NATIONAL RESEARCH CENTRE

APPLIED SCIENCE AND TECHNOLOGY PROJECT
(Project No. 263-0016)

Demonstration Sub-project
(Academy of Scientific Research and Technology)

THE DEVELOPMENT AND APPLICATION OF BIOGAS TECHNOLOGY IN RURAL AREAS OF EGYPT

Fifth Progress Report (PR/5)
Submitted to the JCC

by

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INTRODUCTION

The project started by the beginning of 1979. The final project proposal was approved in the March 1979 JCC meeting. Four semi-annual progress reports have been submitted, in addition to a separate report on the "Sociololgical Survey of Four Villages" (PR/04 - June 1980).

A summary report on project status by the end of phase I (PS/I) was submitted in September 1980. It covered the project background, definition of the problem, objectives, retionale and justification, project program, accomplishments and future plans.

This fifth progress report gives a brief outline of work progress over the past six months and summarizes anticipated future course of action.

The joint U.S. - Egyptian panel for the project held intensive meetings in the NRC during the period from February 7-11,1981 to review the project progress and draw up recommendations for future course of action. The agenda of the meetings and the U.S. panel evaluation report are enclosed in the Annex.

WORK PROGRESS OVER THE PAST SIX MONTHS

The work activities during the reported period can be grouped under three main sectors : NRC development and demonstration site, supportive research and preparation for the village demonstration.

1. NRC Development and Demonstration Site (The Engineering Group)

1. The third prototype unit - which is a 7 cu.m. new design combining the features of both plug flow and movable cap-Indian types - was constructed, tested, adjusted and successfully started up. Operation will be followed up during the initial unsteady-state period for a full retention time of 50 days. The performance characterisitics will then be assessed once the steady-state conditions are achieved.

2. The second prototype unit - which is a 6 cu.m. circular and shallow Chinese digester and which was in successful operation during the period from February to August 1980 - was cleaned and restarted up using a mixture of dung and shredded cotton stalks. Scum formation was excessive and the unit became inoperable. The unit was cleaned again and restarted on a mixture of dung and maize stalks. During this experiment, an unfortunate incident occured (a truck stepped on the digester dome) by which cracks developed. The digester was emptied once more for repair. Precautions were taken to prevent such an incident by surrounding the digester area with a surrounding stone courdon.

3. The first prototype unit (the rectangular Chinese digester) was still under treatment for minor gas leakage. Considerable improvement occured, but the digester did not reach the required gas-tightness state.

II. Supportive Research

In addition to the regular follow-up of operating prototype digesters, the fundamental microbiology and the fertilizer evaluation groups have been working on certain pertinent aspects according to plan outlined in the previous progress report. The highlights of their work may be summarized in the following :

A) Fundamental microbiology group : The group supportive research work encompassed basically three aspects : the immobilization of sulfate reducing bacteria (SRB) as well as hydrogen sulfide, adaptation of simple and appropriate analytical techniques, and development of adequate diagnostic methods.

The effect of adding iron (as nails) to anaerobic cow dung digesters was studied in the laboratory. The most probable number (MPN) of SRB in iron-containing digesters amounted to 92,000 organism/ml., versus 220,000 organism/ml. in the control. This appears as a good indication of the effect of iron on immobilizing the SRB.

Attempts to adapt appropriate methods (simple techniques) for gas analyses have started. Carbon dioxide could be easily determined by a modified gas burette and a sampling syringe. Accuracy within a 5% bracket has been achieved.

Work on development of diagnostic methods for the assessment of the activities of cellulose anaerobic decomposers, volatile acids oxidizers, and methanogenic bacteria has also started. A cellulose "Coupon" technique has been developed to determine the activity of the first group within the digester.

B) Fertilizer Evaluation Group

As reported in the previous progress report, several methods for handling and storage of the digested materials from the second prototype unit have been investigated. These encompassed : air drying, adsorption on silt and post-composting with agricultural residues and silt.

Results indicated that :

1. The air dried slurry has high content of organic matter and minerals, but a considerable loss of nitrogen through volatilization took place (reaching about 46% of its initial amount).

2. Adsorption on silt decreased the nitrogen loss to 2%, but the product has low content of organic matter and nutrients.

3. The post-composting treatment resulted in increasing the total nitrogen content as well as the quantity of manure, but the product has a lower content of minerals than dried slurry.

Work has also been in progress since October 1980 for evaluating the fertilizer resulting from the three handling techniques in green house pot experiments using sandy soil and wheat as a test plant. At the same time, bottom sample from the digester as well as fresh untreated slurry,

farmyard manure and urea are used in this comparison evaluation. All the seven fertilizers were added in amounts equivalent to 20 tons/feddan (the normal application rate). They were put at the sowing time except for the fresh slurry which was applied 5 days before sowing time and urea which was applied 15 days after the sowing time.

III. Preparation for the First Village Demonstration

As was mentioned in the previous progress report, Al-Manawat village - Giza Governate, was selected as the first demonstration site. Frequent visits were made to the village for orientation purposes as well as for selecting appropriate houses in which family-size units may be built. As a result, strong ties have been developed and several houses were chosen on a preliminary basis. In addition to personal discussions with the village official leaders and individual householders, limited group meetings were also held. Posters were employed as a means for initial orientation (see Figure 1). Village representatives were invited to visit the NRC development site where they could see the prototype units and understand the basic ideas related to their construction, operation and maintenance.

In a new NRC program entitled "Science and Technology for Rural Development in Giza Governate", biogas technology constitutes an important element. The Governer of Giza requested immediate implementation of the biogas demonstration program in Al Manawat village as a pioneering field experiment in the Governate. On account of delayed allocation of the project funds, the Governer provided a LE 1000 loan to the project for this purpose. Consequently the engineering group has taken active steps towards immediate construction of three family size units of different designs (prototypes 2 and 3). Construction work will start by the last week of February 1981.

FUTURE PLANS

The tentative plan for Phase II covering the period from 1981 to 1983 is shown in Figure 2. It includes four major elements :

1. Development and Demonstration work at the NRC site.
2. Village demonstrations.
3. Supportive research and laboratory services.
4. Socio-techno-economic studies.

During 1981, efforts will be concentrated on : a) completing the NRC demonstration so as to be adequate for devepolment work as well as for the orientation and training of village personnel ; and b) conducting the field demonstration at Al Manawat village. Certain changes will be made in the tentative plan to accomodate the recent developments by which Al Manawat demonstration will start immediately.

CONCLUDING REMARKS

The successful implementation of future plans would definitely require complete eradication of the adverse conditions the project team has been living with (please refer to the U.S. Panel comments in this regard). The accessibility of the required local funding together with the expedient procurement of ordered equipment and instrumentation would have a decisive influence. And I should conclude by stating that encouraging signs have not as yet appeared.

ANNEX

JOINT COMMITTEE MEETING ON THE DEVELOPMENT AND APPLICATION OF BIOGAS TECHNOLOGY IN RURAL AREAS OF EGYPT

NRC, CAIRO - FEBRUARY 7-11, 1981

Saturday Feb.7th	9:30 - 12	Whole committee will meet to review phase I progress, discuss project status and future plans.
	12:30 - 2	Panel will visit NRC extension sit and discuss engineering group developments.
Sunday Feb. 8th	9:30 - 11	Panel visit water pollution contro lab.,
	11 - 12	Fundamental Microbiology
	12 - 2	and Fertilizer evaluation group.
Monday Feb. 9th	9:30 - 1	Visit AlManawat village.
Tuesday Feb.10th	10 - 1	Seminars by Prakasam Capener Goodrich
Wednesday Feb.11th	9:30- 1:30	Whole Committee - Complete evaluat and Finalize report.

Report of the Biogas Panel

February 1981

Dr. T.B.S. Prakasam
Dr. H.R. Capener
Dr. P.R. Goodrich, Chair

The biogas project has made fine progress since the previous visit of the U.S. review panel in January 1980. Progress reports were timely and fully support this assessment. The discussions, village visit, laboratory visits and demonstration digestors site visit all were fruitful in gaining insight into the progress that has been made.

However, the lack of funding to start Phase II and the lack of instrumentation are very serious problems threatening the success of this demonstration project. Proper monitoring of the digester cannot be done without the requested instrumentation. Delay of purchases has allowed inflation to erode the value of instrumentation that will be purchased with allocated funds as well as delaying project work.

The bureaucracy of AID and the Egyptian system has impeded the project work. We find it impossible not to complain loudly about the callous slowness that seems to pervade AID bureaucracy. This project has been developed with a well qualified inter-diciplinary group of capable workers. They are both competent and enthuseastic. Good work has been accomplished under frustrating and difficu conditions. They have met their time lines as well as possible, although the proper support would have enhanced the overall benefits.

The planned implementation of the biogas technology in two villages was planned to occur at a specific time. Implementation is a complex process that needs cooperation of provincial and village officials and the participating individuals. Development of the educational programs and awareness situations must preceed the technology transfer to the village. These must be carried

out at the proper time so as not to raise expectations and then leave a time gap before the work arrives in the village.

The large gap in funding is very detrimental to planned, and properly executed rural development. Stoppage of work has occured in some aspects because the funds are not available. Retroactive funding is not a reasonable strategy in a situation where funds cannot be allocated from one project to another and repaid later date when delayed funds finally arrive for the project.

Recommendations to AID - ASRT - NRC

The implementation of digesters in the villages is a different type of job than usually encountered by the NRC - ASRT. The principal investigator needs to have flexbility in purchasing supplies that does not now exist in the purchasing procedures. We suggest that a lump sum be allocated quickly at the beginning of the project to the principal investigator so that only his signature and a receipt is needed to draw on these funds. It is too wasteful to have expensive time of highly capable people spent chasing after signatures for minor purchases. Trust must be part of management responsibility.

The funding for the project must be made available. The papers should be signed in Washington without delay.

Recommendations for the Biogas Team

The following recommendations are made to strengthen the biogas demonstration project. We of the U.S. Panel feel that these should be considered as the Phase II part of the project is implemented.

1. The First Demonstration Location "Manawat Village" can more accurately be described as a transition village. This means it has many attributes as a rural agricultural village. But at the same time, due to its close proximity (12 miles) to Cairo, it reflects a range of services and influence of trade, transportation, communication and general life style of a unit moving on the rural to urban-continuum.

2. It would be better understood and accepted at the outset if the demonstration village were described as a "transition village". This will avoid misunderstandings from the beginning on the part of observers or critics who could be quick to observe that Manawat is not a typical very rural village.

3. The wisdom or advantages of the strategy of first choosing a demonstration village can be highlighted. It has many of the conditions in place that are requisites to achieving a first success in the demonstration phase. Those are : leadership, professional expertise, political sponsorship from Govetrnment of Ghiza, buildings, middle management personnel, transportation, communication, etc..

4. The value of highlighting the biogas component as one polished arrow in a whole quiver of development arrows for a Rural Development Strategy will take some of the spotlight of publicity and undue attention away from the biogas project. This will be beneficial to move the work along.

5. The distinction needs to be kept in mind between what is normally thought of as a result demonstration and a village demonstration. In the year ahead the whole Biogas project might be thought of as the village demonstration composed of a series of discreet result demonstrations dealing with water, fertilizers, micro-organizims, fuel etc..

6. The members of the various project groups must be encouraged to project their work in realistic ways out from the laboratory and into the village, family and household setting. This next year could well promise to be one of the most interesting for the whole biogas team.

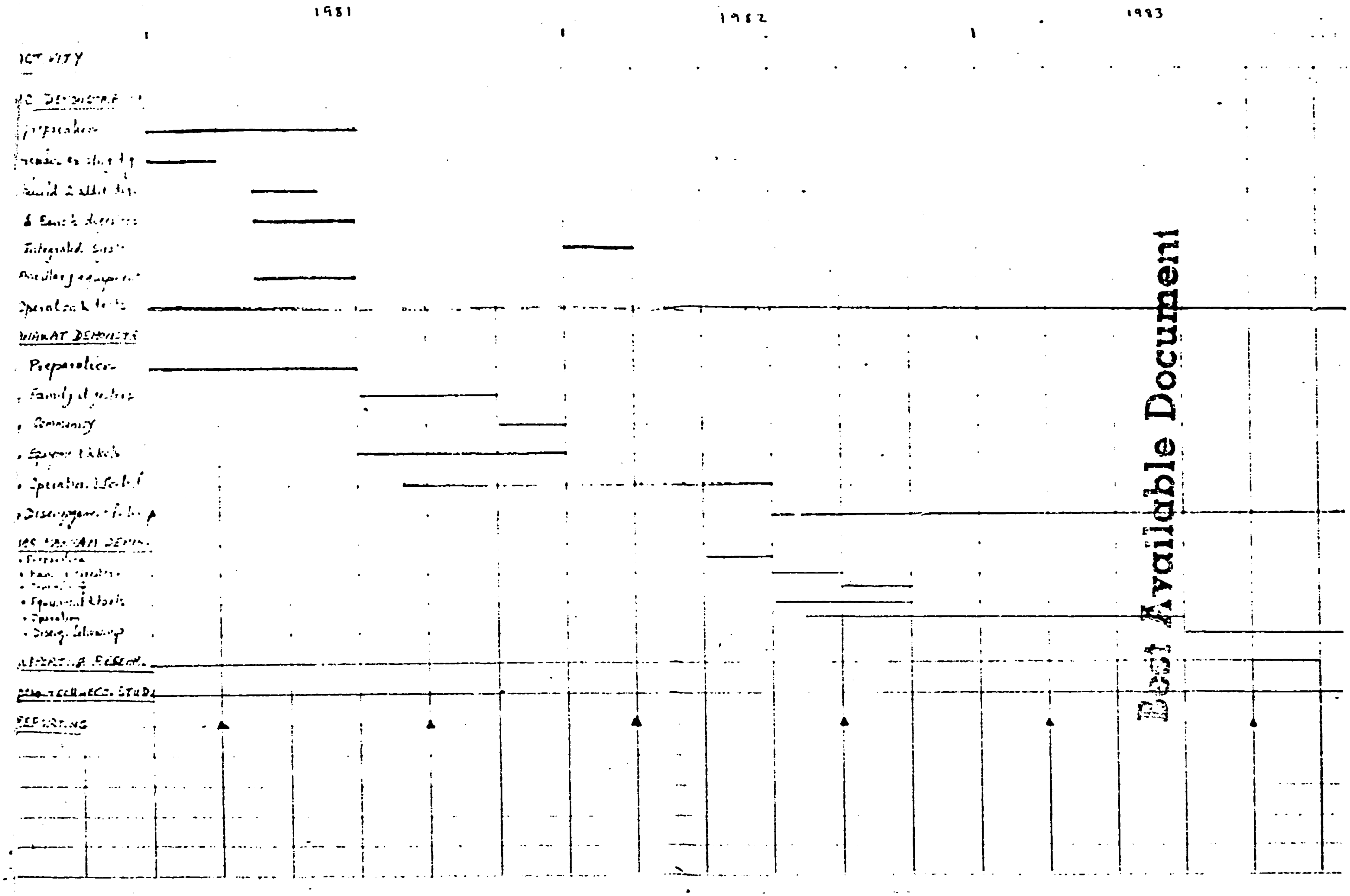
7. An important sub-set of data that will deserve a separate section in the report will be the "Experience, Dynamics", of assembling, moulding, managing an inter-disciplinary team across as many different fields as are represented. Then facing the challenge of getting them out of their laboratories and into the field for applied work. Writing this as part of the official report

will help legitimize its importance for the future. Dr. Capener will be pleased to help with this in any meaningful way.

8. Before the demonstration program gets started at the village level, a representative/representatives of the Governorate in whose villages demonstration will be carried out should be associated in an official capacity with the Biogas Project Team (BPT) of the NRC. These personnel should interact with the BPT at the directive of the Governorate on a regular basis before and during the construction of the demonstration models to get a first-hand knowledge of the interior of digester construction. They also should participate in the follow-up operation and maintenance program of the digesters in order to gain an understanding of the machanics of operation and maintenance of biogas plants. These personnel would be useful in constituting a potential biogas directorate at the village unit level or even perhaps at the Governorate level; the job of the NRC will be simpified in terms of recommending and implementing the extension work when once the demonstration phase is completed. Also,these trained Governorate biogas personnel should be able to provide the necessary training to other potential biogas technicians should a reginal biogas plant construction program be implemented in the future.

The leadership, membership, cooperation, team spirit, dedication and solid progress are all to be higly commended. Strong administrative and financial support of the project is absolutely critical for the excellent momentum to be maintained.

Figure 2 - [illegible] Phase II - [illegible]



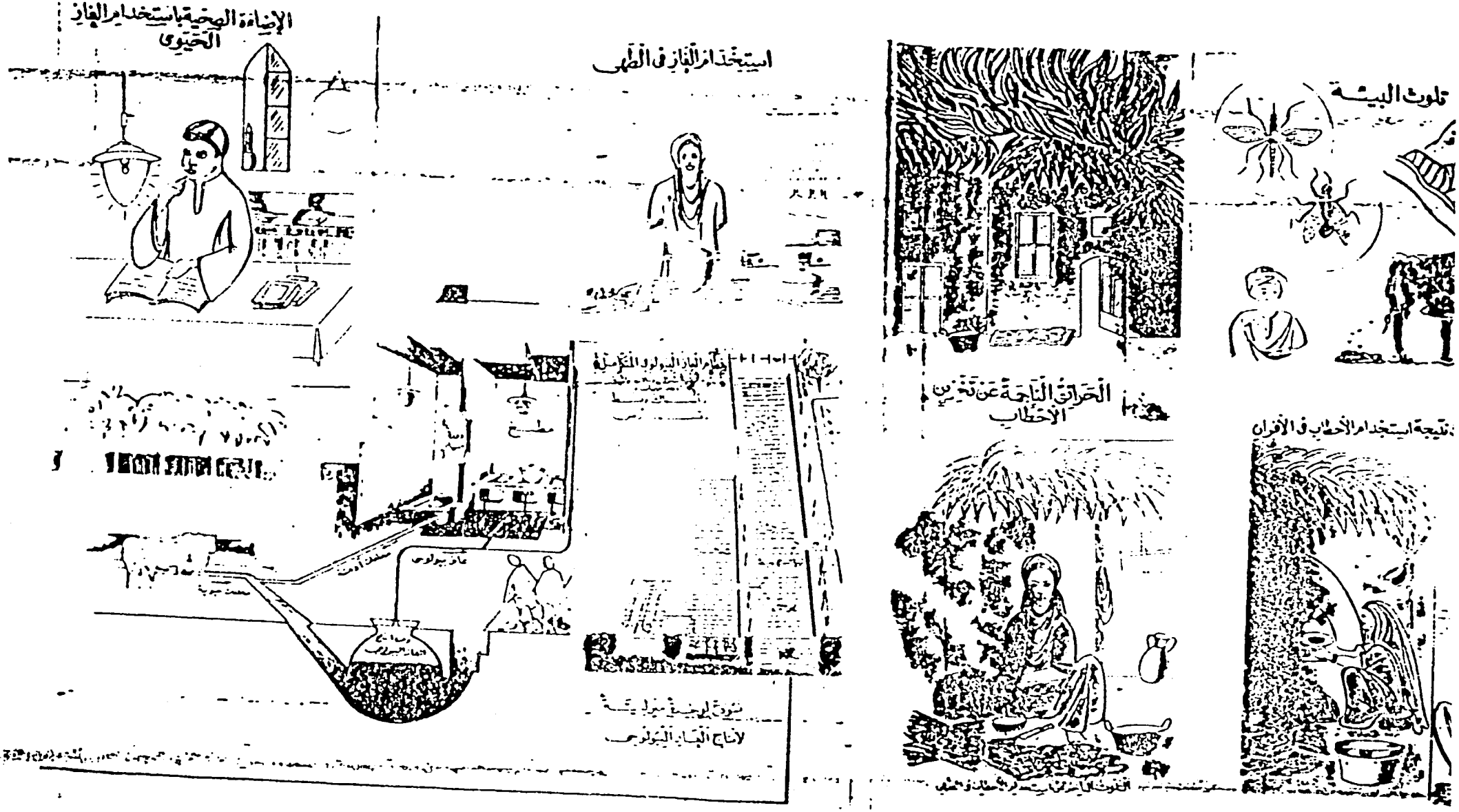


FIGURE 1. Comparison of [illegible]