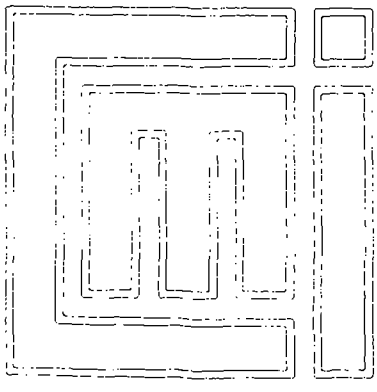
TURI HAMMER

COMMUNITY SELF-HELP ACTIVITIES. PROPOSALS FOR ACTION

A 286



DERAP WORKING PAPERS
CHR. MICHELSEN INSTITUTE
DERAP (Development Research and Action Programme)
Fantoftvegen 38 - N-5036 Fantoft - Bergen - Norway

DERAP ARBEIDSNOTATER
CHR. MICHELSENS INSTITUTT
DERAP (Forsknings- og aksjonsprogrammet for utviklingsland)
Fantoftvegen 38 - 5036 Fantoft - Bergen

Ref. 33.742 IS/DVE

With the compliments of

CHR. MICHELSEN INSTITUTE

Department of Social Science and Development

FANTOFTVEGEN 38, N-5036 FANTOFT,
BERGEN, NORWAY

TURI HAMMER

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A 286*

BERGEN, FEBRUARY 1983

* The series of DERAP Working Papers contains draft documents and papers which are still under preparation, and notes which are not written for general publication.

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DERAP Arbeidsnotat/Working Paper A 286

Turi HAMMER

Community Self-Help Activities. Proposals for Action
(Selvhjelpaktiviteter på landsbyplan. Handlingsforslag)
Bergen, February 1983 41 p.

Summary:

This paper describes and discusses measures to improve living conditions in villages in North Sudan as suggested and worked out in consultation with the local population and politicians. The suggestions comprise organization, financing and implementation of self-help activities which the villagers themselves wanted started, namely supply and hygienic use of water, training of traditional birth attendants, charcoal production and more efficient use of charcoal and firewood. The measures are modest in the sense that they mainly draw on local resources and are directed towards internal needs over which the villagers have some influence. Thus they are but a supplement to changes in structures and policies necessary to eradicate poverty and support the population in peripheral areas in their efforts to improve their situation.

Sammendrag:

Notatet bygger på forslag til forbedring av leveforhold i landsbyer i Nord-Sudan utarbeidet i samråd med landsbybeboere og lokalpolitikere. Forslagene omfatter organisering, finansiering og gjennomføring av selvhjelsaktiviteter på områder som befolkningen selv ønsket igangsatt, nemlig forsyning og hygienisk bruk av vann, sanitære forhold, voksenopplæring for kvinner, helseopplysning, trening av ufaglærte jordmødre, trekullsproduksjon og mer effektiv bruk av trekull og ved. Tiltakene er beskjedne: de nytter hovedsaklig ressurser som allerede finnes lokalt og retter seg mot det interne landsbyliv. De er således kun et supplement til strukturelle og politiske endringer som er nødvendige for å minske fattigdom og gi befolkningen i perifere områder mulighet til en livskraftig og sunn utvikling.

Stikkord:
Selvhjelpsaktiviteter
Intermediær teknologi
Tørrområder
Sudan

Indexing terms:
Self-help activities
Appropriate technology
Arid areas
Sudan

Kan bestilles fra:
To be ordered from:
The Chr. Michelsen Institute - DERAP
Fantoftvegen 38, 5036 FANTOFT

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PREFACE

This paper presents suggestions for activities aiming at improving some aspects of rural life in a North Sudan savanna area.

The measures suggested are modest in the sense that they are based on self-help activities at minimal costs for the beneficaries and in that they aim at mobilizing resources that are available within the communities and local governmental offices; i.e. construction materials, labour, skills and expertice. External financial assistance is by and large limited to get activities like e.g. water supply started. Estimates of costs of goods and wages are at 1981-prices. The internal relationship between the various budget items would probably hold under conditions of changing cost levels and can therefore indicate a model for financing the activities.

The measures are locally-oriented and -based and constitute but a supplement to changes in structures and policies necessary to eradicate poverty.

The paper is based on information collected and discussions held during visits to the 40 villages participating in Integrated Sahel Programme, for which I served as coordinator in 1980/81. Village meetings were conducted together with Programme Administrator Olav Digernes and the Forest Rangers in charge of the various districts. In most villages men outnumbered women in the public meetings, and they were also the more expressive group. I therefore had a number of meetings where only women were present. Furthermore discussions were held with governmental agencies that might become future partners in the community development activities and with various aid agencies working in the Sudan. Information and ideas were also found in literature on rural development and appropriate technology.

The suggestions have been submitted to the agencies in charge of programme activities and are presented here in slightly revised form in the hope that they might be of some value to colleagues and other readers concerned with development issues who find themselves in similar field conditions.

INTRODUCTION

Development Objective

Integrated Sahel Programme had as its overall development objective to improve the living conditions of the population in the area ranging from Bara via El Obeid and Simeih to Ghabsha in the Northern Kordofan Province of the Sudan.

The majority of the population live from rainfed agriculture with subsistence and cash crops traditionally being grown together with Acacia Senegal in a rotation including a substantial fallow period. Political, economic and demographic factors, in the 1970s combined with a prolonged drought, led to a breakdown of this agroforestry system. People associate the present desertification with overcutting of trees for fuel and too intensive cultivation, and therefore asked for external assistance to revitalize the traditional agroforestry system so well adapted to the natural conditions. Assisted by Sudanese experts a voluntary aid agency prior to the start of Integrated Sahel Programme in 1980 made plans for reforestation with Acacia Senegal as a means to halt desertification through soil improvement and stabilization of sand which now encroach on agricultural and grazing land. In a well-managed agroforestry system Acacia Senegal will increase agricultural output through its nigrogen-fixing capability, provide cash from its resin gum arabic and improve fuelwood supply. The programme therefore set out to provide seeds and seedlings of Acacia Senegal to farmers to plant on their fields and to explain the benefits of intercropping trees with agricultural crops in areas where this tradition had disappeared.

Recognizing that a reforestation scheme alone would not suffice to make the inhabitants stay on their homeland instead of migrating to already overpopulated city centers, it was decided that other community development activities should follow in the wake of reforestation. Plans for such activities were to be made by the programme staff in collaboration with the target groups, and for a start one should try to see what could be done to use the resources available in the field with a minimal external support.

The plans of action proposed set forth to assist the population in meeting some very basic needs, e.g. provide enough and safe water, improve health situation in general and supplies of wood for fuel. Measures were also

suggested to relieve people of some of the more arduous daily tasks now carried out by women, men and children and which will give more time for other productive activities. The plans involve the setting-up of cottage industries which will lead to increased employment opportunities in the villages and which will mobilize traditional skills or develop new ones. Some of the measures will also help directly in combatting desertification and thus link up very closely with the reforestation part of the Programme.

Immediate Objectives

In the Government of Sudan's Primary Health Care Programme of 1977-84 health conditions throughout the country's rural areas are described as very poor. The programme states that the primary cause is bad environmental sanitation; poor personal hygiene, lack of supply of clean water and lack of refuse collection. The trends of gastro-enteritis, dysenteris, enteric fevers and tuberculosis are rising. The scarcity of health facilities leads to a high death toll, especially among mothers giving birth, infants and children. Due to lack of balanced diet and ignorance, malnutrition prevails. In remoter areas infant mortality is estimated at 200 per 1000 live births, and child mortality (under five) could be as high as 400 per 1000. The causes are said to be malnutrition and poor santation. Such statements are supported by doctors inverviewed and information obtained from village visits in the Programme area. The bad hygiene and sanitation observed in the area must be explained by poverty and to some extent ignorance, since the deeply rooted Muslim tradition highly values cleanliness. Another main cause of illness and fatigue in most villages is general dehydration due to insufficient water intake. Water is either not available in sufficient quantities or is sold at prices which cannot be paid by those who need it. An immediate objective of the action plans is to reduce the occurence of the most common diseases which are due to the intake of too little or contaminated water, as well as bad hygiene and sanitation among the settled population in their households and in public areas of the villages. Measures directed towards nomads passing through the Programme area might also be considered at a later stage. In accordance with Sudan's Primary Health Programme preventative rather than curative health measures are advocated.

Due to the prolonged Sahel drought in North Kordofan natural regeneration of the forest stands has slowed down. This has happened at the same time as population growth in most villages has led to increased local outtake of wood for fuel. Actions are suggested to diminish outtake of wood for

fuel through more efficient production of charcoal and also more efficient use of charcoal and firewood. This will also allow for less time spent on fuel gathering. A complementary effort to decrease exploitation of the forest stands would be to establish fuelwood plantations at village level.

By creating a demand for local measures to achieve the above mentioned objectives, local craftmanship will expand. The costs of such measures will be smaller than items brought into the area from external producers, and thus come closer to what the larger segments of the population can afford.

Special Considerations

Since the Programme area is located in the periphery of a poor country, the plans presented are based upon the local availability of construction material and skills, and minimum use of imported material is suggested in order to keep down costs and dependence on external supplies. The Programme villages are characterized by a low level of technology, although ingenious use of available material is often observed. The most common local construction materials are wood, grass, sand and clay. Of imported materials worth mentioning are sheet-metal tins (18 liters capacity) used for petrol and converted by local blacksmiths into all sorts of devices, steel barrels (120 liters capacity), buckets and trays, various plastic gadgets, iron for simple agricultural tools, hamp sacks and cement.

Although some individuals have accumulated substantial wealth, people are generally poor and participation in the monetized economy is by and large restricted to basic necessities like food, clothes and some household items. Quite a number of people also pay for water and charcoal. In addition money changes hands on social occasions like marriage and death. Cash outlays for suggested items and services are kept at a minimum, and mainly charged to the beneficiaries.

Throughout the area there is a tradition that villagers pay some of the costs and provide labour for e.g. schools and shallow wells constructed by the government. Thus people are used to participate and invest in schemes that improve village and domestic life. It is also common that friends and neighbours get together and help each other to construct huts

and dig wells, the compensation often being a party thrown by the owner upon completion of the job. In the action plans it is suggested that community development activities build on such help-to-self help traditions.

Many villages report on difficulties in raising enough money for community schemes, and some families cannot afford even the most modest home improvement. It is suggested that the Programme in its budget sets aside fixed sums of money for revolving funds from which villages and households can borrow and pay back over time. This has been discussed with a number of villagers, who greatly favour the idea. The possibility of creating or expanding cheap credit facilities from institutional lenders within the country should also be explored. The Programme has already suggested this to the Agricultural Bank of Sudan, and the management seemed in principle to be open to the idea of expanding its credit programme for groundnut, sesame and gum arabic production into areas such as transport of water and other activities that would stimulate agricultural production.

For some improvements new technical devices are necessary. The technologies proposed are thought to be appropriate for the potential users, i.e. compatible with local customs, resources and immediate needs. Any success will, however, be achieved only if the devices are used correctly. Thus extension and follow-up from the agents introducing them are of utmost importance. Depending on the activity in question extension methods would include posters, leaflets and demonstrations,but, most important, direct contact between extension agents and the population, in plenary or individually.

For planned changes it is important to study previous innovation paths in the societies concerned and start working with receptive and forceful innovation agents. In most villages the chief and his family will be such agents, and also the traditional birth attendants, teachers and the Sudan Socialist Union units. It is to be hoped that the committees established for Programme activities will be other additional and equally important agents, especially since they all have both male and female participation, usually in a 6 to 4 ratio.

In the population concerned a strong and uniform sex segregation prevails in most aspects of life; domestic duties, agricultural tasks, procurement of goods and marketing included. During the first year of the

Programme a number of successful joint meetings took place. In many villages it is, however, rather difficult under the prevailing tradition for women to participate in gatherings where men are present, let alone express their views. Thus extension work must be carefully conducted in order to reach the target groups whose work habits, time allocation and spending of money will be directly affected. Men participate in organizations to a greater extent than women; in clubs, farmers' associations, Sudan Social Union etc. Programme extension workers should approach such groups to discuss and explain the importance of improved hygiene, water treatment, sanitation and anti-desertification measures, and together with the Village committees organize the men for the construction work needed for the suggested innovations. Schools and health stations are acceptable places for women to gather. Where such institutions do not exist, one should look for private yards and huts for women's meetings.

1. PROVISION OF WATER

The World Health Organization firmly states that provision of a safe and convenient water supply is the single most important activity that could be undertaken to improve the health of most people living in rural areas of the developing world.

25 of the Programme villages have no reliable water source throughout the year within their boundaries. Some of these villages have always had to rely upon water from other population centres, whereas 14 were faced with a new situation when their shallow ground water disappeared in the latest Sahel drought which struck them for a period of ten consecutive years.

Detailed and comprehensive research carried out by the Programme staff in the villages without water source of their own measured 12 to 16 liters of total consumption per person per day. These amounts usually include watering for some domestic animals. The people in question report that permanent out-migration, especially among younger people, is caused by shortage of water. Dry-season migration is on the increase as some family members travel to city centers and to irrigation schemes along the Nile in

order not to be a burden on the tight water budget. In some villages schools have closed down as the children are needed to assist their parents in water collection. With a distance from village to water source of 20 kilometers, it takes some 7 to 8 hours to fetch one donkey load; i.e. the amount of water used by 2 to 3 people.

Technical Solutions and Recommendations

Pessimism with regard to quick provision of permanent supplies where groundwater is available, i.e. from drilled deep bores, or where rainwater can be collected in artificial dams (hafirs), together with optimism with regard to a return of shallow ground water deposits after some years with good rains, leads one to suggest that projects be formulated and funds be sought for transport of water to the "thirsty people" of the Programme villages. For some villages there are indications that people will indeed not commit themselves to reforestation activities unless their water problems are solved. Some because they foresee that they will have no time to spare from water collection, others because they do not want to invest their labour on land which they might have to leave due to difficulties in meeting basic water needs.

After discussions with people of water scarce districts of the programme area three models for water supply have been presented; one for provision by lorries, one with tractor and one with horses, each providing a daily per capita consumption of 20 liters. Given transportation costs and storage facilities the most cost effective delivery routes with each transportation type were found. Lorries turned out to be the cheapest alternative for two districts (Simeih and El Obeid) with distances up to 20 kilometers from the water source and horses the cheapest for a single village (Ridesat - Umm Ruwaba district) 3 kilometers away from a water source.

Simeih District Model

Location:

13 villages at distances varying from 5 to 15 km from Simeih hafir.

Population:

From 60 to 1 000 people per village, amounting to 4 560 in total.

Present water consumption:

13 liters per day per person.

Water supply situation:

All villages are situated on goz land, i.e. on sand dunes formed and stabilized some 20 000 years ago. During normal climatic conditions rainwater sinks through the porous sand and forms a ground water layer from 5 to 10 meters below surface. Through hand-dug wells people used to get enough water to meet their needs in the dry season. In the rainy season most villages get their water from natural dams (fulas) in clay depressions between the sand dunes. Following the latest drought the shallow ground water has disappeared, making people dependent upon water from the huge Simeih hafir for 9 to 10 months per year. Each family, travelling on donkeys, fetches its water from pipes connected to the hafir at 0,5 pt[1] per safiha.[2] All schools are closed as children must spend their time collecting water, dispensaries and other health centres are out of operation and permanent and seasonal migration are on the increase due to shortage of water. Some chiefs were debating whether or not to suggest that their fellow villagers abandon the homeland altogether and move to areas where their basic needs could more easily be met. This they would do reluctantly, not the least as the land is fertile with good yields of agricultural crops and gum arabic.

Governmental plans:

The government has approved plans to desilt Simeih hafir. Thus the capacity will be adequate to supply all inhabitants of the district. Although no formal request has been made the government has expressed its wish for international assistance to bore deep wells and establish more hafirs in the district.

Recommended action:

The Programme should assist Simeih district villages in water

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1) pt = piastre
100 piastre = 1 Sudanese pound (S£)
= 1,25 US$ (1981 official rate).

2) safiha = plastic container of 18 liters' capacity.

transport by lorries from Simeih hafir. Total amount required is 5 067 safihas (91 200 liters) per day. The cost optimal distribution requires storage facilities in the villages and lorries driving in total 400 km. per day at 20 km. per hour and with 28 daily loadings and unloadings each of 40 minutes. Four lorries with tanks of 6000 liters capacity, each operating for 11 hours a day, are needed for these operations.

Budget:

1st year's investment			Funding suggested from
Installment of extra pump and pipe in Simeih	S£	4 000	Government
Storage tanks for 2 days' consumption in villages, i.e. approx. 10 000 safihas[1)]	S£	7 000	Villagers
4 lorries á S£ 30 000	S£	120 000	Programme (loan)
4 tanks for lorries á S£ 3 000	S£	12 000	Programme (loan)
	S£	143 000	
Yearly running costs			
Wages 8 drivers á S£ 70 per month	S£	6 720	Government
Wages 8 assistants/tappers á S£ 50 per month	S£	4 800	Government
Wage administrator/manager á S£ 250 per month	S£	3 000	Government
Water fee Simeih á 0.5 pt per safiha	S£	9 247	Villagers
Fuel, 500 barrels á S£ 70[1)]	S£	35 000	Villagers
Maintenance/spareparts á S£ 2 500 per lorry/tank	S£	10 000	Villagers
Administration and contingencies	S£	2 500	Villagers
	S£	71 267	

1) Costs of cement and fuel are based on official prices from governmental stores. These prices are 30 to 50 percent below the free market prices.

There are two realistic alternatives for funding this project:

a) Vehicles with tanks to be provided and renewed after 4 years by external sources: The yearly running costs to be covered by the villagers amount to S£ 56 747, i.e. 3,07 pt per safiha.

b) Initial provision of vehicles with tanks by external sources with villagers building up a fund to replace vehicles and tanks after 4 years: The yearly running and fund costs to be covered by the villagers amount to S£ 56 747 + (S£ 132 000 : 4) = S£ 89 747, i.e. 4,85 pt per safiha.

In addition the villagers shall have to pay for the permanent storage tanks.

As alternative b) aims at self-sufficiency and implies costs within the limit of 5 pt., which the villagers have said they are willing and able to pay per safiha, it is suggested that the Programme and the Government contribute their share to have this alternative realized. The villagers shall have to commit themselves to increase the price paid per safiha according to rate of inflation.

El Obeid District Model

Location:

6 villages at distances varying from 8 to 21 km from El Obeid.

Population:

From 150 to 450 people per village, amounting to 1 380 in total.

Present water consumption:

14 liter per day per person, including watering of some domestic animals.

Water supply situation:

Except from the two villages which get water from a hafir for four months in the rainy season, none of the villages has water sources of their own. A government water lorry is scheduled to fill storage tanks in each village twice a week, but usually weeks and months pass

between each visit. For this water the villagers pay 8 pt per safiha. All other water is brought on donkeys from El Obeid town's pipe system where it costs 1 pt per safiha. About half of the villagers live in El Obeid in the dry season due to lack of water at home. Many children have to abandon school in order to fetch water.

Governmental plans:

Apart from its plan to re-dig the only hafir in the district, the government has no plans for improved water supply.

Recommended action:

The Programme should assist El Obeid district villages to get a lorry to transport water. The total amount needed is 1 533 safihas (27 600 liters) per day. With calculations as for Simeih, one lorry will suffice to supply the villages with water. It shall have to operate for 11 hours a day, driving 113 km and collect water from El Obeid 4 times. In four of the villages existing storage tanks will be filled every third day, whereas the two villages closest to El Obeid will be supplied daily.

Budget:

1st year's investment		Funding suggested from
1 lorry with watertank	S£ 33 000	Programme (loan)
Yearly running costs		
Water fee 1 pt per safiha - El Obeid	S£ 5 597	Villagers
Fuel, 122 barrels á S£ 70	S£ 8 540	Villagers
Maintenance/spareparts	S£ 2 500	Villagers
Wage 1 driver á S£ 70 per month	S£ 840	Villagers
Wage 1 assistant/tapper á S£ 50 per month	S£ 600	Villagers
Administration/contingencies	S£ 400	Villagers
	S£ 18 477	

Alternatives for funding:

a) Lorry with tank provided and renewed by external sources: Yearly running costs to be covered by the villagers is S£ 18 477, i.e. 3,30 pt per safiha.

b) Initial lorry with tank from external sources, with building-up of funds to replace them after 4 years: The yearly running costs to be covered by villagers is S£ 18 477 + (S£ 33 000 : 4) = S£ 26 727, i.e. 4,77 pt per safiha.

The villagers would be willing to pay according to alternative b), and it is suggested that the Programme assists them to realize this alternative. Adjustments must be made according to inflation.

Ridesat Village Model

Location:

3 km north of Umm Ruwaba.

Population:

250 people.

Present water consumption:

15 liters per person per day.

Water supply situation:

Water is transported from Umm Ruwaba on donkeys, where it is taken from water yard taps at a price of 0,5 pt per safiha or from private households at 1,5-2 pt per safiha. Children are taken out of school periodically to provide water to the households.

Governmental plans:

The government has no plans for providing water to Ridesat. A merchant has offered to pay the Rural Water Corporation to drill a deep bore which will make Ridesat a center for watering animals which now go to Umm Ruwaba to drink. Time schedule for this deep bore is not decided upon.

Suggested action:

The Programme should assist Ridesat to have water transported from Umm Ruwaba with horses and build one storage tank. The daily need is 278 safihas (5 000 liters). As one horse can pull a load of 33 safihas and make 3 trips a day to Umm Ruwaba, there is a need for 3 horses with carts.

Budget:

1st year's investment		Funding suggested from
3 horses á S£ 300	S£ 900	Programme/Agricultural Bank of Sudan (loan)
3 carts with tanks á S£ 300	S£ 900	Programme/Agricultural Bank of Sudan (loan)
1 storage tank (554 safiha capacity)	S£ 150	Programme/Agricultural Bank of Sudan (loan)
	S£ 1 950	
Yearly running costs		
Water fee Umm Ruwaba á 0,5 pt per safiha	S£ 507	Villagers
Fodder, S£ 15 per horse per 6 dry season months	S£ 270	Villagers
Maintenance/spareparts, S£ 10 per cart per year	S£ 30	Villagers
Wages, 3 horsemen, S£ 30 per month	S£ 1 080	Villagers
Administration, contingencies	S£ 80	Villagers
Repayment of loan/ building up of fund	S£ 650	Villagers
	S£ 2 617	

Ridesat villagers say they can afford to pay up to 3 pt per safiha. The suggested budget will amount to 2,58 pt per safiha. Again the price must be adjusted according to inflation. The loan might be provided by the Programme or the Agricultural Bank of Sudan. It will be repaid over 3 years, and over the next 3 years a fund will be built up to replace the horses and carts with tanks which are expected to last for six years.

In the rainy season when water might be obtained closer to the villages the transportation means would be used by Integrated Sahel Programme for transportation of Acacia Senegal seeds and seedlings from the nurseries to the villages, and by the people for transportation of agricultural crops from the villages to market places. In the tapping season the lorries/horse carts would likewise bring gum arabic to auction markets at the water sites.

In the event of new water supplies, i.e. return of shallow ground water, digging of hafirs or boring of deep tube wells, the transportation means can be sold to other areas in need of water.

In Simeih district the operation is big enough to justify one person being employed exclusively to organize the four lorries and deal with money matters. In El Obeid villages and Ridesat the recipients would appoint a small executive board to be in charge of daily operations and be responsible towards the Programme.

TREATMENT OF WATER

According to Sudanese health authorities and own evaluation of the villagers' health, the occurance of waterborne diseases is high all over the Programme area. On our travels we often found the water discoloured and smelling. We associated these characteristics with the quality of water sources and the unhygienic ways people were observed to handle their water. Only where people get water from shallow ponds where domestic animals have free access did we hear people complain about illnesses caused by the water, however. Otherwise there seemed to be close to a total lack of awareness as regards the importance of clean drinking water.

Analyses carried out by the Ministry of Health shows that contamination by organic matter is evident in most of the open wells of the Programme area. The contamination stems from people, animals and water drawing

vessels. Spillage of water poured from collection to transport and drinking vessels makes the ground muddy, and seepage down the well easily takes place if the well is not lined and protected by a headwall. Less than a third of the wells are protected. Buckets and leather bags used for drawing water are seldom or never cleaned, and they are left on the muddy ground as people wait their turn at the well.

Contamination of hafir and fula water is common where people and animals have direct access to the water. Only 2 of the 9 hafirs and fulas used by the Programme villages are fenced or guarded against intrusion.

In the households drinking water is most commonly stored and cooled in locally-made open mud jars. Mugs, cups and glasses are lowered into the water to be filled, and dirt or bacteria on the hands or the vessel to be filled might contaminate the water. Although particles sink down and settle at the bottom, there is no doubt that diarrhoea and other diseases are spread through water contaminated in these jars. Local health autorities actually go as far as saying that contamination of water within the households is "a major cause of disease".

Technical Solutions and Recommendations

Personnel from the local Public Health Office should carry out comprehensive on-site analyses of all water sources yearly, preferably in the rainy season when the risks of contamination are most severe, and also check a random sample of jars. The water sources should be re-checked after measures to prevent contamination have been undertaken. In order to observe the 6-hours time limit from sample taking to analysis one should not depend upon water being carried to the nearest town for analysis. Transport is unreliable and service might be slow in the laboratories. If portable analysis kits are unavailable, the Programme should provide such equipment. It might also be a need for assisting the health officers with transport to the Programme villages. The results of these analyses will serve as a basis for the plans of action to prevent contamination and purify drinking water as outlined below.

1. To reduce seepage of dirty water through the ground the well-site should be kept clean by fencing the area off in a radius of 30 m

from the well. Thus animals can be kept away and only the people fetching water be allowed to come close. Dry branches from thorn bushes, a commonly used fencing material, would do.

2. A headwall and drainage apron sloping down from the well will stop surface water from flowing into the well. The construction can be made from reinforced concrete, brickwork, masonry, cement or mud mortar.

3. Four to five buckets or leatherbags for common use could be attached permanently and kept hanging on their ropes inside the well when not in use. This would prevent contamination caused by dirty drawing vessels. Arrangements with fixed buckets are not seen in the villages.

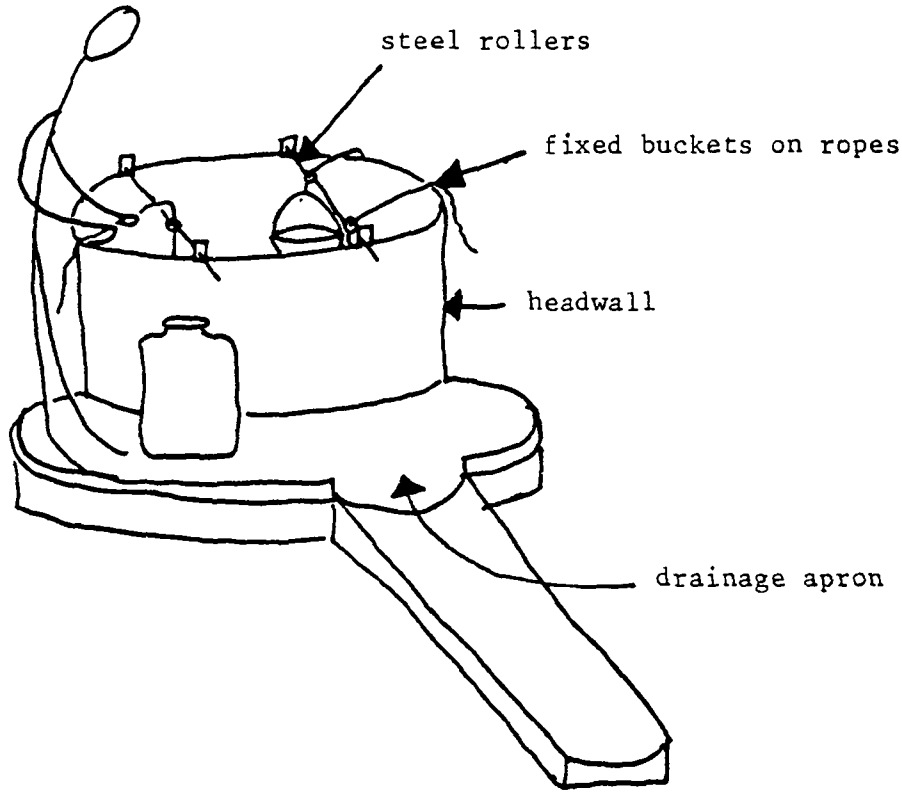
These improvements should be implemented in all villages with open wells. The Programme's Community Officer should explain their potential impact with the Programme committees. The Committees are then to inform the villagers and organize labour for the measures.

The building material required for these improvements comprise cement, bricks, sand, clay, ropes, buckets and thorn branches. As the costs are small, the villagers are expected to be able to cover them. It would be an incentive for them to go into the enterprise, however, if the Programme could assist in getting cement at official price and take care of transport of the material that are not found locally. Where brickmaking skills are unknown, the Community Development Officer should teach local builders the skills of making bricks with the sunbaking technique or with simple pressers which can be made from scrap iron by local blacksmiths.

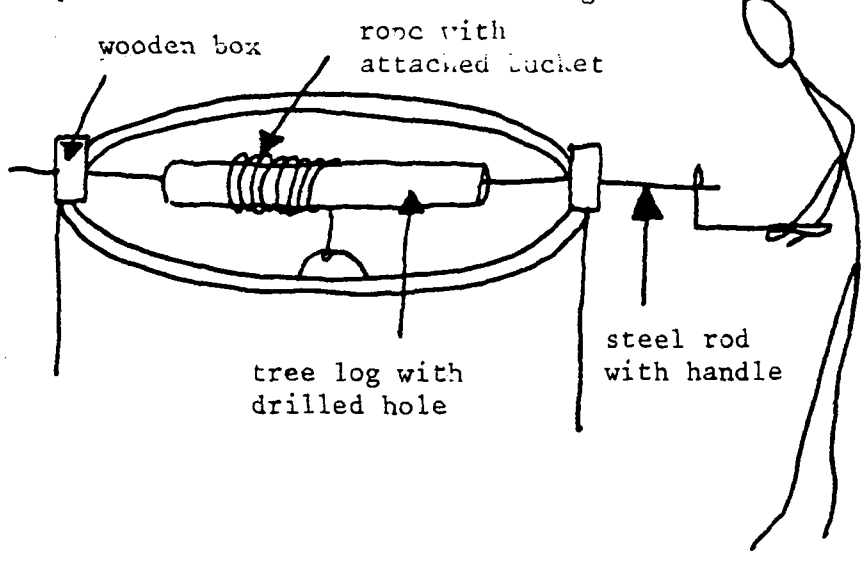
Once the construction material is on site in a village, a local carpenter, recruited from the Rural Water Corporation and trained by the Community Officer, should travel and help in the construction of headwalls and drainage aprons. His assistance could be paid for by the villagers.

4. The drawing of water 10-35 meters in open wells is heavy work.

Technologies which reduce energy input intensity required and at the same time reduce danger of contamination of water are believed to be welcomed by the population. To easen operation rollers can be attached to the headwall.



5. Another very simple solution would be a windlass as shown below. Windlass systems are not used in the villages.



Especially for the wells with water tables below 20 meters the population should be informed about labour saving devices like the rollers or the windlass. For both the building material represent so small costs that there should be no need for external funds. Information and assistance as above.

6. A three-wall rakoba (straw shelter with square walls and roof) can be built to protect the well from sand and dust and the drawers of water from the sun.

7. Lining of 3 meters in clay soil and 6 meters in sandy soil will hinder seepage from the wellsite through the ground and into the water. The lining can be done by brickwork and reinforced concrete and/or the soil in a circle 1 meter wide and 3 meter deep around the well be replaced with puddled clay of 15 cm compact layers.

If the above recommendations to keep the well site clean are not accepted by the villagers, or if they do not work satisfactorily, lining of wells should be suggested. Again the costs will be small and could be met by the villagers, and the work supervised by a professional under conditions as above.

8. Yearly cleaning of the open wells, preferably in the dry season, will reduce risk of contamination.

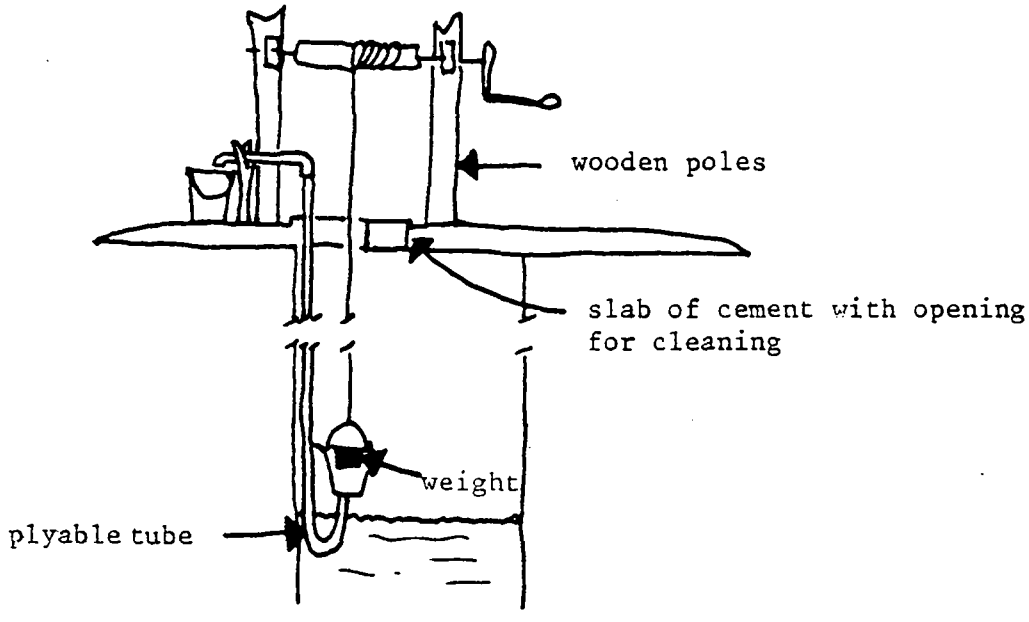
The Programme committees should organize the villagers to this effect.

9. Clorine is quite a safe method of chemical disinfection of well water and can kill bacteria, viruses and amoebas. A pot containing a mixture of coarse sand and bleaching powder hangs underwater. Amount of bleaching powder depends on degree of contamination. Bi-weekly refilling and inspection of the pot are required.

No use of chorination pots should be made except upon the advice of the Public Health Authorities. Likewise, amount of bleaching powder and number of pots per well should be decided by experts. The daily responsibility for proper use of clorine will lie with the owner of a private well or with the village committee for wells used in common by the villagers. However, the Health Authorities should check the use of pots as often as they think necessary. The Pro-

gramme can act as an information agent for the villagers and ease communication between them and the Health Authorities.

10. Total protection of shallow wells consists of fenced off area, lining, a windlass system where water is directed to a tap above ground and a slab covering the opening of the well.



Since this is a slightly complicated system, it is suggested introduced only where recommendations under other points above do not meet the purpose. Information and assistance as for 1 to 5.

11. A well-protected hafir is surrounded by a fence of e.g. thorn branches and guarded by villagers on shift against intrusion by animals and people. An underground pipe connects the hafir with an open well outside the fence from where people draw water.

Adequate protection of hafirs are found in some villages, and it is imperative that these arrangements are spread to all other villages which have hafir water. The Programme should ask villagers who protect their hafirs to act as extension workers to persuade people in other villages to go ahead with protection measures, and provide transport for this assistance.

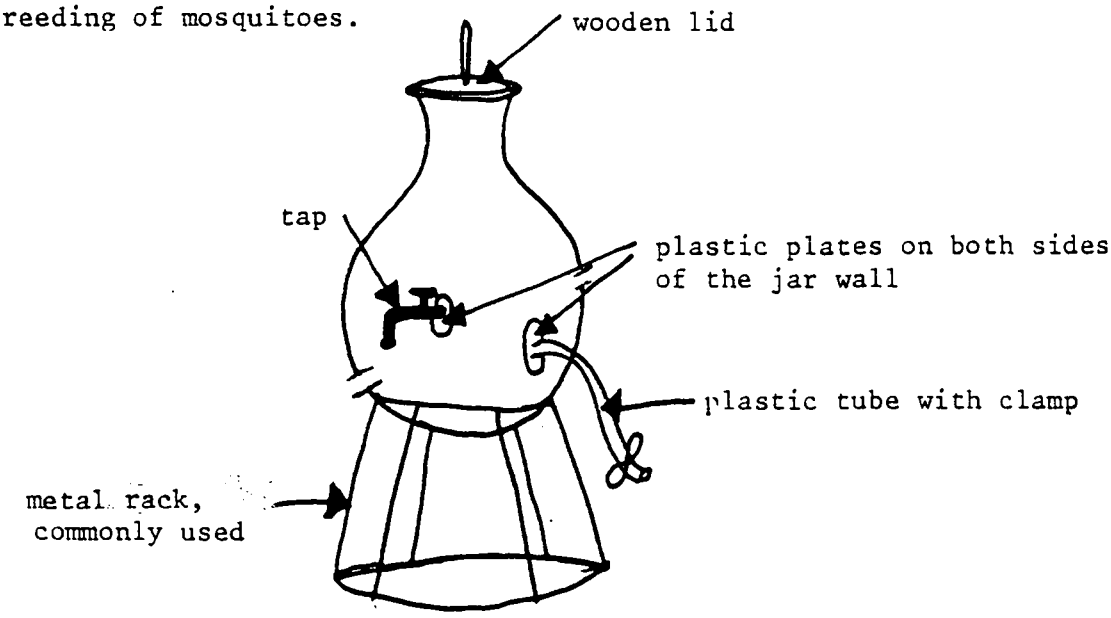
Upon application Rural Water Corporation should provide the material

needed and send their experts to supervise the villagers in the laying of pipes and in the construction of open wells as above. To match existing village hafirs a well of approximately 10 meters' depth will be adequate. The expenses of this enterprise are suggested shared between the local council and the villagers. If any of the partners have difficulties in raising the money, a loan from a revolving fund, either from the Programme or from a national lending agency, should be provided.

12. Contamination of fula water would be reduced if animal and human intrusion is prevented.

The village committees should organize the villagers to fence off the fulas with thorn branches. Also the people should be instructed not to enter the water and install a limited number of clean containers which hang in ropes from wooden poles when not in use.

13. Protection of drinking water at domestic level can be obtained by getting the water through a tap or plastic tube connected to the jar. A lid on top of the jar will keep dust away and prevent breeding of mosquitoes.



All people employed by the Programme should remind the women to keep the jars covered.

It is strongly recommended that steps are taken to have taps or plastic tubes connected to all jars containing drinking water. These devices must be put on the jars during production while the mud is still wet.

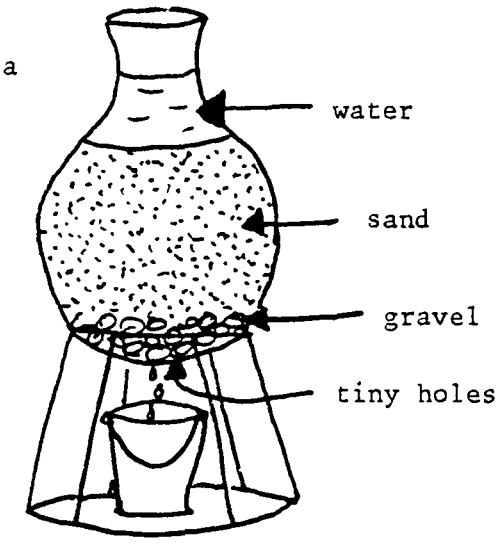
Jars are made by women from certain tribes who live in villages which are close to suitable clay. To convince the producers to attach taps or tubes to jars it might be necessary to confront them with a demand from customers who are willing to pay the 75-100 pt extra for such jars. Thus a successful extension work at users' level must precede attempts to have tap jars produced. The Community Officer could be the communication agent between the potential buyers and the producers of jars, and also instruct the latter in the new technique.

14. A simpler and less safe improvement would be to stop the habit of using all sorts of cups to get water and dip only one device specifically designed for this purpose into the jars. Such a device can be made from a little calabast, which can be bought for a few pt at the local markets, and a wooden stick.

All programme people should bring with them samples of such a ladle when visiting the villages and explain that a simple device like this might reduce the frequent stomach disorders.

15. Purification at domestic scale can be done with sand filters, which, if operated correctly, will remove cysts, ova, most bacteria and silt. The author experimented with a jar, which is cheap and easily available, as container for a filter. Sand and gravel were collected from a desolate place not frequented by people or animals. Heavily contaminated water was poured in for filtering, and the bacteriological test carried out by El Obeid Public Health Laboratory showed that the filter worked perfectly.

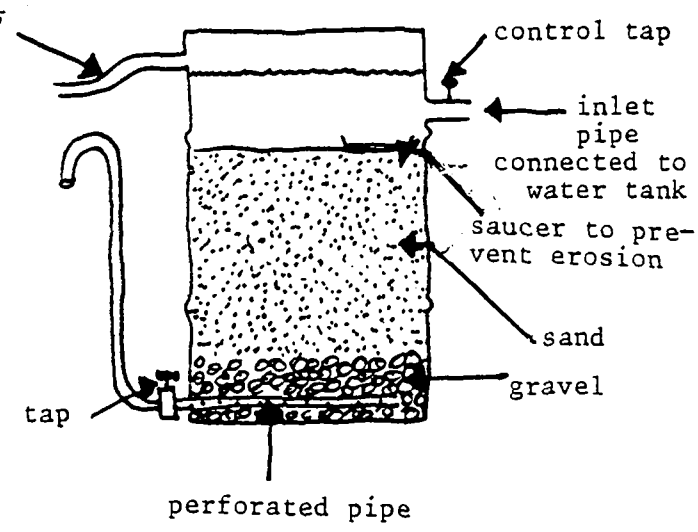
Filling should be stopped every 2 months to drain out the water, and a layer of ca. 1 cm of sand scraped from the top. The filtered water is stored in another mud jar.



Where measures to prevent water from getting contaminated before it reaches the households fail, purification should take place at a domestic scale. As minimum costs are involved for the use of a jar filter (S£ 1-2 depending upon season for extra jar) the method simple and the material easily available, this measure is regarded as a mere extension matter.

The Community Officer should teach this simple purification technique to the Village Committees which would then act as innovation agents towards the villagers. Sand filters are easy to make, but if not maintained properly they can act as breeding grounds for bacteria. Therefore Programme staff should assist in arranging the filters and check the operation after one week's use for correction and again after 2 and 4 months.

16. Sand filters can also be made from 120 liter petrol drums. The control tap should allow approx. 1 liter of water to flow into the filter per minute. The inlet pipe must be connected to a water tank, for example an elevated drum. Bimonthly cleaning as for the jar filter is needed.



Even for larger households a drum sand filter will be regarded as rather expensive (S£ 20 for one drum and S£ 15 est. for blacksmith work, pipes and taps). Since this method has become quite popular in environments similar to the Programme area, the idea could be worth copying by institutions which get water from open wells or ponds. In e.g. schools a teacher should learn from the Community officer how to operate and clean such filters.

17. In parts of Sudan women keep seeds and leaves with disinfecting properties in the water jars.

The Programme staff should study such local traditions and advice more women to apply them where appropriate.

The following disinfection methods have also been considered:

Use of charcoal in household filters is not recommended as it absorbs organic matter and is a potential breeding ground for bacteria. This is difficult to avoid, even with bimonthly change of charcoal. It will furthermore be difficult to convince users to change charcoal often enough, as dirt cannot be seen on the charcoal and as charcoal is in short supply.

Boiling of water for 20 minutes is quite an effective way of killing bacteria. It is only recommended when there is no shortage of fuel.

Filtration by porcelain "candles" is effective, but not recommended for widespread use. Not only are they expensive (S£ 13,25 for one pair), but they need to be scrubbed and boiled for 20 minutes weekly and would, furthermore, be difficult to screw tightly to locally made containers from petrol tins or jars.

Large-scale sand filters at village level have been considered, but are not recommended due to problems in the organization of operation and the danger of recontamination of water before use.

SANITATION

"It now seems very probable that, among poor people in developing countries, most of the spread of organisms which cause diarrhoea is by fecal routes that do not involve drinking contaminated water. All the main diarrhoea-causing pathogens are transmitted from anus to mouth and there are many opportunities for such transmission in a poor and crowded community." (Feachem, R., Diarrhoea Dialogue Feb. 1981.)

In the Programme villages only some 10-15% of the households have any kind of toilets, e.g. open holes excavated 1-2 meters into the ground. These pits are dug without consideration to possible seepage to water sources or food preparation sites. Some have floor slabs made of concrete,

whereas others have treelogs over the pit for the users to balance on. Lids are seldom used.

The rest of the people defecate at random sites, men and children in the open, women hidden from view. The grown-ups claim to go outside the inhabitated areas when need arises, but this is obviously not the case. Squatting position is used when defecating. Sometimes the faeces are covered by sand, and the norm is that one should use water, leaves or grass to clean one's bottom and hands. However, these means are not always available.

These unhygienical practices lead to spreading of infections and diseases like intestinal worms, diarrhoeas, dysentry, hepatitis, typhoid fever, colera etc., either through people's direct contact with excreta or indirectly with flies and domestic animals acting as carriers.

I have discussed the danger of diseases caused by unhygienic sanitary practices with numerous women in the area, and they seemed quite receptive to improvements. They have difficulties in comprehending, however, that also children's faeces might be "dirty".

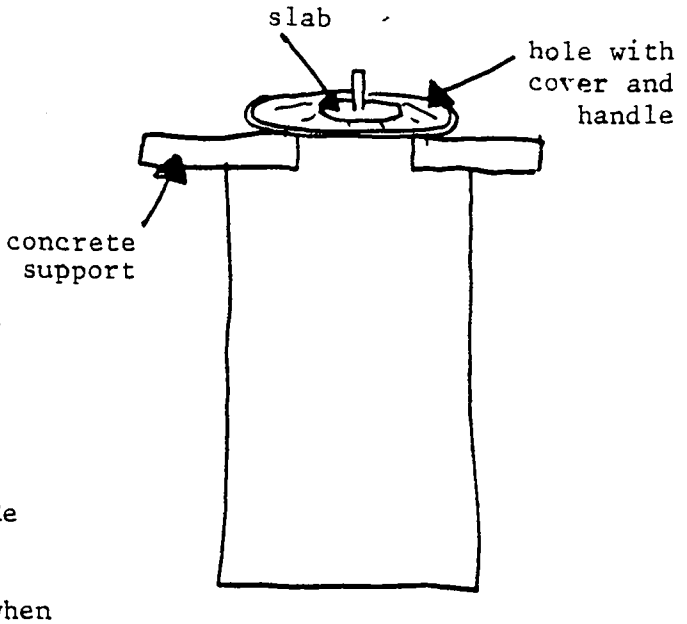
Technical Solutions and Recommendations

1. The simplest way to improve the sanitary condition is to have everybody defecate some distance from households, public areas and water sources, to cover the faeces with sand and to wash thoroughly afterwards.

These are mainly matters of enlightenment which might be dealt with in adult education and health campaigns (see later).

2. Pit latrines of 2-4 meters depth could be built on family or community basis. These pits should be at least 15 meters from water sources or food preparation sites to avoid contamination through seepage.

The squatting plate should be dishformed and made from reinforced concrete or mud-mortar around wire mesh and covered with a very wet cement mix to get it smooth and easy to clean.



A cover must extend over the entire hole to avoid flies and smell.

Loose fittings should be made for the holes to hinder the children from falling down when defecating. To allow for privacy the latrines should have walls from straw and tree logs.

Lining of the pit by bricks and cement will decrease danger of seepage.

To avoid mosquito breeding some oil should be poured into the pit weekly. The pit should be filled with sand when the content reaches 50 cm below surface, i.e. after some 2-3 years of use by 6 persons, and a new one dug.

Preceded by comprehensive extension work pit latrines should be dug in all villages with more than 250 people. Whereas household latrines can be used by all members of the compound, public latrines must be built separately for men and women/children.

Since difficulties are envisaged as regards proper cleaning of communal latrines, these should mainly be restricted to schools where cleaning can easily be organized and checked and where the training of pupils in safe use of latrines is an asset. One latrine would be needed for every 40

pupils. It might be advisable also to have some made at village market places, provided e.g. the Programme Committees assign the daily cleaning task to somebody and check the pits from time to time.

Because of the danger of collapsing, it is not advisable to have unskilled people dig holes deeper than 2 meters. Local well-diggers (quite a profession in villages with shallow ground water) should be trained to dig pits and act as teachers.

The trained pit-digger should be taught by the Community Officer to make floor slabs from cement and wire mesh.

As costs for such latrines are small, they can be covered by the users themselves. Again it would be an incentive for adoption if the Programme helped with providing cement at official price.

3. Regular sweeping of village streets, market and other meeting places will help prevent spreading of diseases via animal and human excreta.

The Village Committees should make each household responsible for keeping a specific part of the public areas clean and organize neighbourhoods to bring all garbage to specific heaps which are burned regularly.

The following measures were also considered: Bucket latrine systems are found in the towns El Obeid, Simeih and Umm Ruwaba. As these systems are extremely unhygenic they are not recommended.

Neither are borehole pits recommended. Soiling of the walls of boreholes, which have a diameter of only 15 to 40 cm, promote fly breeding. Furthermore, construction costs with machines would be very high.

ADULT EDUCATION FOR WOMEN

In quite a number of Programme villages women asked for assistance to have adult education courses arranged. Subjects they would like to

study are hygiene, home economics, handicraft and marketing. Some 95% of the women are illiterate, and their desire for some sort of formal education, although late in life, is high.

Within the Programme area there are Adult Education Offices, located in El Obeid, Simeih and Umm Ruwaba. These offices arrange 2 weeks' courses to train men and women with completed intermediate education to teach adults in the villages. The courses are free, with participants themselves arranging for food and lodgings. Two types of courses are offered, one to learn to teach theorietical subjects like Arabic, religion and mathematics, the other dealing with rural industry. The teachers receive wages from the government for the months they hold courses in the villages.

Recommendations

It is recommended that the Programme assists the Adult Education Offices to offer female trainees one month's courses in hygiene, home economics and marketing.

Whether fundings for such strenghtening would come from the government or from external sources, remains to be worked out.

To assist in the teachers' and village courses specialists from Ministries of Health and Water and National Council for Social Welfare should be invited as guest instructors.

The present village courses are free. However, the women would be willing to pay some modest fees to get good instruction material, pencils, books and other necessities. The Programme should assist in making leaflets, models and other equipment available to the women attending village courses. Headmasters have agreed to let the classes use the schools for free in the afternoons. Where there is no school the classes could be in the open.

Subjects to be included in the hygiene and home economics courses are:

Nutrition: The importance of a balanced diet including suitable amounts of protein, calories, fats, vitamins and minerals should be explained to the women, and examples given as to how locally available foodstuff should be utilized and combined.

Child care: In the villages childrens' health situation is far from satisfactory, with high morbidity and mortality. This must to a large extent be ascribed to poverty and lack of water. But also ignorance of basic rules for child care takes its toll. An important component of education courses for women should be the importance of giving children enough and good water and food, keeping them clean and take them to the health centers for vaccinations. The mothers must learn that children are the main contamination agents of diarrhoea and accept the responsibility to diminish spreading of diseases through children's faeces.

Special women's problems: Practices in relation to childbirth and circumcision which have negative effect on physical and mental health could be changed for the better through enlightenment brought about in courses. However, as these areas so much are parts of women's culture, i.e. where they are the main decision makers and through which they gain respect and are celebrated by their family and friends, attempts at changes from external agents will be a very difficult and delicate task. Advice should be obtained from central health authorities which recently have engaged themselves in the abolition of at least the most dramatic type of circumcision. Special precautions during pregnancy as regards diet and exercize should be explained to the women, as well as the importance of seeking medical help if danger signs of bleeding, anemia or toxemia occur. To the extent that birth control other than withdrawal is practized, it seems to be a women's matter. Despite a number of unwanted side-effects contraceptive pills are used by some village women usually after the 5th or 6th child is born and raised. Other, less harmful methods of birth control should be introduced and made available, combined with general information on the benefits of giving birth only to the number of children it is expected that the family can feed and care for.

Kitchen work: Most women sit on low stools while preparing food, with pots and pans placed on the ground. Through education they can learn the benefits of working at elevated tables, such as keeping dust and excreta from children and poultry from the food and utensils, and that moving around is good for the blood circulation and strengthen the back and legs. Simple material for tables, hanging shelves etc. can be found locally. Small grain grinders, solar drying methods, charcoal refrigerators etc. should be introduced only when these basic home improvements have been adapted.

In cooperation with the Community Officer the Adult Education should modify for Kordofan conditions ideas on home improvements in information from groups such as United Nations Commission for Africa's Training and Research Center for Women/Ethiopia, Rural Industries Innovation Center/Botswana, Faculty of Engineering - Fourah Bay College/Sierra Leone, UNICEF's Intermediate Technology Village/Kenya, Volunteers in Technical Assistance/USA, Intermediate Technology Group/England, Brace Research Institute/Canada, etc.

HEALTH CAMPAIGNS

Each year some 200 members of Khartoum University's Medical Students' Association spend 12 days in a rural district informing villages on preventive health care. It is suggested that the Programme invites the Association to locate one of their campaigns to the Programme area. The field work should be planned in cooperation with the Community Officer.

Subgroups of the Association, comprising students from Umm Ruwaba and El Obeid areas, have volunteered to work with the Programme for some time during their main holidays (May - August). If the Programme provides transport and food, they will work for free as health extensionalists in the Programme villages.

It is recommended that the Programme makes use of the medical students. The villagers need information and advice, and the students will benefit from applying their knowledge and skills on their home ground. The association is well aquainted with extension work of this kind and could be given full responsibility for the professional side of the campaigns.

TRAINING OF TRADITIONAL BIRTH ATTENDANTS

The local government's plan is that by 1983 all villages in North Kordofan shall be served by trained midwives. It is now admitted that this goal cannot be reached, partly due to low training capacity and partly to difficulties in getting the midwives to work for any period of time except in their home village. Many villages have no potential candidates for training, e.g. girls with completed higher secondary school. Only five of the 40 Programme villages have governmentally trained midwives.

In the other villages traditional birth attendants assist in the child birth. They have no formal training but learn their profession through participant observation. Although these attendants usually are highly respected and appreciated by the villagers, women listed trained midwives first or second when asked what could improve village life, the other most important thing was to have more water.

Recommendation

Since demand for midwives for the foreseeable future cannot be met by public schemes, traditional birth attendants should be trained to improve their skills and hygiene. A scheme copying UNICEF's successful birth courses implemented in a region adjacent to Kordofan, would probably require funds from external sources. The community officer should start planning such a venture seeking information from UNICEF in cooperation with local and national health authorities.

CHARCOAL PRODUCTION

In the highly inefficient earth kilns used for charcoal production in the area, 12 weight units of wood are required to give 1 weight unit of charcoal. Furthermore the charcoal is of low quality as dust and other impurities are not removed from the wood before production and because quite significant amounts of the wood get only half-converted into charcoal.

Charcoal is produced partly in an organized manner within forest reserves by labourers hired by Department of Forestry, and partly by individual farmers and nomads on unreserved land. Probably as much as 80 per cent of the charcoal is produced by individuals.

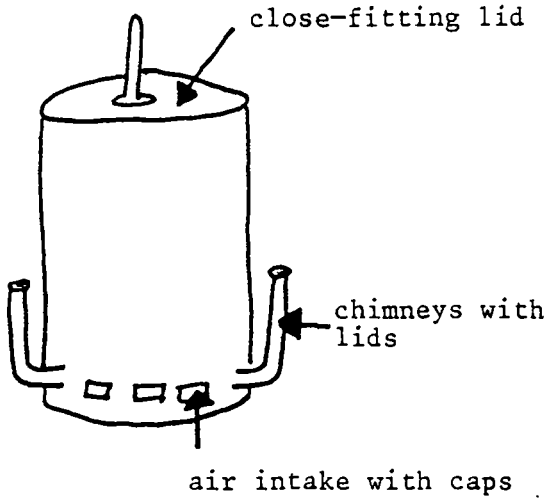
As charcoal production takes place at a wide scale in the area, it is believed that more efficient methods will be an important measure to decrease exploitation of forest stands and thus help in bringing desertification to a halt.

Technical Solutions and Recommendations

1. Portable metal kilns can be converted from petrol drums.

Air inflow and chimneys are adjusted when the charge is burning well, and closed once carbonization is judged to be completed.

Tight packing is necessary, and the kiln works best with straight stems.



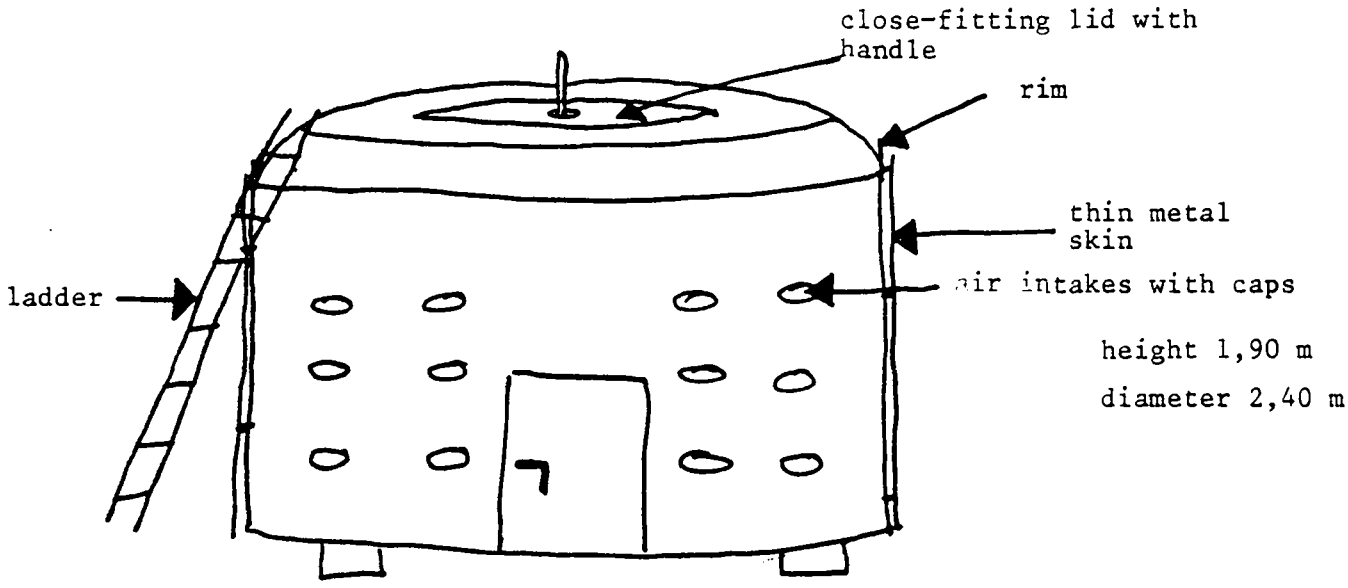
This type of kiln is not field-tested. It is suggested that the Department of Forestry in El Obeid carry out experiments within their forest reserves.

If the kiln proves to be more efficient than the earth kiln, forestry personnel should travel to charcoal producing villages and teach blacksmiths how to produce the kilns and burners how to operate them.

The cost of one unit is estimated at SE 27 (SE 20 for the drum and SE 7 for the blacksmith work and metal for fittings). Groups of 3-4 farmers should be encouraged to procure a kiln and use it one at a time.

2. The Cusab (Charcoal from Useless Shrub And Bush) is used in a number of other African countries. It is fed continuously from the top with woody material of all sizes and charcoal falls to the floor as it is formed. Air inflow is regulated by intakes fitted with removable caps so that air comes through the basal layer throughout the cycle. Operating temperature is 800-1000°C and no smoke is formed. The high temperature enables carbonization to proceed so quickly that a cycle takes 6-7 hours with 4-5 labourers, and the output is approx. 1000 kg of charcoal.

   The kiln body, door and lid are made from steel. It can be transported to operation site on donkey or horse cart.



   To protect the labourers and keep heat within the kiln a metal skin is clipped to the outside 1 cm from the walls. Also, protective clothing is necessary for the labourer fuelling the kiln from a ladder.

A Cusab kiln can be constructed at El Obeid market according to existing specifications at a unit cost of SE 350. It is suggested that the Department of Forestry in El Obeid order such a stove and have their labourers experiment with it in a forest reserve. If test results match expectations this device could greatly improve the output of charcoal without increasing the number of trees cut.

IMPROVED STOVES

Cooking is the most energy-consuming activity in the villages, and the sources are firewood and charcoal. Only insignificant amounts of fuelwood are used for other purposes like heating of water for washing of clothes and personal hygiene, heating of rooms etc. Kerosene stoves are found in small numbers, but are hardly used due to the high price (50 pt for 0.6 liter) and unavailability of kerosene.

Throughout the Programme area women are responsible for all food and drink preparation activities at domestic scale, and in most instances they collect their own firewood. Where village perimeters have become depleted of trees in radiuses exceeding approx. 4 km, men take over the burdensome role as fuel-providers and become professionals; they convert the bulky wood into charcoal to decrease the transport problem and sell it to village women. The rapid change from firewood to charcoal as is now observed is an alarming sign of firewood shortage, and the inefficient charcoal production methods leads to desertification.

Firewood is burnt in the open "three stone stove", either with metal cooking vessels placed directly over the stones, or, in the case of the commonly used kizra (pancake-like bread) with an iron plate over the stones. Charcoal is burnt on grates built into stoves made from petrol tins. The metal pans are placed directly on the charcoal, thus use is not made of the radiant heat qualities of charcoal, and much energy is lost in the open. Energy efficiency is estimated at 3 and 7% for existing wood and charcoal stoves respectively. All cooking is done under shelter.

In most Programme villages the fuel shortage is a problem women would like to have external assistance to solve. Where the energy crisis is acute, also the men express their deep concern over the present energy supply situation and its effect upon the natural environment.

Technical Solutions and Recommendations

Extension work has already started in most Programme villages in that information on the energy situation is collected and lengthy discussions held between the villagers and Programme staff on measures to reverse the growing problem of fuel provision. This extension work should continue in a more organized form than hitherto, addressing itself to particular bodies which will act as innovation agents in their villages. Discussants representing the Programme would be the Forestry staff, the Community Development Officer and a specialist in stove programmes, and from the villages the Committees, fuelwood users and collectors/sellers, carpenters like blacksmiths, potters and construction workers, leading women and Sudan Women's Association units should take part.

One instructor should be assigned over at least one year to be in charge of construction and testing of various stove designs in cooperation with the end-users and local carpenters. This person should preferably be a female, as this will ease access to the prime target group. She should have a technical background combined with social science. If possible she should be recruited from Goverment of Sudan's Institute of Energy Research, if not one should ask for secondment of staff from organizations like Volunteers in Technical Assistance/USA or Intermediate Technology Group/England which have adequate experience in stove programmes. The Institute of Energy Research should advise the instructor on stoves which are considered appropriate for North Kordofan conditions.

Based on comprehensive knowledge of the Programme villages the Community Development Officer should plan execution and coordinate activities of a stove programme, advice the instructor and monitor and evaluate progress.

To train stove builders the Programme should join forces with the Youth

Training Centers and Prisons in El Obeid and Umm Ruwaba. In El Obeid Youth Training Center only male students come from villages - the females are all from the town - and they are also more likely to be willing to travel. It therefore seems most appropriate to arrange stove construction courses for the males. The open prison system which are practiced in the Sudan for inmates serving sentences for minor offences, allows these prisoners to work outside the prison and to travel for limited periods. The Training Centers have indicated willingness to assign staff to train their own students and prisoners in stove construction. The stove specialist would compose a syllabus to be used and the Programme would procure instruction and construction material for training and arrange for transport of the constructors to the villages.

The trained constructors would travel to villages to teach carpenters to build stoves. In some societies attempts have been made to teach each end-user to build her own stove. Experience has shown that it works better to teach selected villagers the construction techniques, and leave maintenance only to the users. Men are the traditional constructors in the area, and it is suggested that the stove technologies are taught to them in courses at village level.

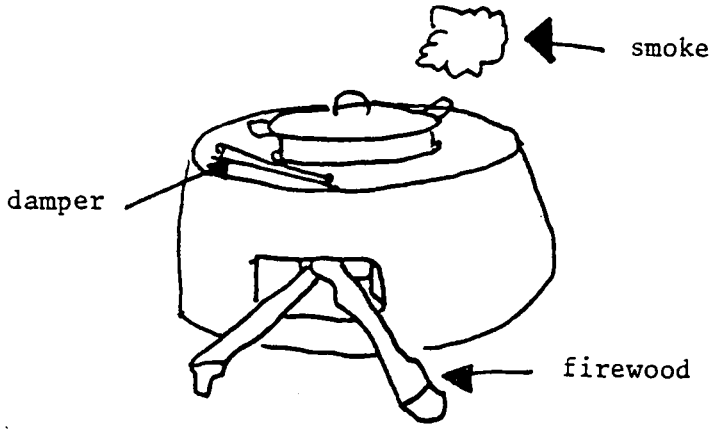
For most of the stoves that are presented here constant tending of the fire, covering of potholes when not in use and careful handling of dampers must be observed. Correct use of the new stoves should be taught to groups of 15-20 women in 2-3 days' demonstration courses. Extension work and check-up visits after people have started using the stoves are of utmost importance. Such visits could be carried out by the constructors.

1. The Louga wood stove from Senegal is made from a mixture of sand and clay and is built up gradually from the bottom with pothole and firebox carved out just before the stove dries.

   Louga is designed for one pot only, which is set in deeply to allow hot gases to heat the pot as they leave the stove.

A damper door might be added to control the fire.

To protect it against rain a thin coating made from motor oil mixed with clay and water should be smeared on.



This stove uses only 50% of the fuel of an open fire.

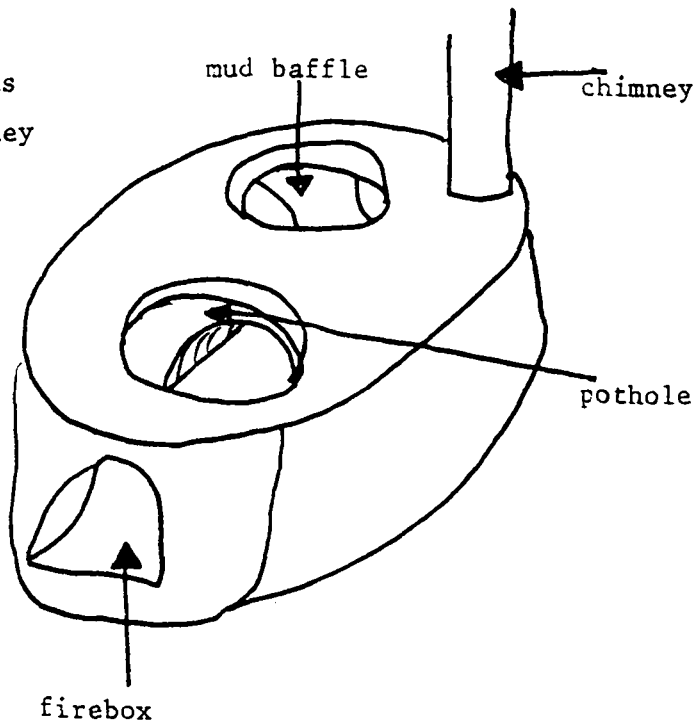
The Louga stove has minimal construction costs and should be affordable even for the poorest households. As the smoke disappears around the pots, this wood stove is recommended for use only in draughty kitchens and not in closed huts.

2. A better woodstove has 2 or 3 potholes closely fitting the pots and a chimney for the smoke. Intermediate Technology Development Group has recently produced such a stove, built on the traditional Indian chula. It is made from a mixture of sand, clay and mud with the potholes and flue system carved out while the mixture is still wet. The chimney can be made from mud around wire mesh, or, preferably, from pipes made of sheet-metal.

Firebox and flue must be cleaned daily, the chimney yearly. Cracks around the firebox and the chimney are likely to develop, and they should be plastered over immediately.

The surface is not strong, and the expected lifetime of this stove is 2-3 years.

Energy efficiency is measured at 24%.

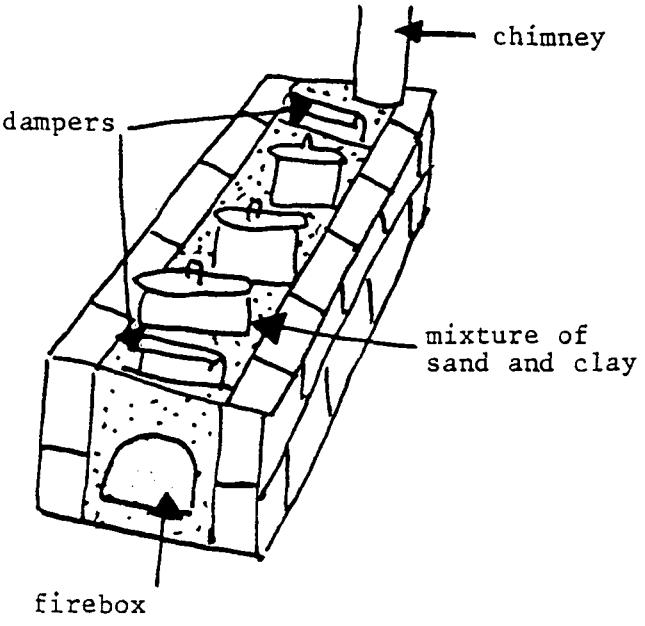


The ITDG chula is very cheap to construct and most families would be able to pay for a sheet-metal chimney and labour costs for a trained village constructor coming to build the stove in situ.

3. A more durable chula type is developed in Upper Volta. The base and sides are made from adobe blocks.

During construction interior of stove is packed with sand/clay mixture. The potholes and tunnels, which slide upwards, are carved as the mixture is still wet.

Construction time is estimated to 1-2 days.



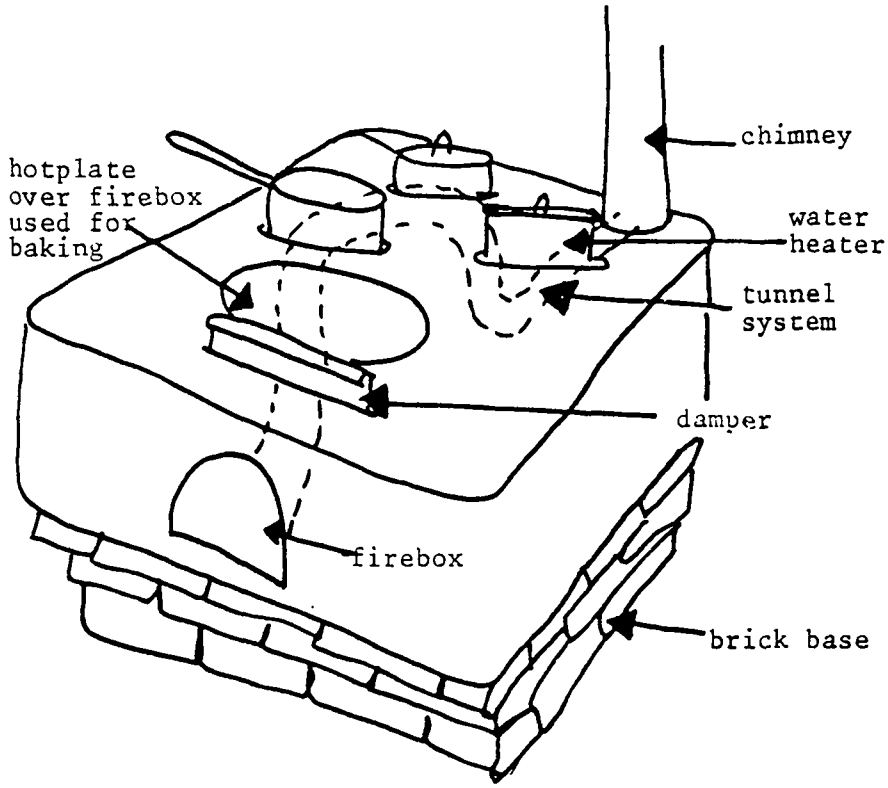
As adobe blocks are quite expensive in the Sudan, and unavailable at village level, experiments should be carried out with the sun-burnt bricks or mud/dung blocks used for construction locally. Also some cement might be needed. Cash outlays for bricks, cement, dampers, chimney and labour would be within the reach of the more well-to-do families only.

4. The Guatemalan highmass Lorena stove is the most complicated wood-stove alternative presented here. It is made from a clay/sand mixture and rests on a foundation of bricks or stones to give desired height for standing while cooking. The clay/sand mixture is built up in layers and the firebox, potholes and flue system carved out while the mixture is still wet. The high thermal mass retains heat for a long time, and this stored heat permits slow cooking with minimal fuel. To be efficient, it should be used for at least 3 hours at a time.

This original Lorena stove has multiple uses, i.e. baking, broiling, frying, boiling and simmering.

Construction time is 3-5 days and expected lifetime at least 3 years.

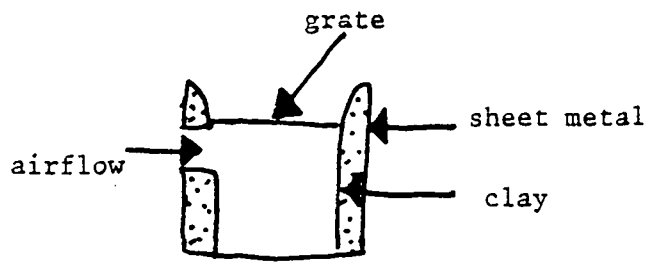
Tests show energy efficiency varying between 16 to 25%.



Due to the large masses of clay (non-existant in many parts of the programme area) and water needed, relatively complicated construction and operation and variation from local working practices, the highmass Lorena stove is not recommended for households in the area. It could be tried out at some institutions, however, like El Obeid prison and some of the boarding schools.

Improved charcoal stoves are also suggested introduced.

5. Due to the metals conductivity much heat is lost through the walls of the commonly used charcoal stove. A simple improvement to this stove could be obtained by lining the walls with a 3 cm thick mud layer.



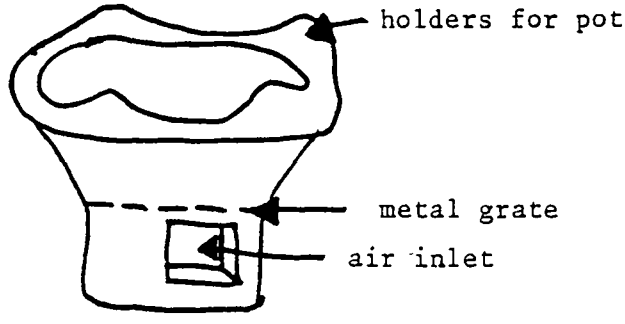
Lining of the local charcoal stove represents the minimum goal for improvement. The Community Officer should instruct the Village Committees to tell village women how this measure can decrease charcoal constumption.

No special course is needed for this improvement - the women can take advice from local builders aquainted with mud/clay mixture and do the improvement themselves.

6. The Indonesian-type clay stove has good thick walls and a damper at the inlet to regulate air intake. Fuel will slide into the center due to the slanted firebox walls, thus providing better use of the fire than the square stoves.

   The stove places the pot close to the burning embers without actually touching them, thus maximum advatages is taken of the fire's radiative heat.

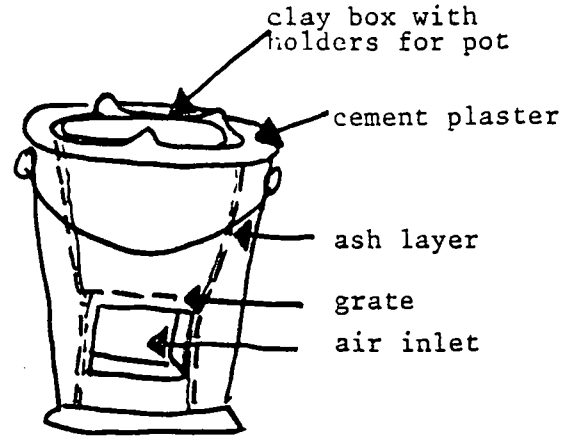
   This charcoal stove is fragile and heavier than metal stoves, and should therefore not be moved around like the custom is with the light metal stoves.



The Programme stove constructors should cooperate with the women who traditionally produce water jars to test the available clay for the Indonesian-type stove. It is more fuel-efficient than the improved metal stove and could be introduced at the markets as a cheap alternative to that stove.

7. A more complicated and practical charcoal stove is the Thai bucket which consists of an ordinary galvanized iron bucket, commonly found in the households, and an inner cheramic firebox. Between the bucket and the firebox there is an isolation layer of ash. Cement plaster is on top of the ash and around the air inlet.

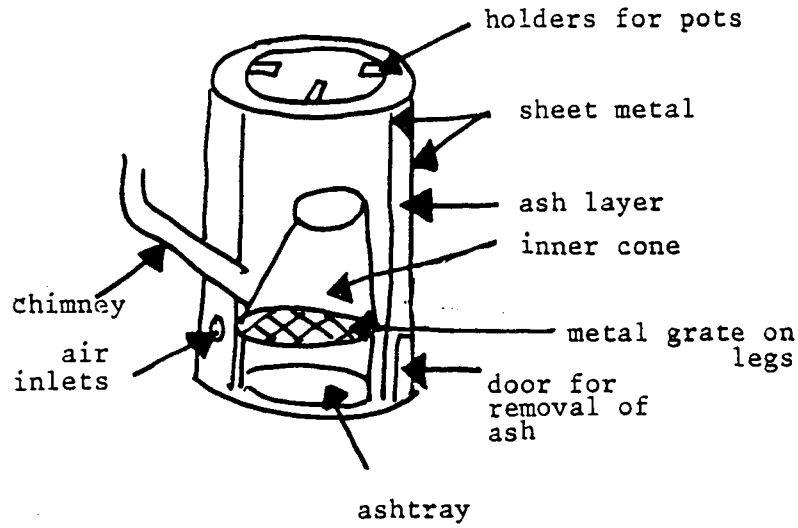
Qualities of slanted sides and use of radiative heat are as in the clay stove. Furthermore the stove is easy to move.



It is estimated to have an energy efficiency of 22% and an expected lifetime of 2 years.

The Thai bucket technology should be tought to local potters who can produce for sale. Since its energy efficiency is so much higher than the traditional metal stove, it is expected that most women who can afford the cash outlay will want to buy one.

8. An improved jiko (East-African charcoal stove) has a combustion chamber in the form of an inner cone. Heat is concentrated at the bottom of the pot and kept inside the stove, and smoke is emitted through a chimney. The double lined sides, inner cone, chimney and grate are made of sheet-metal. Between the double walls is a layer of ash. Heat efficiency is estimated at 25 per cent.



The improved jiko must, like the previous two stoves, be produced by professionals; e.g. blacksmiths who have received training by the stove instructor. This stove will probably be an alternative only to the well-to-do households.

The following stove alternatives have also been considered:

Concrete stoves, like the Kaya from Upper Volta, are not suggested for adoption as the construction costs would be beyond the means of most people.

Biogas stoves are not recommended as there is little vegetative waste in the area and a general adversion against using excreta from humans and animals alike.

A variety of solar cookers have been considered. As easy-to-handle, acceptable, long-lasting and cheap cookers are yet to get off the planning stage, it is not recommended that the Programme itself engage in pure construction research. The ongoing research in developing and developed countries should be closely followed, however, with the view of possible future adaption. The Programme should accept invitations to collaborate with Khartoum University's Institute of Energy Research and US AID's Sudan Renewable Energy Programme and offer to field test their devices in selected Programme villages.

EPILOGUE

In the longer run national and international policies favouring sound and sustainable development of peripheral communities, like those in question here, might be implemented. Until that happens the people must make better use of the resources they control to maintain - let alone improve - their standard of life. The measures suggested here should help them to this effect.