Dry Composting Latrines in Guatemala

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DRY-COMPOSTING LATRINES IN GUATEMALA

A Transfer of Technology between Developing Countries

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Centro Mesoamericano de Estudios sobre Tecnología Apropiada (CEMAT)
International Institute for Environment and Development (IIED)

Poor rural health in the Third World is for the most part attributable to the contamination caused by indiscriminate disposal of faeces. Experimentation with different prototypes has lead CEMAT to promote the dry-composting latrine, for improving the quality of the environment and for producing fertilizer. At an International Seminar on Waste Recycling in 1980 in Guatemala, CEMAT presented its prelinimary results, which have been analysed for Ambio by IIED.

AUTHOR DESCRIPTION

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Roberto Cáceres (Executive Director, CEMAT) is an economist and sociologist with training in Europe and 12 years practical work in Africa and Latin America in rural development and technology transfer.

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CEMAT is a private non-profit organisation dedicated to experimentation, evaluation and dissemination of appropriate technologies and information for rural development in the Mesoamerican Region. Apto. Postal 1160, Guatemala.

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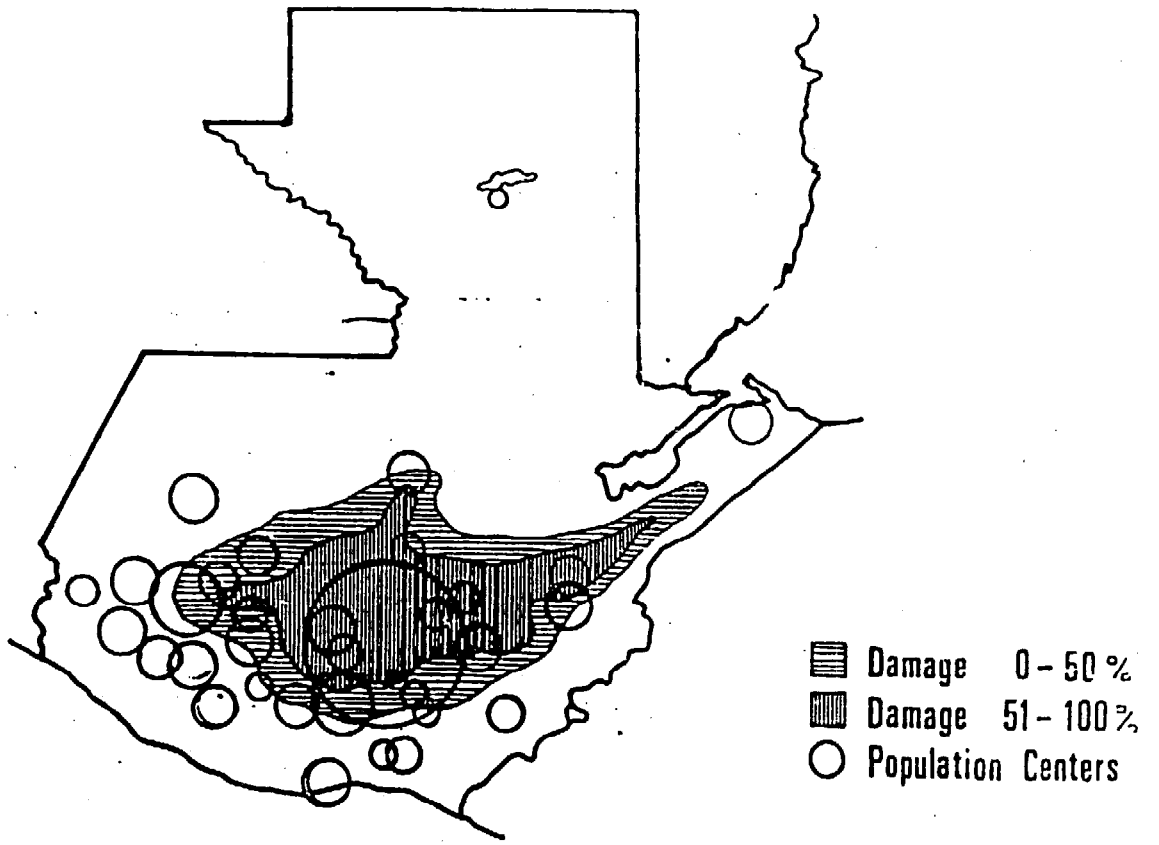
Half of all children in rural Guatemala die before the age of five of diseases directly related to unhygienic sanitation, according to a 1980 governmental diagnosis of health conditions [1]. The survivors suffer two-thirds of the time from cyclically transmitted diarrhoea [2]. Even among adults, infectious diarrhoea remains the most common form of morbidity [3].

Most Guatemalans live in tiny communities, of which all but 2% have less than 2 000 inhabitants. Only one tenth of these people have piped water supply or latrines and most seldom see a doctor. Life expectancy is 45 years - sixteen years less than in the cities - and reflects the precarious environmental and economic conditions of rural subsistence.

The absence of sewage or potable water supply turns lakes and rivers into receptacles and transmitters of faecal contamination. With the pressure of increasing population, the primitive way of defecation in the fields behind houses and in the bushes off pathways can no longer be sustained by the environment. A saturation has been reached, evidenced by the inability of the environment to naturally degrade and accommodate human wastes.



Map.1 Earthquake Damage and Population Density in Guatemala.

THE DRY-COMPOSTING LATRINE

The dry-composting latrine contains two chambers built above ground level and used in rotation for defecation and composting, by a process of dehydration and a microaerophilic alkaline degradation.

All other biological methods of waste treatment which do not use water to dilute and transport the excreta, such as mouldering and composting, process the urine and faeces together, with complications ensuing from high moisture-content and acidity [16]. This design simply channels the urine off to the side (Fig.1) so that the faeces alone fall into the composting chamber.

The dry-composting latrine, or Double Septic Composting Vault system, has shown successful sanitary and diffusion characteristics in its 25 years of application in Vietnam [16], but is practically unknown elsewhere.

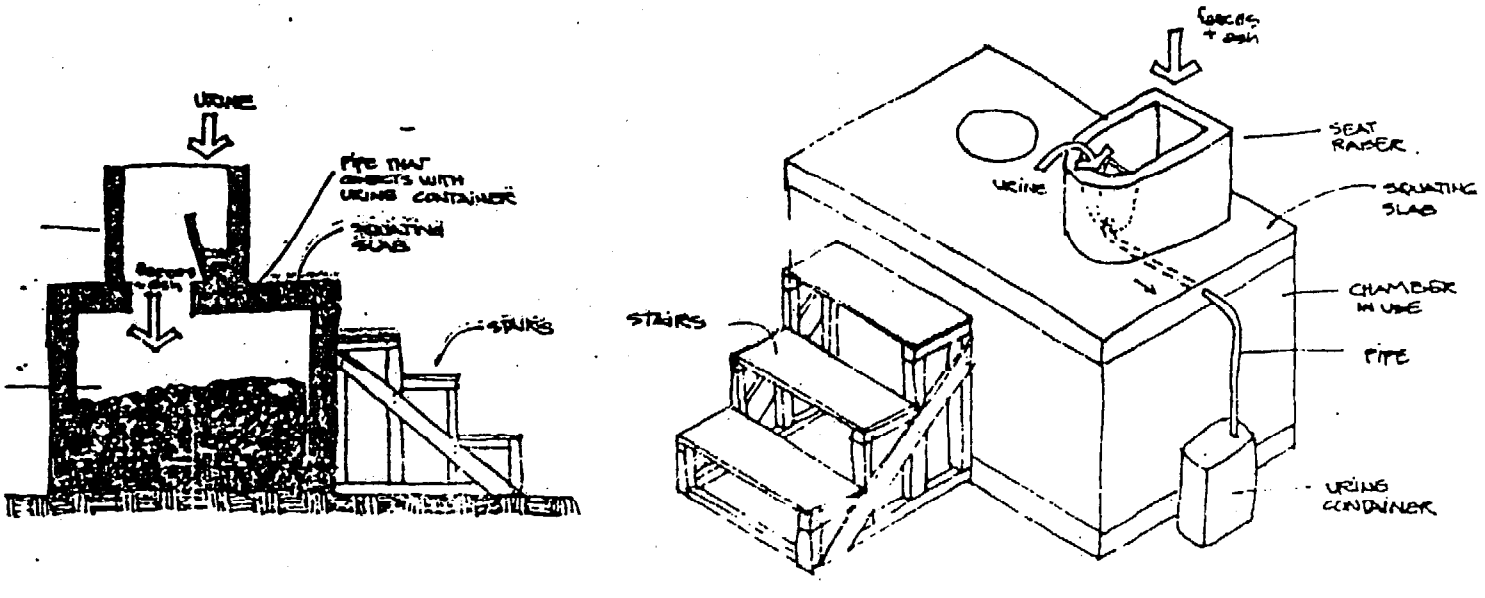


Fig 1. Separation of the urine and the faeces

These latrines in Vietnam are now reported to be producing annually more than 600 000 tonnes of organic fertilizer [17], which is used directly or sold to the State. In a population of 50 million, there is now on average one latrine for every 1.4 households in the Northern half of Vietnam, and a similar programme is being adopted in the South. The decline in the incidence of intestinal diseases in the North, over the period 1968-78, is shown in Table 2.

Table 2. Decline in incidence of intestinal diseases in Vietnam (1958-78)

Infectious agent	1958	1978
Shigella dysenteriae	12-13%	1.2-1.7%
Salmonella	6-7	0.1-0.6
Escherichia coli	4.5-12	1.2-1.8
Ascaris lumbricoides	60-80	15-35
Trichuris trichiura	40-45	10-12
Ancylostoma duodenale	20-25	5-10

Source: Institute of Hygiene and Epidemiology, Hanoi (1979)

EVALUATION

The potential of these dry-composting latrines is now under examination in Guatemala. Over the period 1978-80, CEMAT has built and closely monitored 31 units [19]. Laboratory procedures were modified to permit simple but reliable tests that could be used under field conditions, for determining the sanitary quality of the fertilizer [20]. These tests include coliform counting, quantification of viable helminth eggs, and evidence of entero and rotavirus.

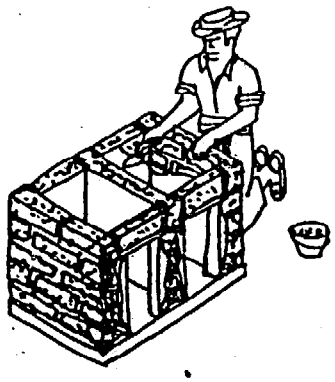
Cumulative data have indicated that an intense biodegradation takes place, unlike pit latrines (Table 3), particularly when conditions of dryness and alkalinity are maintained. As a result the fertilizer product can be used safely, provided its concentration is reduced by spreading and mixing into the land to be cultivated.

Agrochemical qualities are exhibited in high values for phosphorous (116 ± 113 ppm) and organic matter (3-11%), but relatively low values for nitrogen (0.3-1.1%) [20]. The indication is that the value of this fertilizer resides in the organic matter which contributes to the formation of humus and the presence of oligoelements. Experimentation is in progress to determine the role of this fertilizer in soil improvement and agricultural production.

Table 3. Microbiological findings in the monitoring of dry-composting latrines in Guatemala (1978-80)

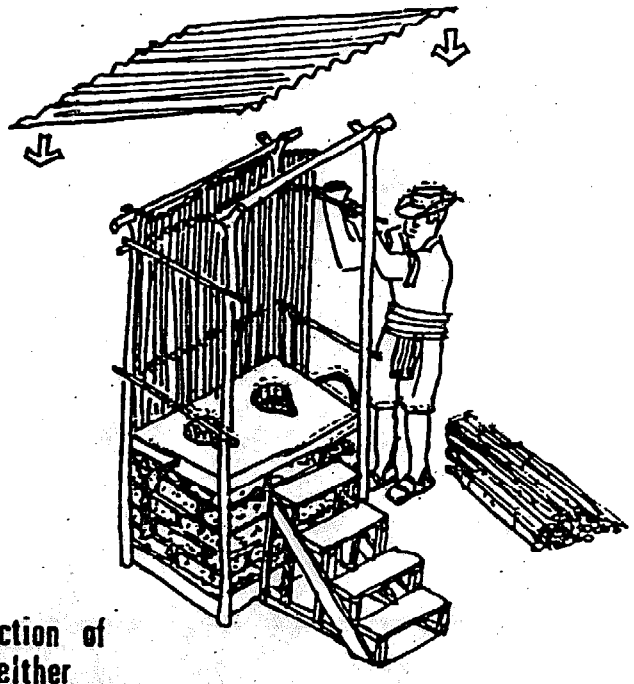
	Pit Latrines (N=20)	Chambers in use (N=73)	Composted by-product (N=21)
Coliforms (MPN/g)	100 000	36 000	10 000
Helminths			
A. lumbricoides (eggs/g)	30 000	30 000	25 000
Viability of eggs (%)	75	10-60	5-20
T. trichiura (% eggs)	5-10	10	5
G. lamblia (% cysts)	5-10	3	0
S. stercoralis (% larvae)	2-5	2	0
Rotavirus (% positive)	10	0	0
Poliovirus (% positive)	30	0	0

Source: CEMAT (1980)



Construction of the double chamber

Construction of the squating slab that covers the chambers



Construction of the shelther

Fig 2: Construction of the

INSTALLATION

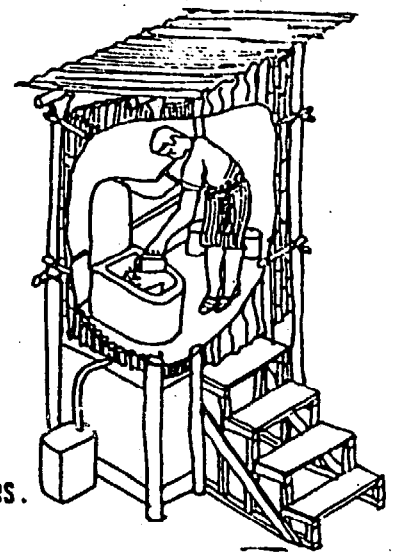
Construction is preceded by discussion of the state of faecal contamination of the area, and the intended location, form, size, financing and maintenance of the latrine, with its future users.

Materials are selected from among those customarily used in the region. The double-chambered base is built of compacted soil, adobe, brick, concrete, lime-pozzolana, or stone blocks on a raised base to ensure isolation from groundwater (Fig. 2a).

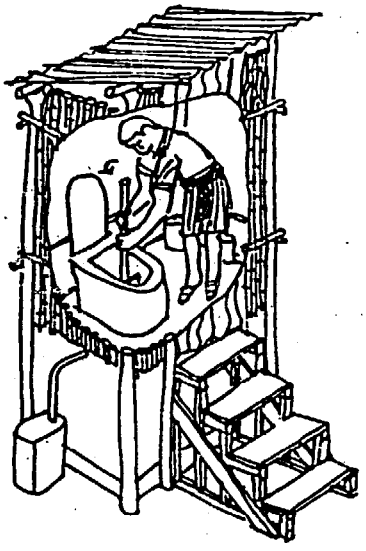
An upper plate made of concrete or a substitute on an armature of bamboo or cane covers the chambers. Beside the holes in the chambers, a groove is hollowed out of the upper surface to channel away the urine (Fig. 2b). Fitted lids keep one chamber closed between defecations and seal the other shut for composting. At the back of the structure, doors to the two chambers are cemented shut while the chambers are in use or composting is taking place. A shelter made of local materials (Fig. 2c) is erected above the platform.

OPERATION

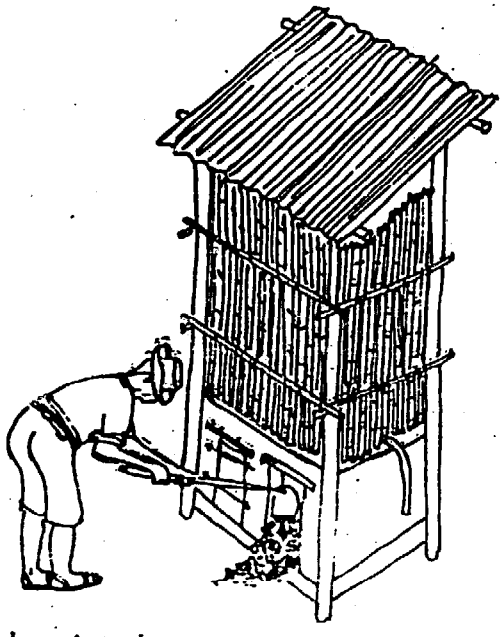
The key factor for successful operation is the dryness of the composting process inside the sealed chamber. Unlike moulder-



Daily adding of ash to the faeces.



Weekly stirring of biomass.



Semestral extraction of compost.

Fig. 3 Maintenance of the Dry

ing toilets, this does not require handling. Proper use of the latrine each day is essential for maintaining dryness.

The urine flows into a separate container and is either diluted with water or absorbed in soil, lime or ashes and used directly as liquid fertilizer. Few diseases are transmitted through urine in comparison with those due to faecal contamination.

Each defecation is accompanied by an application of ashes or a soil/lime mixture (Fig.3a), to ensure the dry decomposition. Every week the chamber content is stirred and more ashes are added (Fig.3b). After 2-3 months, when the first chamber is almost full, it is topped up with soil and its openings sealed shut. For the next 2-3 months while composting proceeds, the other chamber is used; when this in turn is full, the other is emptied (Fig.3a).

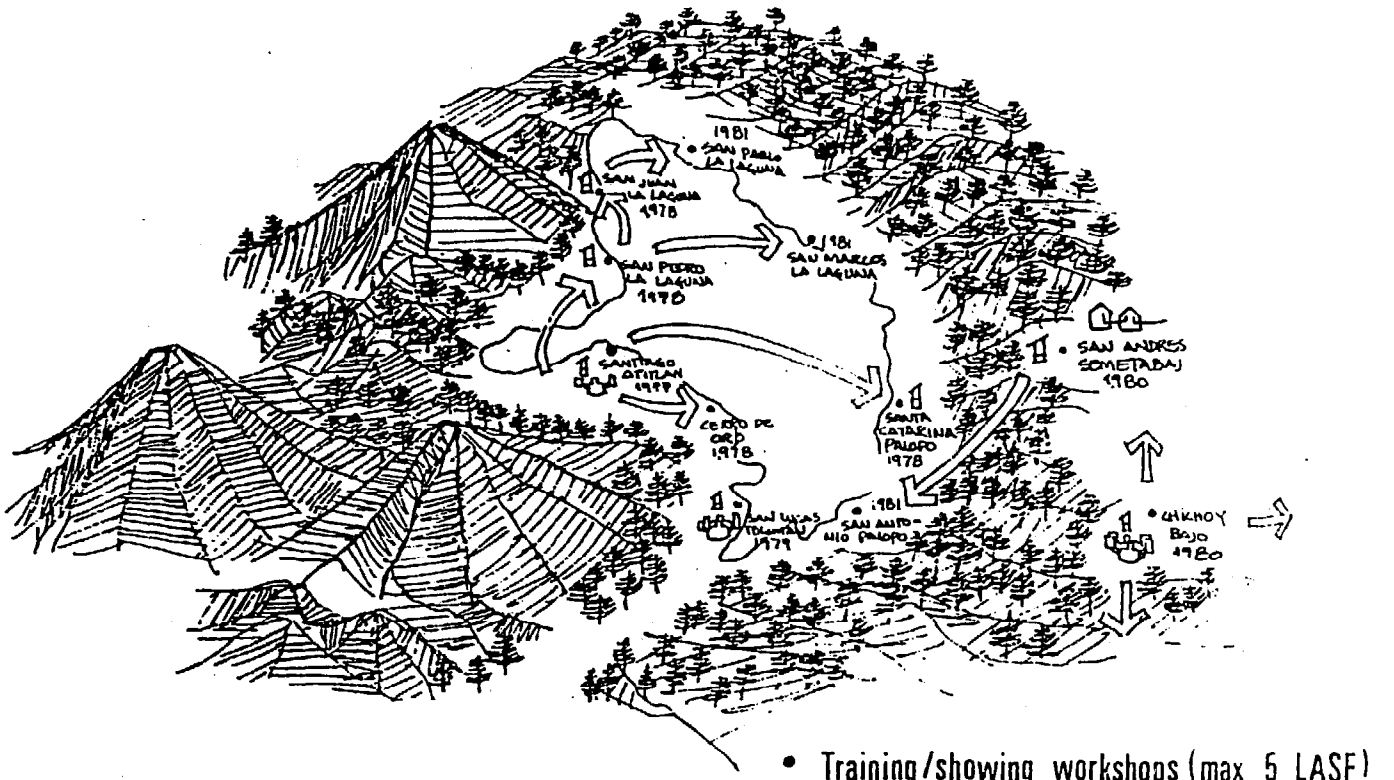
DISSEMINATION AND SOCIAL ACCEPTANCE

Latrine costs range from $35 when adobe is used to $70 for concrete block construction [21]. The primary bottleneck in construction and diffusion has become

the cost of cement. It is particularly difficult to substitute a lower-grade material for building the squatting plate and making the chambers water-tight.

The technique of latrine constuction and use is introduced in a village by means of slides or visits to other villages where latrines have already been built. Courses of instruction are organised by promoters in villages which show sufficient organisation and where interest has been expressed. Over the three days of the course, latrine use and maintenance are explained and a demonstration unit is built. Each participant is required to build a latrine in his own house and serve as a teacher and promoter for others. Participants are asked to contribute for their tuition ($1) and raise the money for their construction materials; in return they acquire a technical ability and a completed latrine. It has been demonstrated that the tuition is also a factor ensuring full attendance at the course.

In some villages the adoption of latrines has been rapid. This occurred in San Pedro La Laguna, where the indigenous promoters had already acquired considerable experience and success in the dissemination of 'Lorena' (mud-sand) improved stoves. In Santiago Atitlán, on the other hand, the initial demonstration prototype did not give rise to immediate replication. Response was slow but confidence gradually rose, and after the first year of installation other groups started asking for demonstration units at their own villages around the lake (Map 2), often as a continuation of the 'Lorena' stove programme.



Map.2 Dissemination of Dry Composting Latrines (LASF) at the Atitlán Lake. (1,977 - 1,981)

PROGRESS TO DATE

In 1978 a network of groups developing waste recycling technologies was organised under the name of REDEBIO, coordinated by CEMAT and supported by the Canadian International Development Research Centre [22]. The introduction of the dry-composting latrines was designed to initiate and monitor sanitary control and to demonstrate latrine use, thereby facilitating dissemination. Since the completion of [illegible]o-year project, separate families

and groups have come forward with requests for assistance in erecting latrines of this type, which they see as useful and suited to their needs. Governmental institutions have recently begun to express interest in programmes to disseminate latrines on a larger scale.

Two years gave occasion for experimentation and construction of 20 demonstration latrines, 10 courses of instruction, and the presentation of preliminary data at six national and international seminars. At the time of writing, approximately 100 latrines are known to be in use. The exact total, however, is unknown, since unrecorded numbers have been built in inaccessible villages and by people who have not attended courses. Recently CEMAT has extended its work to a new area of the country in the eastern lowlands where the water table is high, the climate hot and very different environmental and socioeconomic problems emerge. Courses are being held there in conjunction with INDAPS, the government's Institute for Rural Healthworker Training. Eighteen more latrines have been installed in the last few months in this new region, and acceptance is being demonstrated by the communities.

Instruction has also reached other Central American and Caribbean countries. Demonstration latrines are in operation in Honduras, and in Nicaragua where the weight of the government has been put into the programme and accelerated its implementation at least 50 were recorded built during the first year. Design improvements are continually being made both abroad and where the original work was begun in Guatemala's Highlands.

The interchange between developing countries evident in the construction of dry-composting latrines may prove useful in other places, as a model for the identification, design, deployment, and the gradual upgrading of technologies actually suitable to the development of the Third World.

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