported were washed away and lost. Gradually the land became more demanded, more dessicated and even the native vegetation associations were repalced by more open associations of hardier, less palatable and less protetive species.

Eventually we come to the present land use picture. The cultivated portion is barely one-twenthieth now of the whole country. Large areas of the mountains have lost all vestige of soil and are reduced to bare, usless rock falls, where herds of starving goats barely eke out a living. The rivers are changed to torrent spates, casading dangerous floods, often destroying property and drowning people on their way.

The soils which were in past ages under cultivation in the mountain region, has much of it come to rest in the Tihama palins and foothills where it cannot be made productive because of lack of rainfall, except only in those areas which can be watered by flood irrigation and by water pumped up from the acquifers.

To overcome this continuing degradation of the soil and water resources it necessary to use machinery for levelling, terracing, contour bunding etc.

(19) PLANT PROTECTION

The German Project started in July 1974 and has done really good progress. Activitirs include spraying campaigns, determination of insect pests, collection, training courses, conducting field experiments in agronomy Horticulture insecticide, fungicide, weedicide trials, collection of weather data, setting up of light trap, establishment of agricultural, 2 extension officers, import and multipication and sale of good seeds raising undistribiution wind break trees and work regarding sprayers and agricultural machinery

This is indeed a pioneering work and a nucleus or future devolepment

Plant protection act and plant quarantine regulation are being worked out

They have following machinery at centere

(1) Holder tractor to

(2) Agria powerteller

(3) Knapsack type sprayers power operatedlife in about one season , hence hand operated sprayers are recomended

(4) Sprayers are more popular than dusters

(5) ultra low volume sprayers not yet considerd introduceable for various reasons

(6) Peteus seed cleaners

(7) Mobile repair workshop

(8) Power wheat thresher

(9) Turmite pump not considerdd necessary yet

(10) Stationery workshop

(11) Meterological instruments

(A) Sale of agricultural machinery - and sprayers

So far 3,200 sprayers have been sold. Eight old tractors along with different implements sold to stimulate future import from the side of the farmers, the interest has been very great.

(B) Hiring of agricultural machunery

Wherever possible travtors and cultivation implements are being rented to farmers of Sana'a region.

(C) Repair and maintenance of agricultural machinery - The project workshop staff carries out regular service and repairs for all supplied machinery and spraying equipment.

(D) Conduction of Training Courses in the maintenance and repairs of sprayers

Mechanics and extension officers from different projects received a training in the repair of hand operated and motorized sprayer.

The use of pesticides is going to increase in Yemen in years to come.

T.E. Beskok - FAO Forestry officer 1974.
Report No. TA 3245, YEM/71/007, Afforestation and quick growing tree species and G.E. Chapman. (YEM/71/009).

There are no forests in the usual sense of the word remaining in Yemen. Arboreal specimens of native flora survive. in open savanna formations. There fast being depleted to provide fuel wood and domestic farm timber.

Pitting tools, fencing tools, cwwhar wire tightner, hammer, u nails, fencing wire, barbed wire, soil anger both hand operated and tractor powered take off operated. Hand-tools both for nursery and land afforestation were estimated by MR. Beskok to be about YR 54,000.

In Natural Conditions

Acacia species, Euphorbia, Ziziphus Spina-Christi and Ficus sp. species, quat (catha edulis). The native savvannah species are deep rooted and drought resistant but very slow growing. They are mainly cut for fire wood, poles and small sized beans for rural houses and from general observation heavy over cutting seems to be the order of the day. This applies to areas with donkey transport of the main road which have already been cleared. There seems to be a thriving trade in fire wood and charcoal going on in road markets.

The following data indicates production and import of wood in Yemen.

Wood Production and Consumption in YAR

Total population 73 ---- 6.2 M
Wiban " ---- 0. 461 M (74%)
Assuming 5 persons per household the total number of familie
-----1.24 M consisting of urban families
----- (7%) - 91760
Rural families ------ 1,142,000

Wood Imports -
64 - YR 2,492,000 457% increase
73 - " 11,389,000

Main items 'wood worked' - 16,685 tonnes - value 11,389,000, this tonnage has been assumed to have an equivalent volum of 27,800 , M^3 sawn or 70,000 M^3 round volume.

Wood Production from Internal Resources -(Estimated)

No statistics for internal productio and consumption exist. Estimates have been derived from assumptions:-

Urban families use 50 donkey loads of wood/yeun

Rural " " 20 " supplemented with crop residue.

Average donkey load weighs 25Kgs

1 ton fuel wood = to M^3 solid volume

The calcuation of internal wood consumption os therefore:

Urban - .917600 x 50 loads x 25 Kg = 114,700 tons

Rural1142400 x 20 x 25 = 571,200

Equvilaent volume 1371800 M^3 solid row wood

Add volume of imported wood 70,000

1441,800 M^3 solid row wood.

(21) SUBSIDARY OCCUPATIONS FOR FARMERS

Under these the vegetable and fruit growing, dairying, poultry and bee-keeping are included and there is scope for modernising them.

(A) POULTRY AND DAIRYING

There is a great need to stimulate chicken keeping in the villages as a means of obtaining quick cash returns for small holders. Indeed many farmers have expressed their intention ofgoing in for smale scale operations which they regard as more profitable than dairying. this will also give more protein supplies to the local population

Similarly for dairing when good breeds of cattlear made available under the breeding programe that is under operation

(B) BEE KEEPING

Bee keeping is practiced by many farmers but the techniches are primitive and also is the form of hive construcModern beehives and centrifugal honey extracters shoud be introuduced in place of the indigenous bee-hives.

(C) VEGETABLE AND FRUIT GROWING

The following extract from MR. Batal's report indicates the scope.

(MR. S.Y. EL-BATAL, The Horticulturist "Fruits and vegetable growing in Taiz and Ibb Governorates").

(Central Agricultural Organization and Training Project - Taiz, Yemen Arab Republic Horticultural. Section. - UNDP, FAO - JULY 1974.)

Water requirement for fruit trees needs to be studied.

Fertilization - "The use of mineral fertilizers is quite recent in the country. The consumption of fertilizers was about 9,000 Tons for the whole country in 1973.

Soil is alkaline (pH 7.9 to 8.3) and has high calcium contents. Micro-nutrient problems are expecte under the mentioned soil conditions (oranges and mandarine are showing medium to severe sympthoms of probable deficiency of Zn, Fe, and Mn.

Nearby countries to Yemen are oil producing and there is a great scope for selling fresh fruits and vegetables if export quality products are produced. To do these good garden tools, plant protection appliances are required. The oil producing countries are able to pay considerably higher price for fresh as well as dehydrated fruits and vegetables.

APPENDIX NO. 14

INDUSTRIAL SITUATION IN YEMEN

CONTENTS

INDUSTRIAL SITUATION IN YEMEN

(1) INTRODUCTION -

- Present Status and future Plans

Yemen had remained completely isol ated from the world until 1962 September Revolution. Thereafter a civil war ensued for seven years and a severe drought for five years giving no respite for planned development.

The planned development more or less started from 1970. This applies to industries also. In order to help the small scale industry to get off the ground in a proper way and to make them economically viable, an exper was sent by UNDP/UNIDO.

MR. J.M. Gajewaskis Project No. YEM-111-A (ID) 1971 Information Paper No. 16. UNDP studied the conditions here and recommended the establishment of industrial estates in Sana'a and Taiz. Most of the existing industries in YAR are placed in or near the bigger towns which reflect the pancity of a sound ifrastructure elsewhere. Most of the firms then operated on diesel generating sets.

short comings the private sector has done well. The merchants and traders embarked on a development which is unprecedented. For instance in 1962 there were no modern shops existing but now almost all imported goods are available. The future prospects are also promising as people are willing to make investments.

(2) The following is the gist of MR. Gajewaski's recommendation:

(1) Establishment of Industrial Estates at Sana'a and Taiz.

(2) Establishment of Industrial Corporation Of YAR.

(3) Contimation of present assistance to existing and new industrial enterprises.

(4) Drafting bylaws for the Industrial Corporation

(5) Drafting of a Loan ordinance to facilitate development and financing of small scale industrial production.

(6) Improving skill of village artisans by training them and giving better tools on loan.

(7) Establishing of criteria for a customs tariff to prote local enterprises.

(8) Elaboration and drafting of tax-exemption Act to assis small scale industries.

In so far as agricultural implements and tools are concerned, he made the following recommendations regarding manufacture:-

Production Programme Small Scale Industrial Estate in Taiz

(A) Agriccultural Tools manufacturing workshop - Pieces

(1) Spades -----	20,000	(2) Pitchforks -----	20,000
(3) Rakes -----	10,000	(4) Rippers -----	20,000
(5) Hoes -----	50,000	(6) Scoops -----	20,000
(7) Ploughs-----	3,000	(8) Sprayers -----	3,000
(9) Harrows-----	3,000	(10) Axes -----	10,000

(B) Original Agricultural tools

Market price	Wholesale margin	Factory prices	Assumed prices
4.770000 R.	20%	3.820.000 R.	3.400.000 R
Water pumps			
2.425,000	10%	2.180.000	2.000.000

(C) [illegible] Manufacturing Workshop

	Pieces
(a) Multi- storage centrifugal water pumps Head up to 100m Capacity- up to 4cu.m per min.	500
(b) Self priming centrifugal volume pumps	200

(D) Estate in Taiz Agricultural tools and pumps as above

	Personnel	Building over sq. M.	Electric power Kwh/year	Tech data c M/yr.
Agricl. tools	40	1,000	100.00	1.000
Water Pumps	60	1,000	120.00	1.000

(E) Selection of Custom duties obligatory in YAR

	STASTICS AND DEFENCE	OTHERS
Agril. tools	8%	Exempted
Water pumps	8%	Exempted

In 1970-71, according to MR. Gajewaski, "The industry in YAR is at present in the forst stage of development and needs extensive technical assistance and industrial train The actual total employment in industry amounts to merely 0.3%".

(3) INDUSTRIAL LAWS

During the year 1976 the Law 18 of 1975 captioned as "Promotion and organization of Investment in the Yemen Arab Republic was promulgated in early 1976. Thereafter the pace of industrial development increased rapidly. Theimportant articles in this law are given belo. It is clear from these articles that they are an incentive to the foreign investors.

Law No. 18 of 1975 Regarding Promotion and Organization of Investment in the YAR Sana'a - August 1, 1975

Ministry of Economy

Article- 38 Page 17 (English Translation)

This Law hereby repeals Law No. 13 of 1970 and all other Laws or provisions contrary to it.

Chapter 2 (State Guarantees for investment projects).

Article - 2 The State Guarantees freedom of Investment for Yemeni and for foreign nationals, in economic projects which contribute to the development of the National Econom
Article - 3 The State guarantees that foreign capital invested is approved economic project in accordance with the provisions of this law, will be accorded the same treatment enjoyed by National Capital Project whether the foreign Capital is invested independently or jointly with Domestic Capital.
Article - 4 The State Guarantees the transference abroad o the net-profits according from the Investment of Foreign Capital, following payment of all taxes, duties, charges, and any other financial liabilites provided for inoperativ Laws and in compliance with the provisions of any other payment required by the Law to meet commitents for the personal rights of those employed in the project.

By this Law the Government has given full protection to the foreign investors for repatriation of their capital investment and accruing profits. In addition to Tax-holiday of 5 years at first stage, there are liberal exemptions from custom duties and other taxes. Compared to other developing countries this Law is said to be more liberal. The Government is now committed for accelerated industrialisation of the country.

(4) PROGRESS DURING 1970-71 to 75-76

Considerable progress was made in this period in the industrial field. As per policy of the Government initially preference was given to import-substitution industries and 56 new industries were started as given in the following table. These do not include artisan type small industries. (Source DR. B.K. Chandhury's Paper on Industries in Yemen - next three tables).

TYPE	NO. OF UNITS CREATED	CAPITAL INVESTMENT	NO. OF EMPLOYEES	VALUE OF PRODUCTION
Food				
Biscuits/ sweets	2	9,900,000	444	22,651,000
Cold/Soft drink	4	7,540,000	160	9,959,000
Ice	2	1,993,000	17	1,006,000
Cigarettes	1	5,000,000	214	11,668,000
Textiles				
Textile weaving	2	28,000,000	1890	16,900,000
Cotton Corp.	1	2,000,000	138	34,500,000
Textile goods	4	390,000	63	1,282,000
Wood products	-	-	-	-
Furniture etc.	5	1,634,000	74	1,688,000
Printing Industries				
Printing Publicity Co.	1	2,000,000	132	1,000,000
Others	7	1,210,000	72	1,366,000
CHEMICALS				
sponge mattres andp.v.c.pipes	1	4,000,000	34	800,000
plastic shoes	2	1,480,000	143	6,170,000
	1	1,000,000	24	
perfumes	4	894,000	45	2,610,000
soap	1	655,000	6	302,000
BUILDING MATERIALS				
cement	1	51,000,000	308	21,730,000
blocks	8	1,980,000	133	2,442,000
IRON/STEEL				
water pumps	1	4,650,000	20	900,000
aluminium wares	1	2,000,000	119	2,000,000
wire nails	1	300,000	14	150,000
steele furniture	6	1,510,000	85	2,556,000
		30 Million		

During the year 76-77 about 36 licences were issued to the prospective investors to invest a sum of 158,890,000 YR'S in different industries.

Food-Industries	NO. of licences	Capital -Costs
Soft-drink	4	38-087,000
Dairy Products	1	12-803,000
Poultry	1	1-018,000
Ice-Cream	1	8-357,000
Ice-Blocks		592,000
Textile:		
Wollen Product	2	2-259,000
Readymade garments	1	7-210,000
Chemical Industries		
Chalk	1	185,000
Nylon Bags etc.	2	1,312,000
Plastic papers	1	4,005,000
Soaps detergents	2	8,960,000
Hair/oils/creams	1	1,964,000
Paper Bags	1	1,665,000
Iron/Steel		
Metal house-hold	1	7,960,000
Building Materials		
Tiles/Bricks manufact.	2	16,506,000
Stone Cutting	1	2,497,000
service Industries	2	6,621,000
Tyre retreading		
Engineering		
Plastic Reeds	1	1,015,000

and in addition to this 10 licences were given to existing projects for expansion

Plastic shoes and goods	4	1,925,000
Food Industries	6	30,314,000

The total additional investment is 158,890,000 thus showing that the pace of industrial development has gathered momentum and this is likely to continue because of interest shown by foreign investors.

(5) Five Year Industrial - Development Plan 1977-81

To meet the growing needs of the increasing population the government is keeping a pace with the much needed demandsall around ambitious plans have been made for industrial growth during the next five years industrial-development plan. The investment in public and private sector has been earmarked to be around 2.5 billion Y.R. The industries for public and private sector on the priority list are:-

TEXTILE - MANUFACTURE
Blended yarn cloth manufacture
woolen products
Pharmaceuticals
Poultry
Dairy farms
Fruit Juices and Jam
Macrone plant
Soft - drinks
Paper and paper products
Fertilizer
Salt Refining
Soda ask
Steel re-rolling

Government will invest as a major sharer in Textile chemicals, cement fertilizer, steel etc. and the other are open for private investment, national or international or an Joint/Venture basis, The investment in the Public and Private sector has been compared to be around 2.5 billion Y.R'S.
Govt. invites foreign or national investors to come up with sound proposals for industrial investments.

(6) INDUSTRIAL FINANCE

In order to encourage participation of local people in starting industries either by themselves or by joint collaboration the Government has provided for finance through the establishment of the Industrial Bank of Yemen. The Yemen Arab Republic is passing from the programming stage to the planning stage of its economy and is exerting its maximum efforts to utilize the available human and financial resources in developing the country.

To enhanch this development plaeers, the Government propose for the first time a five-year development plan in which major emphasis was given to the rule of the Industrial Sector in developing country.

Despite the development of the Industrial Sector and its growing contribution in the gross domestic product(GNP) its overall activities remain relatively insignificant especially its contribuition in the past three year plan.

If we study the available official statistics we will notice that in the past contribuition of the Industrial Sector, in the gross domestic products was small.It increased from 2.1% in 1964 to 3.5%. In the pasr three years plan the real increase was 8.6% (at fixed prices) and it is expected to increase to 11.75% durin the coming firstfive years development plan.

The insignificant contribution of the Industrial Sect is basically attributed to its late establishment and to the existence of some obstacles among them, the absence of a specialised agency in industrial financing.

To remedy this shortcoming the Goveenment has statted the Industrial Bank of Yemen.

(7) THE INDUSTRIAL BANK OF YEMEN

The insignificant contribution of the Industrial Sector (8.6% now) is attributed to its late establishment and to the existence of some obstacles among them the absent specialised agency for industrial financing. To remedy this shortcoming, the Industrial Bank of Yemen Act was decreed (Act No. 55 of 1976)with the objective of supporting the Industrial Sector by means of industrial financing and rendering technical assistance.

The authorised capital of the bank is 100,000,000 YR (YR 4.55 = $1)

Objectives

(1) To encourage establishment of new industries and to assi indeveloping the existing ones.
(2) To encourage and assist small scale industries and handicrafts.
(3) To evaluate feasability studies
(4) To participate in developing the less developed areas in Yemen to stimulate their industrialization.

Procedure-Long, medium and short term loans will be given. The Bank will also acquire equity shares in some Industrial projects. Issuing of shares and guaranteeing industrial investors borrowing money from other financial institutions. Maintaining geographical distribution and giving importance to financing the industrial projects listed in the five-year plan of development.

Basis for industrial Financing-

It will grant loans only after studying the economic technical financial and managerial feasability of every project submitted to it. It will also take follow up action and assist in tackling any problems faced by the project

Bank's Five Year Plan 76-81

The total investment to be 129 M.Y.R. out of which 69 MYR will be from bank and 59.8 from clients participation.

The aim is to increase the G.N.P. by 7.2% annually as decided by the Government.

The Bank will start its operations towards the end of 1977. The interest rate will be 8% for short term, 9% for medium term, 10% for long term loan.

The Bank's plan was based in the assumption of 1[illegible] increase in its paid-up capital. However, Government contribution and preference shares subscribed by the private sector exceeded all expectations in the 18th two years

	total planned	paid up
76-77	31	3 T
77-78	16	23

to develop the industrial sector. The Bank will serve as a link and ecordinate efforts between all Government agency, local and foreign investors

By adopting open door policy and providing proper incentives and guarantees, the Gove nment has created the right environment for industrial investment. Also there is Yemen Bank for Reconstruction and Development (YBRD).

A good working relation has been established with the Industrial Development centre for Arabic countries (IDCAS), the Arab Banks Association, The IBRD and its affiliates the IFC and IDH

Recently DEG offered to subscribe in the Bank's share, capital by 5 to 6%. It also promise to encourage

German Industrialists to participate with Yemen private sector in establishing viable industrial projects.

Last but not the least, the Kuwait Fund for Arab Economic Development has granted the Bank technical assistance aid to recruit experts and train some of the local staff.

The following two tables show the slow space of industrial growth in Yemen campared too other countries in the share of the manufacturing Industry in the Domestic Products of selected countries.

(Source Table 1, page 80, Small - Scale Industries in Arab countries of the Middle East, UNIDO publication 1970).

Middle East	Year	Percentage of manufacturing in gross/net domestic product.
(1) Saudia Arabia	63.65	less than 3%
(2) Kuwait	65	3%
(3) Jordan	65	8%
(4) Iraq	64	11%
(5) Syria	63	12%
(6) Pakistan	64	10. 9%
(7) India including including construction elect.Gas and water	64	16. 8% 2 . 7
(8) Japan	65	27.7
(9) United Kingdom	65	35.5
(10) United States	65	30.5

The following tabulated statement shows the percentage of GNP in Industry in YAR.

Year	Industry %
1969	3.9
1970	4.5
1971	4.9
1972	4.9
1973	6.0
1974	5.3

(Source statistical year book 1976)

As indicated earlier the % of GNP is expected
8 to increase to 11.75% during the 1st Five Year Plan 1977.81.

(8) Industrial Estate Development Authority(IEDA)

The Government of Yemen Arab Republic has established at Sanaa an Industrial Estate with the financial assistance of $ 2,300,000 from the World Bank for phase 1 supplemented by the funds from the Government.

For this purpose the Government passed law No 3 entitled Industrial Estate Development Authority in 74 and for its creation.

The area of the estate is 13 hectares

(130.000 sq meters)

The building are to be built in two phases

Phase 1 - consists of 3 standard factory buildings each of 1200 m^2 and
2 plots of land each of 3000 m^2

Phase 2 - consists of about 12000 m^2 of prefabricated buildings and 53000^2 plots of land

A workshop building and one Administration Building have been included in the plan.

The following facilities are provided to the prospective industrialists:-

(1) Physcial facilities- Developed plots or factory buildings with necessary facilities like roads, drainage, watersupply electricity and later on telephones, bank, canteen, postoffice etc.

(2) Technical facilities- Preparation of feasibility studies, getting quotations selection of machines, plant layout, quality control etc.

(3) Financial facilities - Recommending for loan on machineries from the Industrial Bank of Yemen and for working capital from other commercial bahks.

(4) Sales and Marketing facilities-

Agricultural implements is one of the industries included in the allotment plan but so far it has not been rented for this purpose probably because improved small implements are hardly known in Yemen. The buildings and plots have been rented for barbed wires, wire nails,

metal beds, metal doors and windows, metal drums, metal electric poles, etc etc . Approximately 300 persons will be employed for items already alloted and about 660 persons for the whole estate.

The expected sales turnover by the plots already rented out is 80 MYR / year and for the whole estate _____ 200 MYR/ "

It is also proposed to have such Industrial Estates/ Areas for YAR during the five year plan at Hodeidah, Taiz, Sanaa(2nd estate) and possibly at Dhamar, Ibb and Sadaa.

The revised list of industries to be established on priority basis at the Industrial Estate at Sanaa is :-

Metal office furnitures, wooden furnitures, tire retreading, hand batteries, Aluminium doors and windows, aluminium tubular chairs, woolen and acrylic sweaters, hardware items(fittings, hinges) plastic house hold articles, plastic film/ sheet, plastic bags, school chalks, kerosene lamps, locks, underwears, socks, wooden doors and windows sweets matches, metal and plastic buttons, pencils, nails gas/electric kitchen oven assemblies ready made garments, buckles staples, paperclips, sewing neddles, pins, safety pins, barbed wire, wood screw, assembly of bicycles, exercise books, spong for mattresses open top plastic drums polypropylene mats, PVC Rigid pipes, meshed wire netting for fencing , agricultural implements , canning of dried beans,

The rates of shed hire are 120 YR / square meter / year for constructed sheds and 10 YR for open plot

(9) JUMAAN TRADING AND INDUSTRIAL CORPORATION

As the name signifies this is essentially a trading organization, importing deep well pumps and manufacturing some on their small foundary at Sanaa, Called Jumaan factory. The factory employed about 20 persons and is said to produce about 225 deep water pumps of 4" size and 75 of 3" size per year.

The production was started in 1972. It also manufacters cast iron weights. They import pumps from USA and Spain. The capital invested is about 950,000 USA$ and the value on production $ 200,000. The original scheme under the present project was to improve and expand this foundry.

The firm was alloted some sheds at the Industrial Estate Sanaa as a special case. At first they had agreed to take these but later on they backed out. The Government therefore, decided to have a workshop of their own for developing and manufacturing agricultural implements.

On their own the proprietors of the factory have entered into an agreement with a leading manufacturers of pumps in Cyprus-M/S Nemitsas Industries, Limassol and have jointly commissioned Middle East Marketing Research Bureau Ltd. Nicosia, Cyprus to work out a proposal for a feasibility study for the manufacture of water pumps.

Since the Jumaan factory was to be associated with the present project this short account of its activities is given here.

(10) Raw materials

Wood- There are no forests in the usual sense of the word remaining in Yemen. Whatever is left is fast being depleted to provide fuel wood and domestic form timber.

All industiral forms of wood have to be imported. Such imports have risen from YR 2,492 million in 1964 to YR 12,183 million in 73 an alramaing incfease of the order of 46%

IRON STEEL. non ferrous metals have all to be imported in Yemen as at present these are not available.- Nor any oil (petrol or diesel) is available locally and has to be imported.

(11) The Labour

The industrial labour in Yemen is very scarce and costly. The skilled labour is not available and for every project the skilled labour will have to be trained prior to the implementation of the project. This should be one of the main conditions in the future contracts or joint ventures.

The unskilled labourers are earning as much as 30 to 50 YRS per day which is probably the highest in the developing and the least developing countries. This contributes largely to the higher prices of locally produced goods than the imported ones. A mason gets 125 to 150 Yrls a day whereas an expert stone dresser or a reinforcement concrete fitter gets bout 200 to 300 Yrls a day. The labour problem has to be solved on a National level. This is perhaps enaging the attention of the Government .

Because of the labour situation 'materials handling' in any industrial venture world form an important aspect and latest materials handling equipment has to be used.

(12) The Joint ventures and Foreign Collaboration

Many joint venture projects for Yemen are under study. Recently a Government delegation headed by this Execllency the Minister for Development and Planning visited India and entered into three agreements.

The feasibility studies for all projects are examine in depth by the Experts given by the United Nations Industria Development Organization. The unit consisting these experts is called "Industrial Promotion and Advisory Unit" and is attached to the Department of Industries, Ministry of Economy.

Some plans are underway to introduce at least in the selected industries Standardization and Quality marking.

(13) IMPORTS

Inadequacy of port facilities is a great bottle neck Hodeidah is the only port available in Yemen Arab Republic . The imports are increasing year after year and one port alone is unable to cope up with the offtake. The following extract from the 'Industrial World' (Sept,1977 Issue) amply indicate the situation .

"Ballons carry cargo from ship to shore.

On September 26, this moron, the port of Hodeidah in Yemen will be the first to try out a new system to unload cargo from some 100 shipd which have been waiting half a year for a berth in the congested harbour. A helium filled ballon with a ten ton capacity is winched ashore carrying

a cargo boat alon[illegible] a steel cable guide. The cable is stretch[illegible] between a mast on shore and a buoy in the harbour a dis[illegible]ce of about 1500 feet. The system can operate upto a distance of [illegible] take a week to erect and uses diesel powered multi-drum winch. Operatin[illegible] costs are estimated at $ 23 per freight ton compare to $ 35 for barges and $ 65 for helicopters. Lights speed and unsworth Inc(30 Vesey St New York USA) which developed the syste[illegible] recom[illegible]ends it for coun[illegible]ries with inadequate port facilities, causing costly delays in unloading ships"

Transformation Industries

The Extract from the First Five Year Plan-1976-77 to 1980-81. Prime Ministery office, Cenetral Planning Organization.

13 June 1977, P. 46 Volume 11- Analysis of the status Quo

3.1 Ministry of Economy(Industrial Sector).

The industrial sector in the Arab Republic of Yemen as indicated by the survey reports, is constituted by the following installations:-

_____ 59 installations employing 10 workers or mor[illegible]
_____ 211 employing from 5 to 9 worke[illegible]s

_____ inaddition to 11067 industrial installation employing ----- 1 to 4 workers. They are establishments which cannot be considered as being on the level of industrial activity by international standards, but they perform their work in activities some of which are related to the industrial sector and some others representing services and trade activities.

The number of people working in the filed of industry and related activities amounts to 23856 persons, of which 50.8% are employed in food industries and tobacco, 25.4% in textile industries, 11.8% in mineral industries, 7.6% in non-mineral buildin[illegible] materials industries and 4.4% in chemical products industries. Their total salaries and wages is money and in kind amounted in 1975/76 to about 107 million Riyals at an averge of 4497 Rials per worker yearly.

The value of the production of existing industrial installations in 1975/76 at market prices amounted to about 5/3 million Rials, distributed amongst the various industrial

activity sectors. Food industries, textile industries, chemicals, building materials and mineral products.

As for the productivity of the worker in these installations, it amounted in 1975/76 about 23 thousand Rials (?) in the five above mentioned fields of activity, in addition to wood and golden jewellery industries. Worker productivity in the chemical and wood products industries and printing accounts for 3.4 times the general average of worker productivity followed by the building industry and metallic products industry.

The value added to industrial installations in 1975 amounted to about 255 million Riyals, and participation of these installations in the Gross Domestic Product amounted to 4.9% in 1975/76 - In addition to this, these installation participated in the value of exports with an amount of 31 million Rials in 1975/76. This represents a proportion of 62% of the total exports of that year.

Industrial activity is considered as being concentrated at present in the three main cities:- -Sana'a, Taiz and Hodeidah.

This is due to various factors the most important of which are:

- Concentration of capitals and investments, whether of Governmenment or private in large cities, and desire of the investors to be near the place of the investment in order to ensure control therof.

- These three cities represent the main demographic concentration in the Republic, as about 90% of the total urabn inhabitants and about 84% of district chief civities live therein.

- Failure of the main structure of the industry during the first period of the industry, in respect to electric energy sources, transport and communication roads, and water sources outside the main large cities.

Positive sides of industrial activity are represented in the following:-

(1) Entry of investors into the field of industry as a new economic activity after having relied for many years on trade and agriculture. Despite entry of the government in some industrial ventures as partner, individual investments are still representing the largest part of the toal investment in industrial activity, with a value of about 221 million Rials at the end of 1975.

(2) Opening of the industrial process in the country on the technological evolution in the workd. We may in this field point out the advanced mechanical equipment in the industries of pumps, plastic proudcts, aerated work bottling biscuits, hide drying.

(3) The degree of skill the Yemeni worker has achieved in industrial production.

(4) Appearance of woman in the field of industrial activity such as plastic and textile industires.

(5) Enactment of Law No 18 of 1975, encouraging and guaranteeing foreign investments, including the right of the investor to transfer the net profits and capital sums on liquidation in the same currency as introduced in addition to customs exemptions on machines, spare parts and goods requisites.

Most Important Negative sides and Impediments.

(1)- Very low participation of the industrial sector in the production structure, national product and working potentials.

(2) Small size of existing industries, as they are envoronmental consumer industries, representing small and numerous productive units where the traditional craft character prevails.

(3) Reliance of existing industries on the human labour element, and backwardness of technological sides.

(4) Low quality of production of most industires, and manufacture of goods not being based on any standards.

(5) Reliance on the outer world as a main resort for obtaining goods requisites.

(6) Presence of unused and idle potentials to a large extent in factories, high production costs and high prices

(7) Unavailiability of trained technical manpower and lack of scientific management .

...chinery and increase of their wear despite their newness because of misuse and lack of maintenance.

(9) Shortage of the electric powers needed, and in particular for factories which operation relies on electric power unavailability of the fuel necessary for this power locally and necessit to import it.

(10) Lack of completion of production lines, shortage of the necessary machinery and equipment in particular infood industries and use of primitive means in the manufacture of some products.

(11) Absence of planning for the production .

(12) Competition from imported consumer commodities against local products.

(13) Poor coordination between Government bodies, in particular inrespect to government industrial projects.

(14) Lack of clarity of the policy governing the industerialization in the country.

(15) Need for a unified accounting system and calculation of costs in most existing factories.

(16) Need for a system of standards and normal for governing quality of production.

The First Five-Year Plan 76/77/80-81 Volume V, Description of Projects, Y.A.R, Prime Ministry office C.P.O.

Ministry fo Economy - Mixed Sector Projects

(1) - Manure Mixing Factory Project at Salef

The project aims at mixing various manures used in agriculture with capacity of 55,000 tons of agricultural manures.

Execution and operation starts in 1978/1979. The project requires raw material most important being various manures. The project will provide 35 jobs. It is aproject of the mixed sector for which 29,000,000 YR has been allocated.

(2) Project for an Insectide Factory in Sana'a

The project aims at producing insecticides to combat insects with a capacity of 2,000 tons. The project require availabiltiy of certain raw materials most important being some chemicals petroleum derivatories. The project will cr 73 jobs. The project will cost 10 million YR, executed by the mixed sector.

(3) Project for a workshop for maintaining Agricultural Equipment (heavy tractors) and cars in Hodeidah

The project aims at maintaining and repairing a agricultural equipment and cars. Execution starts in 1976 and operation in 1977/78. The project will create 100 job It is a project of the mixed sector for which 10,000,000 has been allocated.

(4) Project for animal fodder factory in Sana'a

The project aims at producing animal fodder with capacity of 4,200 tons. Execution starts in 1976/77 and ation in 77-78. The project will require raw materials a proteins. It will create 9 jobs. The project will cost 1013,000 YR's executed by the private sector.

(5) Al-Amiry Project for poultry in Sana'a

The project aims at producing chicken and eggs with a capacity of 24,000 chickens and 1,660,000 eggs. The project requires raw materials the most important being starter and chicken feed. It will create 12 jobs.

The cost of the project will be 3 million YR'S executed by the Private Sector.

(a) Barbed wire factory.
(b) Nails, plugs and screw nails factory.
(c) Iron Products Assembly Plant.
(d) Pumps Factory.
(e) Tractors Assembly Plant.

(14) MANUFACTURE OF HAND TOOLS

There is a lot of demand for building construction tools almost all of which are imported such as, the stone dressers, hammers, chisel, axe, pitch-axe, spade, wheel barrow, etc. It should be possible to manufacture the in Yemen. The building activity has increased considerably and is likely to be manyfold in the next 5 to 10 years.

Similarly for agricultural tools including sickles which are also imported to a large extent. Secateu for prunning coffee were introduced by a Christian Social organization and proved very popular.

The fitter tools like pliers, spanners, files, saw, screwdrivers, hammers etc. are also imported. With proper jigs and fixures and heat treatment equipment all the above mentioned hand-tools can be manufactured in Yemen. A beginning will be made in the proposed U.N.I.D.O. workshop to produce some of these hand tools.

APPENDIX No. 15

PRE-FEASIBILITY STUDY OF A FOUNDRY PROJECT IN THE YEMEN ARAB REPUBLIC.

The development of industries in Yemen is is still in its infancy. At present there is only one small foundry in Sana'a which manufactures some parts of the deep well pumps. Therefore almost all cast iron parts or articles used in the Y.A.R. are imported; which needs to be stopped as early as possible. There is a good demand for many cast iron parts:

(1) At present there are about 15,000 pumps in Y.A.R. and their number is increasing rapidly. The Agricultural pumps are in great demand because a farmer or the owner gets back his investment in pumps within two years. The domestic pumps are also in great demand and the impeller the impellar casing pilleys etc. are all made up of cast iron.

(2) There is a great spurt of construction activities in all cities of Yemen and, therefore, a great deman for stone workers hand tools such as hammers, axes, adezes, chisels, cement blocking making machines,wheel barrows etc. All these tools are imported. For the manufacture of these tools high carbon steel (with 0.4% to 0.9% carbon) is required. If in the second phase a heavy forge and a power pres is added to the foundry some of these tools can be manufactured if suitable scrap from old automobiles etc. is availab

(3) Agricultural Machines like maize stellars, fodder cutters, tractor wheel or chassis weights are made of cast iron.

(4)Manufacture of weights and measures like one kilo, half kilo, and Quarter kilo weights.

(5) In every Yemeni home there is a tool for grin ing and mixing spices for cooking-this tool is made of cast iron.

Thus the demand for cast-iron articles is there if some Jobbing type foundry is established. At prese there is no scope for a production type foundry but mayfac need it after a period of about 5 years to manufacture parts of oil-engines power-tillers etc.

The Jobbing type foundry is one where the customer supplies patterns and the foundry produces goods as per those patterns.

AVAILABILITY OF SCRAP IN YEMEN

	1970	1971	1972	1973	1974	
284- Metal Scraps Export	13,000	24?,000	22,000	186,000	200,000	Y.R.

(Source Page 83, Table 37, Stastical Year Book, 1976 published by Central Planning Organization, Yemen).

That means during the five years if 1970 to 1974 Metal Scrap worth 468,000 YR was exported. Probably there is much scrap available especially in big towns and cities like Dhamar, Ibb, Marib, Taiz, Sana'a, Sadad? Hodeidah, Mokha etc. provided arrangements for their collection is made. The public works department which constructs roads, buildings etc. can be a good source of scrap and they can collect it at convenient centres to be transported to the proposed foundry.

Regarding non-ferrous scrap, its collection would give work to poor people. They can collect old locks, brass bronze, aluminium cans and foils, zinc etc. which could then be supplied to the foundry.

Much more scrap is likely to be available in future. if we consider the trend in the use of machinery of every sort that has been imported in Yemen. The same machines would require for repairs many cast iron parts. The following extract taken from pages 86, 87, 88, 89, and 90 of Table No. 39, Imports by Values and Quantities 1973-74, from the Stastical Year Book 1976 by The Central Planning Organization will clearly show this trend:-

On a modest scale this scrap supplemented by import pig iron would be able to keep a small foundry of 3,000 tons per year going. Later on, if more scrap and raw material is available one more cupola can be added in the second phase of about 2,000 tons capacity per year making the total capacity of the foundry as 5,000 tons per year. This will be more economical than installing a bigger cupola in the beginning itself.

Site	Commodity	Unit	1973 Value in oooYR	Quantity	1974 Val. in ooo YR	Qua
67-	Iron and Steel	ooo	12,010	-	31,765	-
673/2-	Iron wires		112	-	147	-
673/3-	Bars and rods	ton	7421	7303	20,141	15,69
674/1-	Iron sheets	"	1614	1272	4,183	2,01
68 -	Non-ferrous metal		2,212	-	2,89	-
682/2-	Plates and sheets of copper	Kg.	18	2192	2	2,00
684/2-	Aluminium	ton	1,093	228	1,565	359
689/9-	Other non-ferrous metal		91	-	6	-
695 -	Tools for use in hand	"	1,924	-	1,642	-
698/11-	Locks	Nos.	1,303	-	574	-
711/5 -	Internal combustion Engines	"	571	270	5,500	1,00
712/1 -	Tractors	"	969	63	1,11	6
712/2 -	Other Agricultural machinery	"	788	978	2,104	44
715/21	Turning latre machine		209	405	22	2
719/21-	Agricultural water pumps	"	4,313	3,479	6,258	3,38
718/42-	Welldrilling machines	"	186	53	78	
732/1 -	Passengers motor cars	"	10,252	1,344	13,26	1,3
732/3 -	Lorries and trucks	"	8,741	351	13,103	7
732/8 -	Spare parts for cars		12,588	-	16,772	-
732/91-	Motor-cycles	"	2,076	2,416	5,32	3,0
732/92-	Spare parts for Motor-cycles	"	546	-	1,643	-
733/911-	Bicycles	"	276	1,496	473	2,3
733/12 -	Spare parts for bicycles	"	-	-	120	-
733/3 -	Whwel barrows	"	28	480	42	3
719/52 -	Carpentery machines	"	259	46	418	
719/9 -	Spare parts for machines	"	5,046	-	8,438	-
718/51 -	Stone breaking machines		25	3	33	
718/51 -	Brick manufacturing machines		95	22	27	

PROPOSED PHASED DEVELOPMENT PROGRAMME

(1) First Phase- (first 3 years) Installation of Jobbing foundry of 3,000 tons capacity per year.

(2) Second Phase- (next 2 years) Installation/Expansion of the foundry by installing a cupola of 2,000 tons capacity per year, to make overall capacity of the foundry as 50,000 tons per year.

(3) Third Phase - (sixth year) Adding a small non-ferrous section to the foundry.

(4) Fourth Phase - (sixth to 10th year) Convertion or Expansion of the foundry to production instead of jobbing when pumps, power-tillers. oil-engines are manufactured in Yemen.

THE POWER SPECIFICATIONS in Yemen are 220 V, 50 cycles, single phase OR
380 V, 50 cycles, three phase.

And suitable foundry equipment is available from any industrially developed nation in the world. It would be necessary to take automatic modern machines and also to give highest priority for training of the personnel in handling the machines.

The construction of the cupola using steel sheet and fire bricks and the shed is likely to cost about 100,000 US$. The foundry equipment and machinery (about 18 in number) as indicated below will cost CIF Hodeidah about 1,35,0 US$ (based on 1977 prices and increased to get an idea of prices in 1978-79.

(1) Jolt Stripper Moulding Machine (Model TL-25)	-	2 sets
(2) Jolt squeeze Moulding Machine (Model F-2A)	-	2 sets
(3) Belt Conveyer	-	1 set
(4) Bucket Elevator	-	1 set
(5) Sand Sifter, Model (VSS-IDS)	-	1 set
(6) Sand Storage Model (55-164)	-	1 set

( )	Sand Mill, Model (MS-5A) -	2 sets
( )	Sand Blender, Model S.S.R. -	2 sets
( )	Muller Mixer, Model(MSU-2D)	1 set
(1)	Drying Oven (with oil burner) -	1 set
(1)	Overhead crane (capacity 1 ton)	1 set
(1)	Ladle model "GCL-05" -	1 set
( )	Electric panel -	1 set
( )	Air Compresser -	1 set
( )	Moulding box for head -	20 sets
( )	Moulding box for pulley -	30 sets
( )	Moulding flask for flayes -	4 sets
( )	Moulding flask for impeller -	4 sets

(Quoted by the courtesy of the Industrial Estste Development Authority - Quotations (Date - May 23rd, 1977) by M/S Ace Trading Co. Ltd. 15-17,-2 chome Nishi - Shinbashi, Minato-KU, Tokyo Japan, - Telephone - 501-8981, cable address, Acemakisan Tokyo, Telex - J23362 ACETRADE).

The above quoations were received by the Industrial Estate Development Authority P.O. Box 538, Sana'a. Other quotations were also received but after studying the designs, the capacities of the machines, the above seem to be appropriate for a small but modern foundry hence they have been indicated above. These machines are manufactured in Taiwan by M/S Taiwan Shinton Machinery Co. which is a joint venture of M/S Shinto Kogyo K.K. in Japan. It is suggested that the Director General Industries when he visits Japan may like to see these machines and examine the possibility of Japanese firm collaborating in establishing the foundry in Yemen.

The raw materials required except for lime and available coal will have to be imported:-

(1) Foundry No.1 grade pig-iron (high marnganese 1 to 1.5% high silica 2 to 2.5%).
(2) Coal
(3) Hard Coke
(4) Mould and Core Sand (may be available on the Red Sea Coast).

Japan imports a lot of pig-iron from GOA (India) and if collaboration with the Japanese firm is possible, they may divert some to Yemen. Or it may be obtained from any pig iron country.

The total cost of the foundry including land, buildings, equipment etc. is expected to be 300,000 US$ and including one years stock of raw materials and wages of workers and supervisor, water and electricity cost it is estimated to cost 500,000 US$ for such a foundry project.

APPENDIX NO. 16

A [illegible] FOR ESTABLISHMENT OF A WORKSHOP UNDER THE UNIDO TECHNICAL ASSISTANCE

1 [illegible] of the Project:

Demonstration Pilot Engineering Workshop for Assembly and Manufacture of Agriculture tools, animal-drawn implements, hand operated agricultural machines and allied simple products with repair and maintenance activities.

2 OBJECTIVE:-

- Identify suitable agricultual implements, field test them, modify them to suit local conditions.
- development of local technical competence.
- Train farm mechanics and village artisans.
- Assist in the utilization of local raw materials or scraps whenever feasible.
- Act as a catalyst in local manufacture of suitable simple labour saving implements and machines and assist in future rural industrialisation.
- Development of local entrepreneurship.
- Extend repair and maintenance services
- develop a pilot demonstration scheme as the neucleus for future transformation into a vialable commercial plant which could serve as a model for future establishment of such small plants in other rural areas.
- To obtain quick results, implementation of a special small part of the project as detailed in R-2.

3 DURATION:-4 years (one year pre-project activity and three year operation activity).

4 HIGHLIGHTS OF THE PROJECT:

(a) The immediate objective is to manufacture a limited number of improved agricultural implements and tool for small terraced farms in Yemen with special reference to the existing accepted needs on a priority basis.

(b) This integrated project aimsat the establishment of physical facilties for pilot demonstration manufacturing of simple agricultural implements, training the local personnel (From mechanics and artisans) and initate preliminary activities towards strengthening of local design development and adaption capabilities of local people to facilitate production of new or imported implements of found useful during field trilas.

(c) It proposes to establish a practical and direct link between the needs of agriculture in Yemen, with agricultural tools and implements as as important 'input' for increasing agricultural production and the need for industrialisation with emphasis on appropriate technology transfer.

(d) This small manufacturing plant also aims at the establishment of repair and maintenance units through integration of equipment (mobile units).

(c) This project also aims to be the neucleous at a later date for training of local artisans and thus catalyze rural industrialisation on small scale to help the majority of small farmers in Yemen.

5- RECOMMENDED LOCAL EXECUTIVE AGENCY

Appropiate Section or an Agro-Industries Corporation under the Director General (Industries in the Ministry of Economy.

6- RECOMMENDED LOCATION

In the Industrial Estate at Sana'a (Two sheds would be required for this purpose) Sana'a is a good location being in the heart of an agricultural country. The sheds are also readily available. Initial activity will pertain to small implements and tools and not tractors which could be looked after by private dealers. In the second phase power-tillers would be included after making a detailed feasability study.

7- ESTIMATED UNDP INPUTS:

(a) Preliminary Mission 4 /m US$ 10,000 the present report is the report of preliminary mission (Pre-project activity

(b) OPERATIONAL ACTIVITY

i- PROJECT MANAGER:

AGRICULTURAL ENGINEER _____	36 m/	151200
ii- Workshop Engineer_____ (Mechanical)	48 m/M	96,000
iii- Design and development Engineer _____	24 m/m	96,000
iv- 4 UN Volunteers _____	_____	_____
	Sub Total:-	353,200

(c)- (1)- Prototype sample implements, designs drawings as per list given by preliminary Mission 30,000
(Recommendations NO. to NO Please see Annexure 1 to this scheme

(ii) - 2 Mobile Units/for repaird maintenance and one Jeep _____ 5,000

one to be located in Taiz and the other in Ibb. Both are important Agricultural Governorates. The third agricultural area of importance is Tihama plains. But there Wadi Surdud project for land reclamation, Guneisha Experimental farm and heavy tractors and automobile Repair workshop under Korean Aid are available hence the two mobile workshops have been recommended for Taiz and Ibb areas.

(iii)- Workshop Machinery
(As per Annexure 2 to this scheme _____ 125,00

(iv) Testing equipment including dynamometers, etc. 20,000

Sub-Total 210,000

(d) Observation Tours and fellowships (The observation tours are for higher offices like the Director General etc.. to countries such as Pakistan, India, Japan etc.. for about 4 weeks _____ 7,8000
and fellowship for counter-part officers for 3 to 4 months on inplant training _____ 14,000
preferably in Pakistan, India, Japan.

Sub Total 21,800

(e) Short term consultants 6mm_____ 99,000
as per proposal given in R-2 for obtaining quick results

(f) Initial Raw-material _____ 16,000

Total UNDP Input 700,000

Recommended Contribution from the Government of Yemen Arab Republic

(1) Land and Buildings ———Two sheds in the Industrial Estate at Sanaa

(b) Governments Counterparts - One Engineer and 3 mechanics passed from vocational training schools.

(3) Raw-material supply - (steel, wood, etc) US$ 4,000 a year

(4) Maintenance, Electricity.water etc. 12,000
US$ 2,000 a year
for 3 years 6,000

(5) Working capital at US $ 8,000 a year for 3 years --	24,000
Total:	46,000
Expenses of (1) and (2) above approximately --	54,000
Total Contribution from the Government.	100,000

ANNEXURE 1

A LIST OF PROTOTYPE (SAMLPLE) AGRICULTURAL TOOLS IMPLEMENTS AND POWER DRIVEN MACHINES TO BE OBTAINED FOR TRIAL PURPOSES: ONE ITEM OF EACH

(a) MANUALLY OPERATED TOOLS

- (a) Winnowing fan
- (b) Winnower
- (3) Maize sheller
- (4) Cotton stalk puller
- (5) Chaff cutter fodder cutter
- (6) Soft centre steel serreted sickle
- (7) Wheel hoe
- (8) Hand seed-drill
- (9) Seed-treating drum
- (10) Seed cleaner
- (11) Sprayer
- (12) Duster
- (13) Soil-gun
- (14) Prunning and graftin knife
- (15) Secateur - Single and double lever
- (16) Hedge shear
- (17) Fruit plucker
- (18) Seedling transplanter
- (19) Cream separator-alfa laval
- (20) Butter churn
- (21) Butter worker
- (22) Small incubator for poultry

- (23) Modern Bee-hive with frames
- (24) Centrifugal honey extractor
- (25) Poultry feeder
- (26)

(B) ANIMAL DRIVEN IMPLEMENTS

- (1) Single animal plough
- (2) Small turnwrest mould board plough
- (3) Small ridger plough
- (4) Steel bladed harrow
- (5) Steel bladed hoe
- (6) AKOLA hoe for cotton
- (7) MacCormic Adjustable cultivator
- (8) Multipurpose tool bar with plough ridger and 3 row seed-drill
- (9) Bund-former
- (10) Soil-scoop or scraper
- (11) Terracing blade
- (12) Leveller with steel prongs
- (13) Two row and three row seed-drills
- (14) Single row cotton planter with fertilizer attachment
- (15) Stone threshing roller
- (16) Olped thresher

(C) POWER-DRIVEN MACHINES

- (1) Heavy duty cultivators
- (2) Scarifier
- (3) Seed-cum-fertilizer drill
- (4) Seed-cum- fertilizer planter for cotton
- (5) Tractor mounted fodder cutter for dura stalk
- (6) Tractor power wheat thresher
- (7) Power driven multi-crop thresher
- (8) Power tiller with all attachments (diesel) 8 to 10 H.P. for ploughing, harrowing, hoeing, sowing, mowing, trailor, pump sprayer and rotavator.

- (9) Power tiller with all above mentioned (Petrol) 5 to 6 H.P. attachments
- (10) Light power tiller
- (11) Self aligning Italian Power tiller for working on slopes.
- (12) A tractor with offset implements for working close to the terrace bank.
- (13) Low lift high volume pump
- (14) Potato planter (German make)
- (15) Road-Roller (using heavy tractor)
- (16) Combine Harvester

(D) HYDRAULIC, WIND POWER OR SOLAR POWERED OR OTHER MISCELLANEOUS MACHINES

- (1) Hydraulic Ram
- (2) Windmill Australian type with plunger pump
- (3) Solar water heater
- (4) Bio-gas plant
- (5) Bone di ester
- (6) Coal-dust pallet making machine

ANNEXURE 2

A LIST OF WORKSHOP EQUIPMENT

	Appropriate price unit
(1) A complete set of carpentry hand tools	,000
(2) A complete set of blacksmiths tools along with Hearth, blower, anvil and surage block	10,000
(3) A complete set of tinsuithy tools including sheet bending machine	,.00
(4) A complete set of fitters tools	5,000
(5) A complete set of tools for brazing and pipe work	3,000
(6) One Oxy-acetelelyne gas welling, set	3,000
(7) One electric arc-welding set with transformer and accessories	10,000
(8) Two Drilling machines, pedestal and wall	6,000
(9) One Pedestal grinding machine	3,000
(1) One hand sheer for steel	1,000

(11)	One power hacksaw	2,000
(12)	One power operated punching and shearing machine	10,000
(13)	Small sized foundry equipment	22,000
(14)	One 'Wolf' portable hand tools	500
(15)	Cup-boards, tool-boxes, work benches vices	20,000
(16)	Transport, packing, insurance for above machines	10,000
(17)	Installation charges for items NO'S 8,9,10, 11,12,13 etc.	
(18)	Miscellaneous Expenses	7,500
	Total	125,000

APPENDIX NO. 17

A STUDY OF MECHANIZATION OF AGRICULTURE IN YEMEN

CONTENTS

Annexure 1 - Questionaire to tractor dealers

(1) INTRODUCTION

We have already seen the Agricultural and Industrial Situation in Yemen in Appendices NO's 13 and 14 respectively. So also we have studied in Appendix NO.12 the types of indigenous implements and tools used by the Yemeni farmers and the position of availability of power in Yemen. Now we can give attention to the progress of mechanization of agriculture in data regarding this has already been mentioned in the report and need not be repeated. At present the mechanization of agriculture confines to the use of tractor and pumps. The use of other implements and machines is relatively insignificant. The following Table gives the figures for tractors as 776 and for the pumps 14374, though these may be nearly 1½ to 2 times more. Due to lack of repair facities at least one third of their number is said to be out of order. During the First Five Year Plan period, the target is to import 3,000 tractors or about 600 tractors per year. This in short is the progress of mechanization and future prospects.

IMPORTS OF AGRICULTURAL REQUISITES 1966-1975

(Source - Table 24 Statistical Year Book 1976- Sixth year- original source: Central Bank of Yemen)

Year	Tractor Numbers	Agricultural pump NO.	Fertilizer Tons	Pesticl tons
1966	104	230	50	
1967	75	134		
1968	66	249	115	
1969	145	462	1997	118
1970	20	1402	3153	135
1971	80	1205	4046	218
1972	46	725	1799	482
1973	63	3497	4256	357
1974	63	3285	3869	717
1975 (ninemonths)	114	3055	7932	2510
Total	776	14,374		

(2) PREVIOUS WORK DONE IN THIS LINE

We have already described in a gist form in item No. 1.1.3 (Introduction) the findings, and observations of

(a) MR. C.M. Downing.

(b) MR. Osten.

Therefore it need not be repeated here.

Similarly a summary of work done at

(a) The West German Plant protective Centre, Shoub, Sana'a

(b) The Agricultural Mechanization on centre, British Project in Taiz

(c) And the progress made by proposed project of a Repair Maintenance workshop for tractors and cars under the North Korean Aid at Hodeidah has been m entioned at respectively

(3) Use of power driven m chinery on bilateral proj ects and Government farms such as at

(a) Wadi Sordud Land Reclamation project.

(b) Gumeisha Farm, near Hodeidah

(c) Wadi Zabid Experimental Station

(d) Aussefera Farm, Taiz and also other Government farms

(4) Use of pumps for Irrigation and for domestic water supply is increasing rapidly and would increase in future. There is however necessity to regulate in some way the use of the pumps in too much proximity otherwise the ground water level may go dangerously low as has been already happening in some areas.

All pumps are installed in the existing or new hand dug wells. Average area irrigated by a pump is 10 to 12 ha.

Since pumps owners receive at least 50% of each crop (75% of them are also the landowner) some owners have been able to recoup the cost of the pump and installation within 2 years. This has encouraged the traders and merchants with capital and available to invest in pumps and has caused land values to rise tenfold over the past 6 years to about YR 30,000/ a ha for top quality land.

Village water supply There is merit in standardization

Present- shaft driven turbines requires large holes

Change to- Mono lift of positive displacement pumps they are also cheaper.

Some hand operated pumps of positive displacement type (screw on piston) need to be introduced

Power Hints -- aircooled diesels Peter lister,

A centrifugal clutch is fitted to each engine to extend life and installed in power horse.

Cost of establishing and maintaining a water supply unit for 2½ years is about YR 1 million (68 installations) but including capital works (tanks, towers etc) - YR 5.5 million

Training and pump maintenance Mobile units required.

Also a local workshop for undertaking routine service and major repairs.

(5) A Questionnaire to main tractor dealers was circulated as shown in Annexure 1 to elicitate informetion on tractor drawn implements etc. and by personal contact some of the information was obtained.

Based on this main observations are

(a) The use of tractors by the Yemeni farmers is increase rapidly.

(b) The farmers prefer for prestige purposes higher horse power tractors 75 to 90 H.P.

(c) The dealers are in the process of establishing workshop for repair and maintenance.
(d) They are conscious of giving service to the farmers by way of repairs and maintenance.
(e) There is urgent need to train the tractor operators. The dealers are willing to cooperate in any training programme as was arranged under the FAO/Industry Cooperation in 1970-71 in which 5-6 dealers took active part.
(f) There is need to publish operation and repair manuals in Arabic language (a beginning has been made at the Agricultural Mechanization Project (UK Govt. in Taiz).
(g) At present about 18 to 20 different makes of tractors are being imported in Yemen. Obviously this needs to be limited now in the interest of farmers.
(h) Custom hiring of tractors for ploughing, threshing is increasing.
(i) Recently 8 to 10 small horse power tractors (four wheel having 12 to 14 horse power have been sold indicating a demand for them.
(j) Suitable tractor tyres be used
(k) Suitable tractor wheel weights be used
(l) Correct type of catagory 1 and 11 mounted implements need to be used
(m) The farmers mostly purchase the tractors in cash

All these observations are important. So far no particular efforts have been made for effecting modifications in tractors or implements to suit local conditions. Nor is there any concrete programme for progressive manufactur of at least the simple implements such as cultivators, trailers, levelling blades etc. Proper field demonstrations to show correct use of tractors and matching implements should be arranged. With the increase in the use of tractors all 'safety' precautions should be taken to avoid accidents

There is most urgent need now to make a detailed feasability study of the use of Power-tillers (walking type tractors of 5 to 10 H.P. and of small four wheeled tractors of 10 to 20 H.P. which are likely to be the main stay of agricultural power in the near future. Highest priority should be given to this so that no time is lost.

(6) Perspective Planning

The Government is aware of the usefulness pf the mechanization of agriculture and have rightly considered it in their perspective planning and long-run objectives as given below. They cover both research as well as use:-

In the sphere of Agricultural Mechanization

PERSPECTIVE and long run objectives

(Source:- The First Five-Years Plan 1976- 1977 to 1980-19
Volume 111, The General Objectives and Strategies, the objectives of sectors and Departments and their strategie YAR Prime Ministry office, Central Planning Organization)

Research Plan p. 27 - "Carrying out experiments on agricultural mechanization under Yemeni conditions and reaching certain results in this connection in order to overcome manpower shortage".

Mechanization Objectives (p.33 to 36) :-

(1)- Defining the mechanical agricultural operations relevant for lands and various crops.

(2)- Defining the suitable kinds of matching and equipment for carrying out the mechanical agricultural operations.

(3)- Improving the area, the shape and the levelling of fields in Tihama Valleys, in order to improve their irrigat and facilitate the use of machinery in them.

(4) Expanding the introduction of mechanization in agricult within the limits of economic and social variables, in orde to recompense the exceeding agriculture operations in the right way, thus increasing production and reducing its cost

(5) Full control over the import of agricultural machinery and equipment, trading in these machinery and guaranteering their maintenance.

(6) Creating trained cadre capable of working and maint air machinery in the private and public sector.

(7) Raising the standard of using agricultural machinery and equipment.

Definite Objectives of the Plan

- Increasing the introduction of mechanization in agricultural operations of suitable quality.
- Improving the efficiency of using agricultural machines and equipment
- Importing 300 tractors of proper kinds during the year of the plan.

THE STRATEGY

(1) - Streghtening th technical staff working in agricultural mechanization by qualified personnel of different levels.

(2) - Carrying out experiments and technical and economical studies on the machinery under use,

in order to evaluate them and determine the suitable kinds of these machinery.

(3) Introducing new agricultural machines and equipment, and carrying out experiences on them in order to determine their suitability and carrying out the necessary alterations when needed.

(4) Carrying out experiments to determine the proper mechanical agricultural operations for crops amd various lands, in the plantations of Government and in farmer's lands.

(5) Carrying out technical and economical studies on the development of the area, the shape and the levelling of fields in Tihama valleys, and setting up pioneering projects in this field.

(6) Establishing two centres for training on agricultural machines and equipment. The first in taiz in the first year of the plan, the second in Hodeidah (in Jummeisha farm) in the third year plan. These centres will be used for training labourers working in agriculture mechanization, drivers of tractors, in private and public sectors and will subscribe in training extension workers.

(7) Practicing explanatory guidance and applied exercises to guide and convince farmers to the importance and practicability of agricultural of agricultural machines and equipment through agricultural machines and equipment through agricultural credit, especially in the sphere of small machines for harvesting, threshing, winnowing and mechanical hoeing.

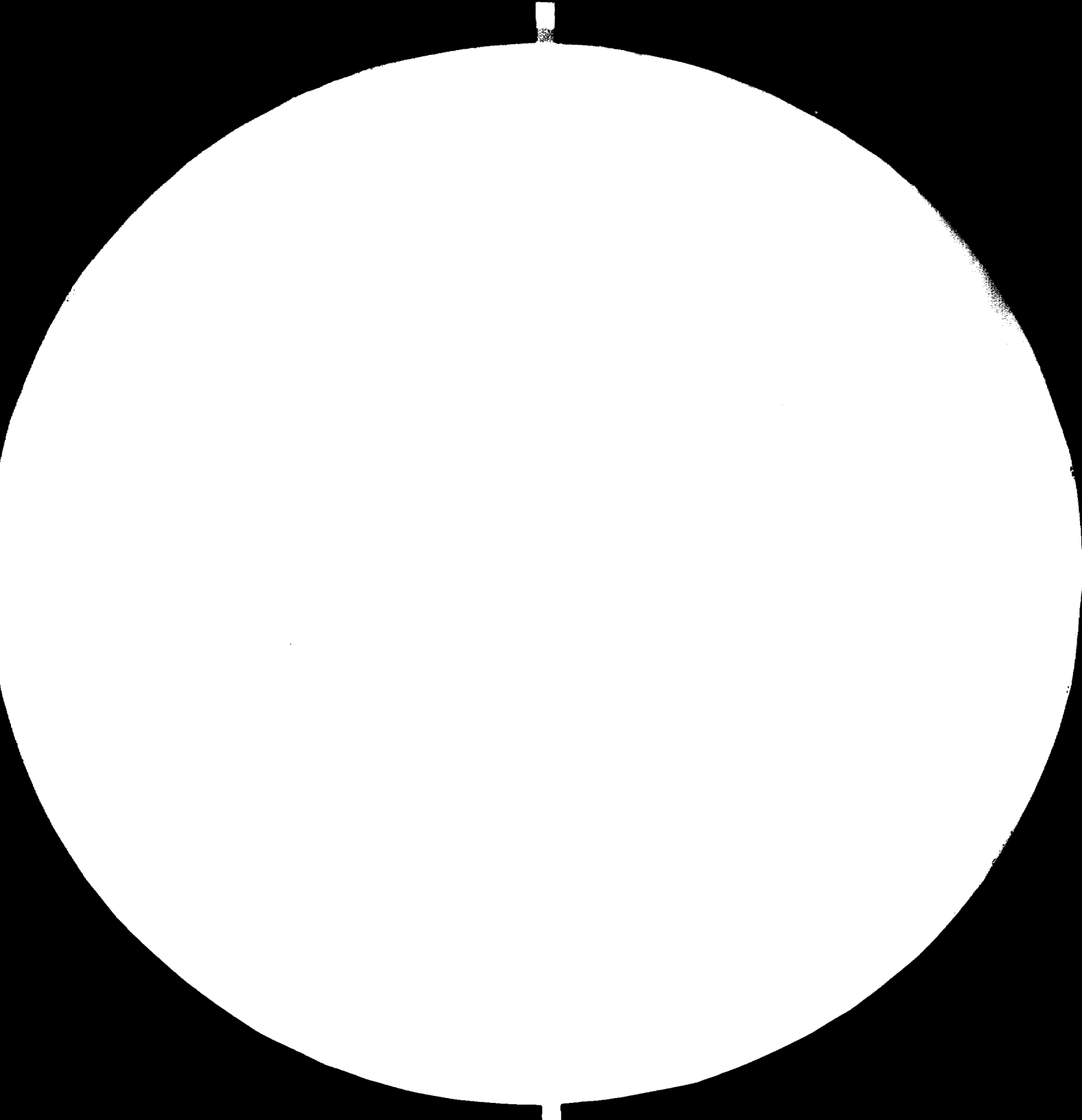
(8) - Encouraging the establishment of agricultural machines Co-operatives to render services to farmers, especially with machines which they are unable to acquire.

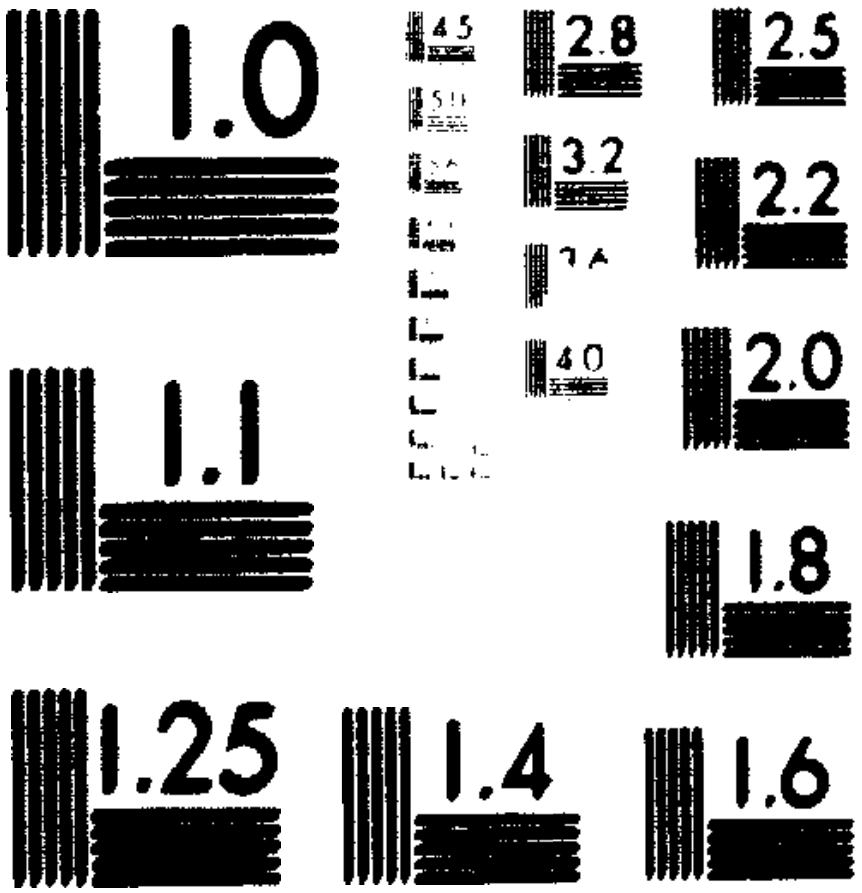
(9)- Helping farmers technically to choose the suitable pumping units.

(10)- Encouraging the import of necessary and suitable agricultural machines and equipment.

(11)- Organising the control over the import of machines and equipment to guarantee the import of suitable kinds, and availability of spare patrs and maintenancee.

(12)- Concentrating on developments mechanisation in Government plantations especially on Sordud and Jummeisha to become a prototype for guiding farmers and Co-operatives.





(13) - Ensuring Co-peration and co-ordination between parties working on agricultural research and experimentation and parties working on experimentation in agricultural machinery.

(14) - Encouraging government and private workshops to make some agricultural machines and eqipment locally

(15) - The lists of Prototype (sample) agricultural tools, implements and power driven machines which look promising for use in Yemen and which the Expert has prepared to be obtained for trial purposes through the UNIDO technical assistance are given in Annexure 1 to Appendix 16. and sketches A brief description and sketcjes of some pf them are given under the chapter Recommendations paragraphs 3.8, 3.9, and 3.10.

ANNEXURE 1

A Questionnaire to Tractor Dealers

December, 197

From:

MR. D.N. Kherdekar
UNIDO Expert attached to
the Ministry of Economy
Sana'a - Yemen Arab Republic

To

Sir,

Having learnt that you are a premier dealer in tractors drawn implements / accessories, your kind assistance is being sought for compilation of relavant data regarding the use tractors and tractors drawn implements and machines in the Yemen Arab Republic. It will be very much appreciated if the attached questionnaire is fitted up and sent to the undersigned anearly d te. The information is required for preparing a report on "Mehanization of agriculture in Yemen".

Latest catalogues and current price lists of tractors and implements supplied by you may kindly be sent along with the questionnaire.

Two copies of the proform are being sent so that you can rtain one and one may plaease be sent to us.

Thanking you

Yours faithfully

D.N. Kherdekar
UNIDO Expert attached
to the MInistry of
Economy.

TRACTORS

1-, Number of tractors of various sizes and types imported and sold so far ----------

2-, Comment on future prospects of sale of tractors during next three years

1978 ----------

1979 ----------

1980 ----------

3- Tyre sizes (Rear tyres) ----------

4- In the catalogues is the BHP mentionrd or draw bar H.P.-9

5- Is H.P. corrected for high altitude such as Sana'a which is about 7,000 ft. above sea level?

6- Comparision of 35 HP tractor and 60 HP. tractor qnd 8.5 H tractor

Regarding:- Prices of tractors 35/40 60/65 80/

Priced of 3 popular implements ---- -- --

(please mention only about machine equioments) ---- -- --

Fuel/lubrication charges/hour ---- -- --

7- Areweights added to chassis or wcels-

no. of kgs ?

Price ?

8- Position regarding quick moving spare parts

9- " " slow " "

10 Any Mobile repair workshop with location list of list of main machines.

IMPLEMENTS

1- Three most popular implements which are in urgent demand

a- ----------

2- Three next popular implements

a- ----------

b- ----------

c- ----------

3- Any trailed implements ?

4- Mounted implements category one ?

and category Two implemments ?

5- Are there any plans to at least progressively Manufacture or assemble any implements in Yemen and which?

6- Any entirely new implements which you propose to introduce in Yemen?

GENERAL

1- Have any field demonstrations been held?

2- Has any operation and service literature been published in Arabian language or cyclostyled - names (copies may please be attached)

3- Is there an agricultural Machinnery dealers Organisation/Association in Yemen or is it a part of the Federation of Industrialists.

4- Any 'safety' problems noted in Y. A. R. for tractor operation

5- Has any modifications or research or testing etc...been done to tractors or to implements to suit local conditions ? or from your field experience can you make any suggestion

6- Are there any special problems noted which requires urgent attention ?

7- Tractor and implement hire-charges per hour in Yemen Arab Republic.....1-Ploughing_____
2-Cultivating (harrowing) ___
3-Transport_____
4-Threshing_____
5-Any other operations____

8- Monthly salaries of (a) Tractor Operator
(b) " Mechanic
Workshop staff i- Welder
ii- Carperter
iii- Blacksmith
iv- Fitter
v- Foundry worker
vi- Patter maker

9- Brief description of servicing facilities available

10- Have the repair mechanics been trained? Where and for how much period ?

11- Are there any plans for adopting any village or area by your firm for extension work ?

12- If a museum of agri./machinery is made in Sana'a would you like to place some implements there for display ?

13- Would you like to take part in training seminar if organised by the Govt./UNDP ?

14- What are chances of cooperative use of Agriculturing Machinery in Y. A. R. ?

15- Are there any g. service/Custom Hiring centers?

16- Prices of Diesel _____ per lit.
Gasoline_____
Lubricants_____
(Are these subsidised and if so how much is the subsidy ?

17- Are there any taxes on sale of tractors and implements ?