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Editorial

In many of our earlier issues we have clearly focussed the urgency of generation of large scale employment through a range of decentralised production technologies. Events of past several months in the country and the populist pronouncements in its wake like generation of 3 million jobs-a mere rhetonic, because of being bereft of any well-drawn plan of action-on one hand reinforce our belief but on the other hand disappoint us. The reason being that unless there is a political will to recognise the fact and to act on it that such a massive employment generation-critically needed now to save the country from being made an inferno by the politicians, will never be possible unless there is radical change in industrial, S & T and educational policy. In fact what we need today is a scientific integration of these three prime sectors of national development. In the backdrop of prevailing grim scenario of rising unemployment and inflation, it is redeeming to note the decision of the Govt. to order all public sector undertakings and government departments to buy KVI products. It is indeed a welcome step but how honestly and quickly it is implemented is a matter to be seen. Our country in four decades of self-governace has seen many such freak positive decisions which either met premature end or have not been enduring. The prevailing socio-political turmoil has at least one positive side that arm chair intellectuals are gradually moving out of their safely enconsed nooks and niches. But far more is needed. All well-meaning citizens should unite to gradually enter into the democratic process of governance of the republic instead of abidicating their responsibility in favour of those who are least concerned about nation-building. Then only it will be possible to save the nation from the hovering apolcalypse and to, build a society through application of ethical values and through technology with a human face.

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MANUFACTURE OF COUNTRY TILES FROM RED/BLACK SOILS OF PHULBANI DISTRICT (ORISSA)

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The demand for cheap and durable roof covering materials has considerably increased in rural, tribal and adivasi areas of Orissa state in particular. Half round clay country roofing tiles (Fig. 1) are one of the most widely used roof covering material in this state. Other roof covering materials used in EWS housing in the region are leaves, thatch, bamboo reeds etc. Quality of burnt clay products as tiles, bricks etc. being manufactured in the area are far from satisfaction, showing poor strength and durability. In view of the increasing demand of suitable roofing materials for various housing scheme being undertaken for rural and adivasi inhabitants of Orissa, Phulbani Rural Development and Technology Agency (PRDATA), G. Udayagiri (Phulbani) under the financial support of CAPART requested CBRI to provide package technology for small scale production of cheap and improved quality roofing tiles and for use in various blocks of Phulbani District. Investigations were therefore undertaken to locate suitable soil deposits for the manufacture of country tiles, to develop and demonstrate suitable process technology for country tile manufacture, impart training to adivasis and artisans so that the poor masses could manufacture them for their use on self help basis. Results of these investigations and process demonstration for manufacturing country tiles, test data on fired products, details of quality control measures etc. are described in the paper.

SOIL SURVEY AND SAMPLING

Large variations in the characteristics of soil deposits were observed in the entire Phulbani district. Most of the soils are of residual origin, possessing red and black colour with loamy to clayey texture[1]. Transported soils also exist in the ridges of rivulets which are yellowish grey in colour and are loamy to sandy loam in texture. All the soils are rich in organic matter, ferruginous and siliceous nodules. These soils are highly plastic and show high index values. Such material can be excavated from a depth of 0.5 to 3 m. Details of soil samples collected from various blocks of the Phulbani district and their physico-chemical properties are given in table 1.

Laboratory results show that the soil samples are rich in clay size fractions except sample from Nuasahi village (S-3) which is sandy loam in texture. All samples are mildly acidic in nature containing organic matter in the range of 0.2 to 0.36 percent. Plastic properties of soil samples from Nuasahi site (S-1 and S-2) show moderate plastic index (PI) 18 to 21 while black soils from Balaguda areas are highly plastic in nature (PI $>$ 34). Total water soluble salts present in all the soil samples are, however, low (below 0.14%) indicating sufficient leaching of salts from the transported materials.

Mineralogical studies based on x-ray diffractometer and differential thermal analysis indicate the presence of kaolinite (ordered and disordered) group of clay mineral as a predominant constituent with association of mica and or the presence of low proportions of expanding group of clay minerals in these soils. Quartz, hydrated oxides of iron and aluminium are also present as accessory minerals.

Since the soils show large variation in physical properties, blending of lean and plastic clays to obtain soil mass of suitable plasticity and mechanical composition for the production of good quality tiles appear inevitable. This is necessary to check excessive and also to reduce warping and cracking of tiles[2-3].

COUNTRY TILE MAKING STUDIES

Studies were undertaken on five soil samples to evaluate their tile making characteristics. The optimum composition of soil mass found suitable for tile shaping and drying from various sources of raw materials are given in table 2. Various admixtures containing sandy/clayey soils and rice husk ash were prepared to assess drying shrinkages occuring in the clay body and to arrive at an optimum wherein the warping and cracking tendency in tiles could be brought to minimum. Experimental tiles from these admixtures were shaped on CBRI country tile moulding table at a moisture content slightly above plastic limit adopting a procedure reported earlier[4]. Results of shaping and drying properties of tiles moulded from different soils/soil admixtures and dried undershed on plain ground are given in table 2.

Dried tiles were fired in (1) an electric furnace at 850°C (2) conventional open clamp at 700°-800°C and (3) CBRI designed circular updraught kiln at 850°C (Fig. 2). The soaking period of 4 hours was maintained in case of tiles fired in an electric furnace, and 2-3 hours in case of circular updraught kiln. No soaking at the required maturing temperature was however maintained in open clamp as virtually no temperature control is possible in clamp kilns. Experimental fired tiles were tested for breaking load strength, water absorption and resistance against action of water.

The results so obtained are given in table 3 which show that good quality country roofing tiles can be manufactured from modified soil or soil admixtures at a firing temperature range of 850°$\pm$30°C.

PILOT PLANT STUDIES

Pilot plant studies and practical training cum process demonstration programme was undertaken jointly by Phulbani Rural Development and Technology Agency and CBRI at G. Udayagiri (Phulbani). During this programme over 15,000 country roofing tiles were shaped on tile moulding table, drying of tiles was carried out under shade. A small capacity kiln was erected and firing of dried tiles in the kiln were undertaken.

(a) Kiln Construction

A small circular updraught kiln of internal diameter 4.5′ (1.35 m) and height 7.5′ (2.25 m) was erected at the village Panganaju (G. Udayagiri). Kiln structure was constructed using burnt and unburnt bricks. The base of the kiln up to 3′ (0.9 m) was constructed using locally available clamp burnt bricks. Iron rods (40 $\times$ 40 mm cross section) seven numbers weighing about 57 kg were used in the fabrication of kiln base for product loading.

(b) Loading of Kiln

Two layers having a total of about 120 number of unfired bricks were laid to form the kiln floor chequer (Fig. 2). Two layers of country tiles (Nalia) were set on the kiln floor. Each layer of country tiles consisted of about 600 nos. of half round tiles. Temperature measurement at this level was made with the help of a chromel-alumel thermocouple and a pyrometer. Over half round tiles, about 535 number of flat country tiles (Khapras) were loaded in each of the two layers. Provision for insitu fire wood as fuel in central zone perpendicular to the bottom feed holes was also made at this level for better temperature distribution and control. Half round country tiles, about 300 numbers, were again loaded over the flat tiles.

An additional layer of 140 nos. of circular tiles (shaped on potter's wheel) were also loaded at the top of the tile setting. At this level, and within the setting of circular tile, a thermocouple for temperature recording was placed. Finally the setting was covered with scattered placement of unburnt bricks at the top to minimise heat losses from the kiln top.

(c) Firing of Kiln

The firing of kiln was continued for about 13-14 hours with a smoking period of 4-5 hours, full firing 8-9 hours and soaking at maturing temperature of 850°±30°C for 3-5 hours. Firing schedule of the kiln is indicated in the Fig. 3.

Firing operation of the kiln was stopped by sealing the bottom feed holes with the help of bricks and mud. The top layer of setting was covered with a thick layer of ash to minimise heat losses from the top. About 340-360 kg of firewood was used for firing the full kiln load. Salient features of kiln and firing operation are given in table 4.

It may, however, be mentioned that the rate of rise of temperature was quite high in the lower half setting of kiln as the inceneration bed of fuel was just below and less than a metre away from actual tile setting. It is therefore, essential that fully dried half round tiles (preferably having moisture content less than 3 per cent) should be loaded in the first three bottom layer of setting to overcome the firing losses. Half round tiles are more resistant to firing stresses as compared to flat tiles due its intrinsic geometry and small size and should be loaded in first or second courses of the setting.

(d) Test Results on Fired Product

Kiln was unloaded and the tiles made during the pilot plant trials undertaken at G. Udayagiri were evaluated at CBRI (Table 4). The results show that tiles of good finish, uniform size and shape possessing breaking load strength above 35 kg and water absorption below 20 per cent can be manufactured from properly processed and weathered soil mass as available in the region at a firing temperature range of 800°C to 900°C.

RECOMMENDATIONS AND CONCLUSIONS

1. Country roofing tiles of improved strength and adequate, durability, resistant to rain water showing a breaking load strength 35-50 kg and water absorption 15 to 20% can be produced from locally available red and black soil admixtures.

2. The process is easy to adopt, involves low capital investment with minimum infrastructural set up.

3. The process for country tile manufacture has potentials for employment generation and improvement in the quality of life in rural and under developed regions of the state.

4. The process for the manufacture of country roofing tile can be undertaken in red and black soil regions of the country, particularly in Orissa state. The technology is feasible for adoption on self help basis, utilising locally available materials and resources.

ACKNOWLEDGEMENT

The authors are thankful to Sbri Parasbhai, Executive Secretary and Shri P. K. Dash, Tech. Asst., Phulbani Rural Development and Technology Agency and CAPART New Delhi for providing necessary help, cooperation and financial support for undertaking the work. Thanks are also due to the Director, Central Building Research Institute, Roorkee for his keen interest and help during the course of these studies and permission for publication of the present paper.

Table 1—Sample Details and Results of Physico-Chemical Properties of Phulbani Soils

(*) Soil Admixture used for Pilot Plant Trials

Sl. No.	Location	Mark	Mech. Composition (%)		Plastic Properties		pH	Organic Matter (%)
			Clay	Total Fines	LL	PI		
1.	Masedikia —Rakia Block	S-1	33.7	54.8	42.7	18.7	6.4	0.32
2.	Nuasahi —1	S-2	46.3	62.8	48.7	21.5	6.1	0.27
3.	Nuasahi —2	S-3	11.2	21.4	—	—	5.6	0.36
4.	Baladaguda —1	S-4	50.5	84.4	64.7	34.7	6.1	0.31
5.	Baladaguda —2	S-5	51.1	77.9	72.5	41.9	6.0	0.21
6.	Soil Admixture*	AM	39.2	54.8	43.2	19.9	6.4	0.30

Table 2 **Moulding and Drying Properties of Soil/Soil admixture from G-Udayagiri and adjoining areas (Phulbani Distt.) for country tile manufacture**

Sl. No.	Soil Sample	Composition		Rice husk ash %	Mark	Moulding Moisture %	Linear Drying Shrinkage %	Drying losses %	REMARKS
		Soil %	Sandy soil %						
1.	Masedikia	90	—	10	AM-1	30.1	6	5-20	Suitable with controlled drying
		80	—	20	AM-2	34.4	6-8	8-10	do
		100	—	—	S-1	27.9	8	15	do
2.	Nuasahi	75	25	—	AM-3	28.0	6-8	8-12	Suitable
		90	—	10	AM-4	31.6	6-7	8-10	Suitable
		80	—	20	AM-5	34.2	6	10-15	Suitable with controlled drying
		100	—	—	S-2	29.0	6-8	20	do
3.	Baladaguda	90	—	10	AM-6	42.0	7-10	25-75	Not suitable
	—1	80	20	—	AM-7	44.0	6	8-10	Suitable
		100	—	—	S-3	38.0	10-12	75	Not suitable
4.	Baladaguda	90	—	10	AM-8	35.0	9	20-60	Not suitable
	—2	80	20	—	AM-9	38.0	6-8	20-60	Not suitable
5.	Baladaguda —1*	50	50	—	AM	30.0	6	3-4	Suitable

* Soil composition taken for pilot plant trials.

Table 3—Test Results of Tiles Fired in Electrical Furnace, CBRI Circular Kiln and Open Clamp

Sample No.	Electric Furnace at 850°C		CBRI Circular Kiln 850° ± 20°C		Open Clamp 700°C	
	Breaking Load (kg)	Water Absorption (%)	Breaking Load (kg)	Water Absorption (%)	Breaking Load (kg)	Water Absorption (%)
AM—1	48	13.8	38	15.4	All tiles failed when put	
AM—2	28	22.2	—	—	under water for 24 hours	
AM—3	18	15.6	—	—		
AM—4	24	20.2	—	—		
AM—5	28	21.4	—	—		
AM—6	42	18.9	35	19.4		
AM—7	45	20.0	47	19.2		
AM—8	48	16.4	42	17.3		
AM—9	48	21.0	—	—		
S—1	48	14.8	31	14.9		
S—2	50	17.1	40	14.1		
S—3	93	11.5	72	9.7		

Table 4—Details of Kiln Firing During Pilot Plant Trials.

1.	Kiln dimensions :	
	(i) Internal diameter	1.35 m
	(ii) Height (overall)	2.25 m
	(iii) Height (above kiln floor)	1.65 m
2.	No. of feed holes	Two
3.	Maximum firing temperature attained	850°±20°C
4.	Type of fuel used	Fire wood
5.	Fuel consumption	340-360 kg.

(Table 4 Contd.)

6. No. of tiles/other products loaded :

(i) Half round tiles	1680
(ii) Flat tiles	630
(iii) Bricks	160
(iv) Guna tile	140

7. Setting height above kiln floor — 1.50 m

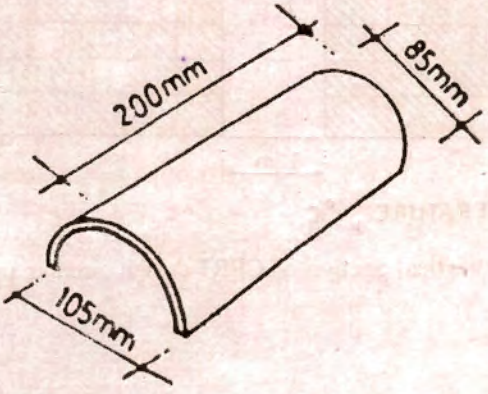
8. Average setting density — 1000-1100
No. of half round tiles per m^3

9. Quality of fired product :

(i) First class, %	60-70
(ii) Second class, %	20-30
(iv) Rejects, %	3-5

10. Properties of fired tiles :

(i) Breaking load strength (Nalia), kg.	40-92
(Khapra), kg.	30-40
(ii) Water absorption, %	14-15.8



HALF ROUND TILE
(NALIA)

Fig. 1 Country Tile

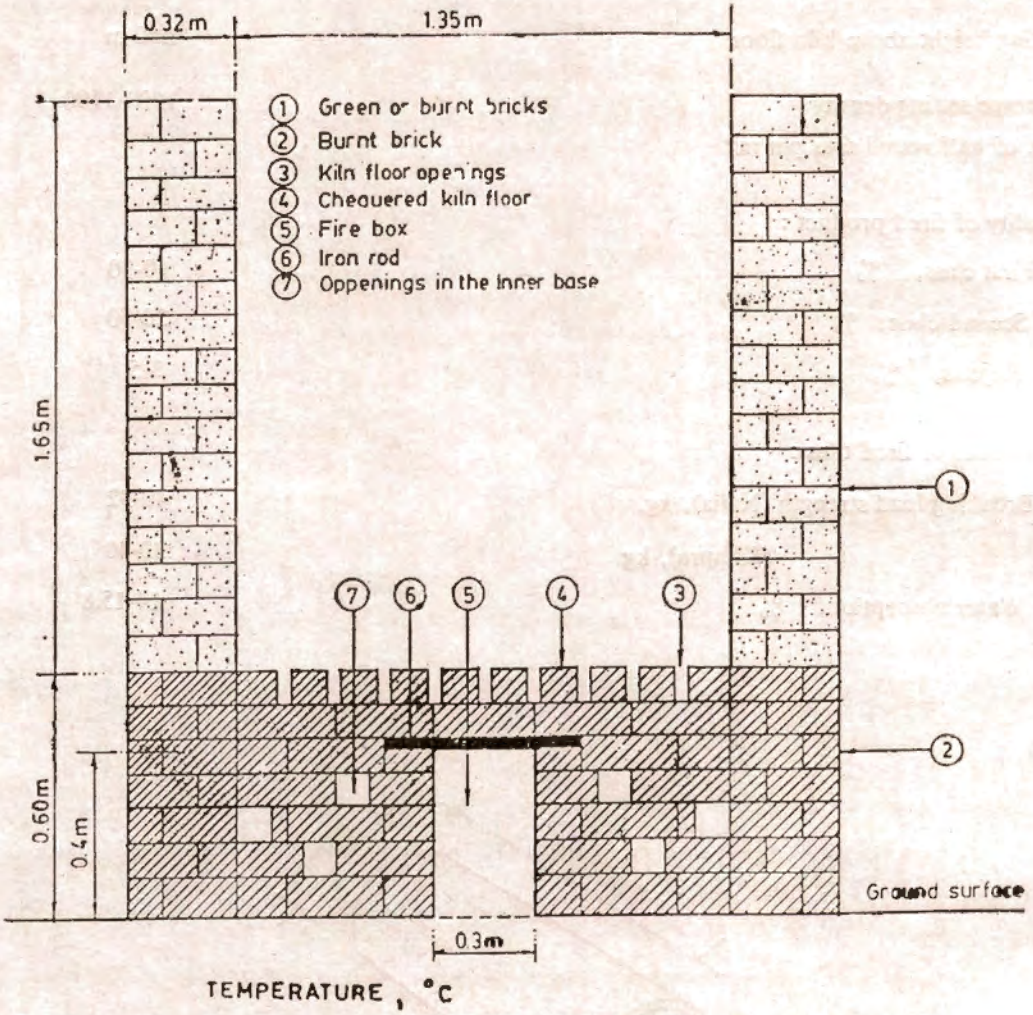


Fig. 2 Vertical Section of CBRI design circular updraught kiln.

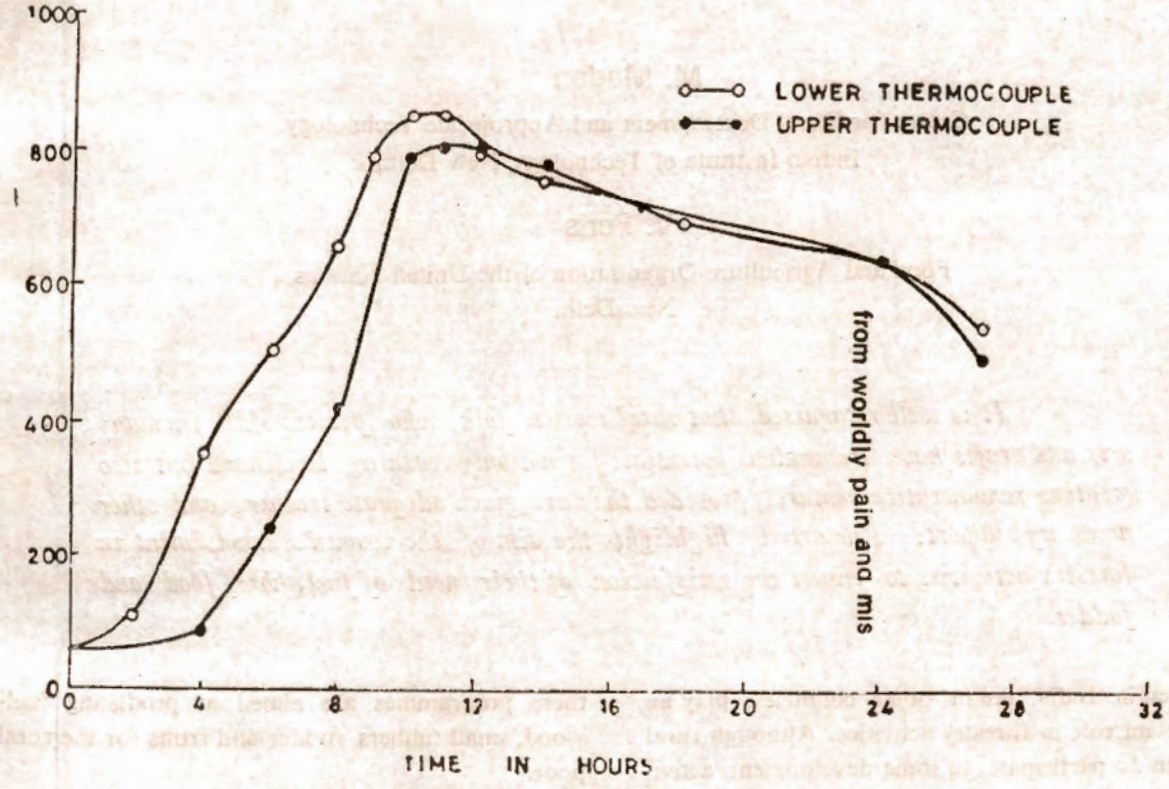


Fig. 3 Firing Schedule in Circular up Draught Kiln

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WOMEN'S INVOLVEMENT IN FORESTRY ACTIVITIES

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It is well recognised that rural women folk, who possess skill in many arts and crafts have tremendous potential for not only earning livelihood but also creating remunerative ventures, provided they are given adequate training and other necessary support. The article highlights the aim of the women's involvement in forestry activities to ensure the satisfaction of their needs of fuel, fibre, food and fodder.

Women in India, like in other countries, play an important role in forestry activities. Although rural women do participate in some development activities, they can only be reached by other women. Since awareness on women's role and participation in forestry is growing, a need has arisen to train women as extension workers with a basic forestry knowledge.

'Women in Development' is by no means a new issue. Traditionally, women have been playing an important role in the development process. The degree of their involvement, however, varies according to the socio-cultural traditions.

FAO has initiated a plan of action for rural women, to ensure that they are accorded equal rights and opportunities to enable their potential contribution to rural economic development. In the area of forestry, both men and women are involved, but there is general recognition and acceptance that women's involvement in forestry programmes is considered to be of utmost significance, because these programmes are aimed at producing fuelwood, small timbers, fodder and fruits for the rural poor.

In the developing World, women are the actual users of most of the forest resources such as firewood, grass and leaf fodder, leaf litter, medicinal herbs, fruits, barks and fibres. As such women can play a significant role.

The most important role that women have to play is the educative one. There is a wise saying : "If you educate a man you educate a person, but if you educate a women you educate the whole family". By nature, mothers are the best teachers. In their capacity as rearer, friend and guide of the family, they can teach the members, particularly the young ones, the economic use of resources and of the importance, in other ways, of forests and programmes aimed at improving and increasing them. In India, women are actively involved in forestry programmes such as the following :

(a) Afforestation

The nature of women is such that they are generally very conscientious and preserving and this makes many rural women fit to work as labourers in nurseries as part of afforestation programmes.

In the nursery rural women are involved in :

(1) Seedbed preparation which consists of making wooden sticks, putting the sticks into the soil as a border and levelling the plots;

(2) Seed sowing;

(3) Transplanting, filling plastic bags with soil and organic matter;

(4) Transplanting seedling into plastic bags or in the nursery beds;

(5) Nursery maintenance such as : fertilizing, watering, weeding and spraying plant with pesticides.

Beyond this, for another 2 years, women are involved in planting out the seedlings in the field and taking care of them, including replacing stunted ones with healthy seedlings, loosening the soil around the seedlings and weeding.

(b) Silkworm rearing

In silkworm rearing and the particular in the supply of mulberry leaves for the worms, involvement of rural women is very important. Silkworm rearing is very much a family business and it needs the kind of care and patience for which women are noted. Some rural families grow mulberry trees and sell the leaves later on, rather than rear the silkworms themselves which need so much care and patience. Growing mulberry trees is not only useful for silkworms but also protects bare lands from erosion.

(c) Bee-keeping

Another activity in forestry which involves rural women is bee-keeping. This activity is also known as Apiculture. The beehives are kept usually along the outskirts of forests to enable the bees to collect nectar from the flowers in the forest.

(d) Non-formal education for rural women

The objectives of non-formal education for women in forestry activities is to improve and to increase their participation. For instance, all activities carried out by rural women in afforestation, silkworm rearing and beekeeping are preceded by a period of training given by extension workers.

Some of the extension workers are themselves women from rural areas. The training comprises of all activities from the nursery stage to the maintenance of plants in the field.

The role of educated women in forestry was, however, confined to :

(i) Planning and programming

(ii) Data analysis

(iii) Laboratory work

(iv) Teaching

(v) Field extension

To increase participation of rural women in forestry activities, it would require in addition to non-formal education more technical methods. Of prime importance is the elimination of illiteracy. By this means women become receptive to innovation in improving their living conditions.

One of the best example of women's involvement in forestry activities is SEWA (Self Employed Women's Association). This association has started tree growing activities with rural women and has an urban and rural wing.

SEWA is trying to bring the rural women into the main stream of national development and the primary goal is to organize rural women around economic self-reliance progammes.

SEWA'S rural wing has been involved in the following programmes :

(1) Women's dairy cooperatives.

(2) Tree growers cooperatives.

(3) Income generation through spinning and weaving,

(4) Vocational training for rural women and children.

During the last three years SEWA is implementing a tree growing/wastel nd programme in Gujarat State. The women's tree growing project, started with the support of the National Wasteland Development Board. Rural women were organized to plant fodder and fuel trees. Training programmes are organized from time to time on subjects such as social forestry, how to establish a tree nursery, water management, land development and managing a tree cooperative.

For the last several years, the Centre for Development and Appropriate Technology, IIT, Delhi has been doing extensive work for rural development. The Centre is organising several training programmes with the following objectives :—

(1) To increase public understanding, specially to rural women and children on the nursery raising and bio-energy plantation.

(2) Economic, social and cultural betterment of rural women through the benefits of various selected technologies such as silkworm rearing, mushroom cultivation on tree branches, vermi-composting and efficient utilization of wastes.

(3) Increasing awareness among rural women and children for the technologies which provide employment opportunities, improved sanitation, improved he.lth, nutritional status of people.

In general, it has been observed through experience that the utilisation of technology in developing human and material resources can be dramatically enhanced when women are included.

In conclusion, programmes in forestry are going to have to be integrated into the total economic and social lives of the villagers. Women, from the local woman to the national figure, have special knowledge and skills to bring to this new approach.

The only means of strengthening one's intellect is to make up one's mind about nothing to let the mind be a thoroughfare for all thoughts. Not a select party.

—John Keats

BIOGAS PLANT FAILURE : CAUSES AND REMEDIES

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India, having the largest cattle population in the world, provides a vast potential for generation of biogas. Government of India being aware of the fact launched National Project on Biogas Development in the year 1981 with a view to setting up biogas plants throughout the country. A number of plants have been constructed under the project so far but their functionality has been found low because of a variety of problems administrative, technical, social or otherwise. The present paper deals with such problems in details and their possible remedies. The removal of all such problems will help establishing biogas as one of the most reliable sources of domestic energy in India.

1. INTRODUCTION

In most of the developing and underdeveloped countries domestic energy shares the largest proportion in total energy consumption. In rural India this share is about 64 per cent, while the major source for which is firewood supplying about 68.5 per cent of the total domestic energy demand. The continuous use of firewood for rural energy is bringing a number of social and ecological problems. Thus there is an urgent need to seek for alternate domestic energy sources. In India biogas is being considered as one such alternative.

The cattle population of India has been estimated to be 240 million. This produces about 1000 million tonnes of dung annually. Thus there is a potential for setting up about 22 million family size (2 to 4 cum) biogas plants in the country. Since the launching of National Project on Biogas Development more than 1 million family size biogas plants have been installed in the country. Institutional and community biogas plants are also being set up in the country to help the families which are having lesser cattle population than the minimum required (4-5) for a plant of 2 cum. capacity. About 432 such plants are at present functioning in the country. According to the 1988-89 Annual Report of the Department of Non-Conventional Energy Sources, Ministry of Energy, Govt. of India, these plants are generating about 1100 million cum of biogas annually providing energy equivalent to 38.18 lakh tonnes of firewood. In addition they are also producing about 183.6 lakh tonnes of highly enriched organic manure. The annual saving in India due to biogas is Rs. 152.7 crores in terms of fuel gas and Rs. 152.0 crores in terms of organic manure. The extent of prosperity this technology is bringing to India may be estimated from the fact that the total investment on developing non-conventional energy sources in India during the last five years was Rs. 435 crores while saving in fuel and organic manure, only through biogas programme was estimated to be Rs. 473 crores per year.

Looking to the benefits of biogas Govt. of India has decided to intensify biogas programme. It has been planned to set up about 40 lakh new family size biogas plants in the country during the course of 8th five year plan (1990-95). This will further increase the use of biogas in India.

Although a number of agencies governmental or private, are working for the development and maintenance of biogas plants in India yet their functionality has been found low. To find out the causes of this low functionality of biogas plants a survey of 410 biogas plants was conducted in seven districts of Rajasthan state in India. The survey indicated that a host of problems administrative, technical, social or otherwise were responsible for this low functionality. The paper discusses these problems and their possible remedies.

2. PLAN OF WORK

During the course of the survey 410 beneficiaries in seven districts of Rajasthan state were personally interviewed. The owners of the non-functional plants were asked about the causes of functioning of their plants. Informations were also sought by observing the sites of installation of biogas plants.

3. RESULTS AND DISCUSSION

The informations obtained during the survey are presented in Table I. The table shows that the functionality of biogas plants is low (48.54 per cent). More than half the plants are non-functional. Here we discuss the major problems related with non-functional biogas plants.

Administrative Causes

The administrative causes are responsible for non-functioning of 14.88 per cent biogas plants. The major causes of this nature include target oriented programme of Govt, unavailability of a large technical force at lower level and improper supervision of the plants at the time of construction and afterwards. The target oriented programme reduces the quality of the work. Sometimes compromise has been made with essential requirements necessary for successful operation of plant resulting in non-commissioning of such plants. Certain plants have faulty construction due to lack of proper supervision.

The administrative causes are responsible for the greatest number of non-functional biogas plants in India. Therefore there is an urgent need to review the set up. The programme should no more be target oriented and strict quality control should be observed. Before installing any plant it should be ensured that the beneficiary possesses required number of animals. If the beneficiary possesses a alrge number of animals the capacity of the plant should be decided based upon his family energy demand. It has been observed that the functionality of small family size biogas plants (2 cum. capacity) is high as compared to large family size (3 to 4 cum capacity) biogas plants though the beneficiaries possess the required number of cattles to operate the bigger plant.

Attempt should be made to produce a large number of trained masons and technical experts. Govt of India is working in this direction by organising masive training programmes for masons and staff workers.

Technical Causes

The second largest causes responsible for non-functionality of biogas plants are technical by nature. These account for 13.66 per cent non-functional plants. The major technical causes include faulty construction, faulty pipeline installation leakage in gas holder and pipeline at the time of installation or afterwards, chocking of pipeline etc.

The cases of faulty construction are few. They generally took place when the plants are constructed by unskilled masons. In most of the cases technical problems like dome leakage, pipeline leakage, pipe chocking etc. developed a few years later when the plant was in use. Such plants became non-functional due to the lack of knowledge of the beneficiaries about the successful operation of plants. Lack of timely supervision of the Govt. officials was also one of the causes.

To overcome the technical problems all the plants should be constructed by skilled and trained masons under strict supervision of Govt. officials. Timely supervision should be made of functional plants. The beneficiary should be technically guided about the maintenance and operation of biogas plants.

Social Causes

The social causes include the lack of education among rural masses, their ancient traditions and superstitions. These contribute for 10.49 per cent non-functional plants. Education and knowledge of technical know-how about the successful operation and maintenance of biogas plants is very necessary on the part of the beneficiary specially in remote villages. In the absence of this a majority of plants stop functioning due to minor problems as timely supervision cannot be made.

The tendency of the people to use dung as dung-cake, as their forefathers used to do, creates another problem. Similarly it is also considered unhuman to cook food on the fuel gas that is being generated from human excreta. This is why the number of human excreta based biogas plants is low in India.

Most of the social problems can be easily removed if the people get proper education.

Other Causes

A host of problems other than administrative, technical and social are also responsible for non-functioning of 12.44 percent biogas plants. One such reason is frequent droughts in India. People do not get water for mixing with dung for feeding biogas plants. Droughts also reduce the number of cattles. The drought of 1986-87 was responsible for 20 per cent reduction in total cattle population of India.

The law of inheritance due to which the animals get divided among brothers, lack of time, lack of labourer etc. are few other problems which ultimately bring the plant to non-functional stage. Lack of time due to agricultural works is responsible for low functioning of large family size (3 to 4 cum capacity) biogas plants.

4. CONCLUSION

A number of factors are responsible for low functionality of biogas plants in India. Most of these factors are non-technical and very minor in nature. By adopting the measures as suggested in this paper most of the problems regarding biogas plants can be solved and their functionality can be considerably increased.

ACKNOWLEDGEMENT

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Table I : SURVEY REPORT OF BIOGAS PLANTS

S. No	Name of the District	No. of plants surveyed	No. of plants functioning	No. of Non-functional plants	Causes of Non-functioning of plants			
					Administrative	Technical	Social	Others
1.	Tonk	28	6	22	8	10	2	2
2.	Jhalawar	22	18	4	2	1	1	—
3.	Nagapur	50	24	26	10	6	6	4
4.	Dungarpur	222	98	124	25	32	27	40
5.	Sikar	19	2	17	9	5	2	1
6.	Bhilwara	21	16	2	—	1	—	1
7.	Udaipur	48	32	16	7	1	5	3
	TOTAL	410	199	211	61	56	43	51
	Percent	100	48.54	51.46	14.88	13.66	10.49	12.44

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The present troubles of the world are due to science having advanced faster than morality : when morality catches up with science, these troubles would end.

—Einstein

GENERATING BIOGAS FROM AGRICULTURAL RESIDUES

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Leaves and stems of papaya plant were digested anaerobically at 37°C in 5-litre capacity batch digesters. The results show that under the uncontrolled conditions of pH and total volatile fatty acids the digesters fed with the leaves of papaya, failed and only 171 litre of biogas/kg of total solids was produced within eight weeks of digestion period, whereas under controlled conditions the total biogas production was 434 l/kg. total solids. In the case of papaya plant stem, there was no drop in pH value in acidic range but the total biogas production was only 169 l/kg of total solids.

INTRODUCTION

The biogas potential based on about 684 million tonnes/year of cattle dung in India is 30780 million kwh. Which is equivalent to more than 300% of electrical energy presently being used in the agricultural sector. This energy potential could be further increased by using agricultural and forest residues for biogas production.

Sharma et al., (1988, 1989) have identified a number of agricultural and forest plant materials which do not have any fodder or timber value but could be digested anaerobically for the production of biogas. The effective implementation of the biogas programme requires identification of such plant materials which have dual utility-food/crop production and fuel generation and could be grown easily in Indian climate. Papaya (*Ca ica papaya*) is such a plant besides banana plant, which is grown in abundance in the backyards of the city houses/ homes and in villages. This plant is generally cut down after having a crop and is neither used as a fodder not for burning as fuel. The papaya fruit have a medicianal value as it contains Papain Enzyme, which helps in a number of diseases in human being. It is a tropical plant but also grows in a mild tropical climate upto an elevation of 2000 m. The total cultivatedarea under payaya in India is about 10,000 ha (Singh, R., 1969). Some varieties of papaya attain a height of 8–10 m. with a stem diameter of around 300 mm.

The following paper describes the work carried out on the anaerobic digestion of papaya plant stem and its leaves. The objectives were to investigate methane production rate and biodegradation efficiency of the plant residues.

MATERIALS AND METHODS

Feed materials

The following plant materials were collected from the surroundings of the university campus.

1. Leaves of papaya (LOP)
2. Stems of papaya (SOP)

The shredded materials were first dried under sun and then in an oven at 90°C. The finally dried materials were ground in a Belco make grinder and sieved through a sieve of 425 micron. The under sized particles were used for feed preparation. Effluent slurry for inoculation was taken from a family size domestic digester operating on cattle dung as feed material with a retention time of 55 days.

Experimentation

Leaves and stems of papaya were separately mixed with distilled water to make a slurry mixture of 8% solid concentration (w/v). The so formed slurry was mixed with effluent slurry in 1 : 1 ratio (v/v) and anaerobic digestion was carried out for eight weeks at 37°C in modified digesters of 5 litre capacity as described elsewhere by the authors (Sharma et al , 1988). For each of the plant materials, two sets of experiments were carried out. In one set pH was controlled between 6.75–7.25 using lime slurry and the other set was run without the addition of lime slurry.

Analytical

All tests and analyses were conducted according to standard methods as described elsewhere (Sharma et al., 1989).

RESULTS AND DISCUSSION

Characteristics of feed materials

The characteristics of feed materials are summarised in Table 1. The carbon content in SOP is slightly higher than of LOP. LOP is found to be very rich in protein (22.26%) as compared with SOP (5.42%) This is reflected in the values of the carbon/nitrogen ratio, which are 58.5 and 13.2, respectively, for SOP and LOP.

The ethanol-benzene and hot water solubility which is a measure of the quantity of waxes, oils, fats, resins, tannins etc. is found to be 6.35%, 36.1% and 5.10% in SOP, LOP and effluent slurry, respectively. It has been observed by the present authors that plant green matter such as leaves contains higher quantity of waxes, oils, fats, resins etc. as compared to plant stem, straw etc., (Sharma et al, 1988).

Anaerobic digestion of LOP Samples

Fig. 1 shows the weekly change in pH, total volatile fatty acids (TVFA) and biogas production in LOP samples (without pH controlled). The slurry pH fell down sharply in acidic range (5.25) within the first 3 days of digestion with a TVFA concentration of 5479 mg/l. TVFA concentration continued to increase upto a value of 6075 mg/l during the third week. Thereafter, TVFA concentration decreased and pH value started increasing. In the first 3 days the biogas production was found to be 30 l/kg of total solids (TS) and thereafter gas production stopped upto second week. After third week due to increase in pH and reduction in TVFA concentration the methane producing bacteria became viable and active and gas production was observed. Highest gas production was observed to be 50 l/kg of TS during fifth and sixth week of digestion. After that the gas production again slumped drastically with its value reaching 6 l/kg TS in the eighth week. The highest reduction in total solids and volatile solids was observed during the first 3 days. It decreased upto third week and thereafter again started increasing (Fig. 2). It is also evident from this Fig. 2 that when the gas production stopped in the first and second week of digestion, there was some reduction in total solids as well as in volatile solids This shows that acid forming bacteria continue to be active even at low pH (= 5.25) and a TVFA concentration of 6412 mg/l. In order to activate the digester for methane generation, the control of pH and TVFA is necessary.

Fig. 3 shows that when the pH of digester substrate (LOP) was monitored and controlled between 6.75–7.25, by the addition of lime slurry, TVFA concentration never rose above 1310 mg/l and the gas production was observed with its maximum value of 160 l/kg TS during the second week. It is important to note that the pH was controlled only for

the first 2 days, after that there was no need to control pH and it remained under optimum range throughout the digestion period. However, sudden fall and rise in biogas production during and after fourth week was observed. As reported above during this period there was neither drop in pH nor increase in TVFA concentration. The interruption of the anaerobic process might be due to the development of some toxic substances during the course of digestion.

The total biogas production within eight weeks under controlled conditions was obtained as 434 l/kg TS (Fig. 4). Whereas under uncontrolled conditions it is only 171 l/kg TS. The average methane content in biogas obtained from uncontrolled and controlled digesters of LOP was 64% and 65% (v/v), respectively. As shown in Fig. 4 the initial volatile solids was 80.2% which reduced to a value of 60.5% within eight weeks of digestion period.

Anaerobic digestion of SOP

Fig 5 shows the weekly reduction in TS, VS, change in pH and TVFA concentration and biogas production from SOP samples. The reduction in TS and VS and the production of biogas was found to be higher in the first week of digestion period and thereafter continual decrease was observed. The TVFA concentration was slightly above 500 mg/l in the first week and thereafter it remained around this value for the whole of the digestion period. In the case of SOP, there was no need to control pH under optimum range, as it remained around neutral value throughout the digestion period. The change in pH and TVFA concentration depends upon the characteristics of the feed materials. However, in a well balanced digestion the TVFA concentration is found in lower concentrations of ($\simeq$500 mg/l) because the amount of TVFA generated in the slurry is immediately taken up by the methane forming bacteria thus maintaining a dynamic equiliburium. However, this depends upon the methanogenic and non-methanogenic bacterial population. Also it has been found that the materials which are resistant to bracterial attack are less degraded and subsequently lower TVFA concentration and lower gas production. The total biogas production by SOP sample was 169 l/kg TS, which is 2.56 times less than that obtained from LOP sample. However, in both the samples the highest gas production was observed in the first two weeks of digestion period. The average methane content in the biogas obtained from SOP sample was 60% (v/v . The less gas production in SOP samples compared to LOP might be due to higher C/N ratio in SOP or due to its higher resistivity to anaerobic degradation. As shown in Table 1, LOP is rich in protein (22.26%) and has higher ethanol-benzene and hot water solubility. Generally, the plant materials having ethanol-benzene and hot water solubility above 20% and C/N ratio 325, have higher capacity for biogas production; normally above 400 l/kg total solids within eight weeks of digestion period under optimum conditions. For example *Mirabilis* leaves, Cauliflower leaves and *Ipomoea fistulosa* leaves produce 415, 520 and 510 litre of of gas/kg of total solids, respectively (Sharma et al., 1988). These materials have C/N ratio, respectively as 21.2, 12.1 and 21.2 and the ethanol-benzene and hot water solubility as 24.0%, 21.5% and 34.0%, respectively.

For reference purposes, effluent slurry was also digested anaerobically under similar experimental conditions. The total biogas production was found to be 74 l/kg TS for effluent slurry with a methane content of = 60% (v/v).

CONCLUSIONS

Papaya plant stems and leaves could be used as a good supplement to cattle dung for biogas production. Under the controlled conditions, the total biogas produced by leaves and stem of papaya plant was 434 and 169 l/kg. TS, respectively. The production of papaya should be raised by the farmers so that besides having income from fruits. the plant residues could be used for producing smokeless, clean gaseous fuel along with a good quality fertilizer. It is also recommended that in order to enhance the papaya production a good quality saplings should be made available by the

Govt. nurseries and the guidance and information regarding profit should be provided to the farmers at Block level.

ACKNOWLEDGEMENT

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TABLE 1. CHARACTERISTICS OF RAW MATERIALS
(Dry weight basis)

Parameters		SOP	LOP	Effluent slurry
Moisture content	%	62.85	70.20	95.53
Volatile solids	%	89.42	83.07	75.39
Carbon	%	49.67	46.15	41.88
Protein	%	5.42	22.26	6.76
Cellulose	%	60.50	60.00	27.60
Lignin	%	27.40	15 30	15.10
Carbon/nitrogen ratio		58.50	13.20	39.50
Ethanol-benzene & hot water solubility	%	5.35	36.10	5.10

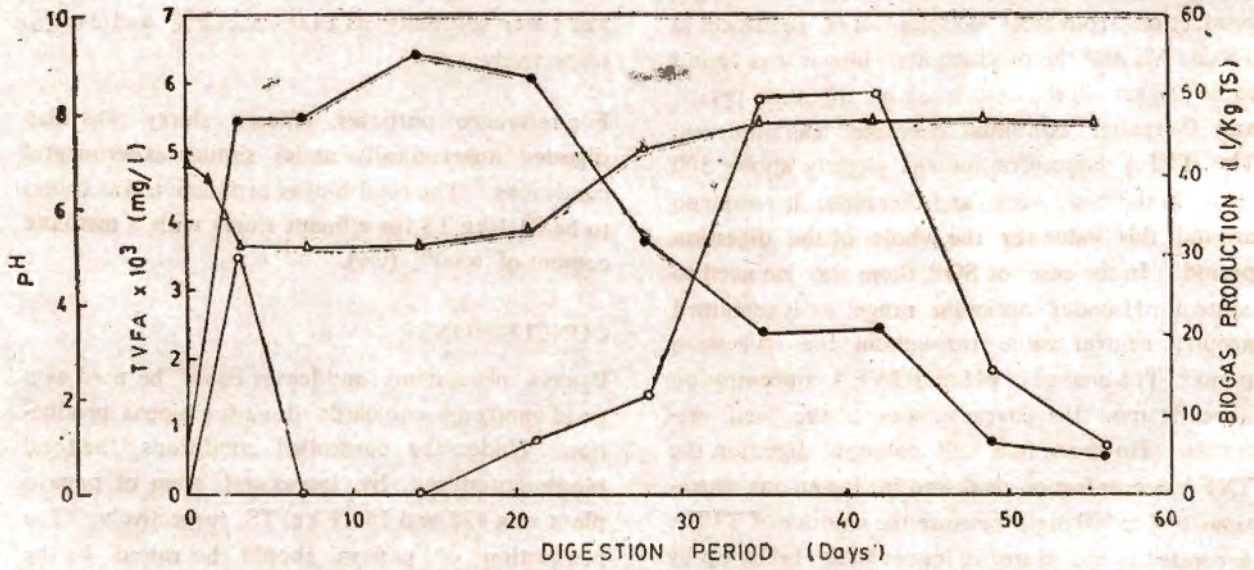

Fig. 1—Weekly Change in pH & TVFA and Biogas Production in LOP (pH Uncontrolled). TVFA ; △pH ; o Biogas.

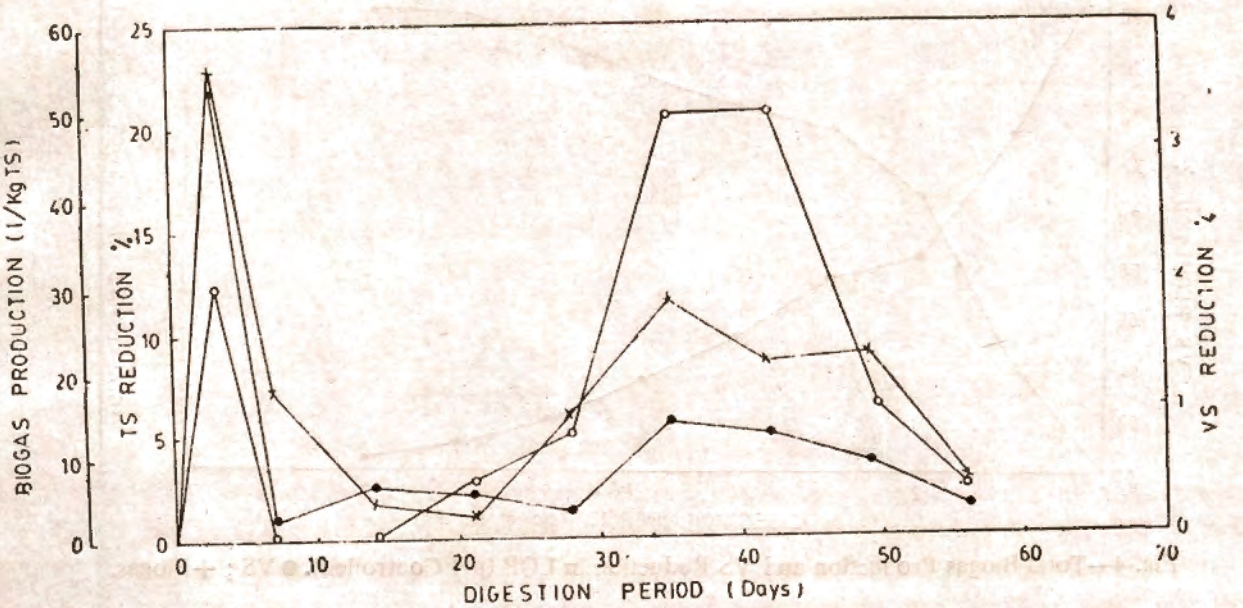

Fig. 2—Weekly TS, VS Reduction and Biogas Production in LOP (pH Uncontrolled). ● TS, + VS ; o Biogas.

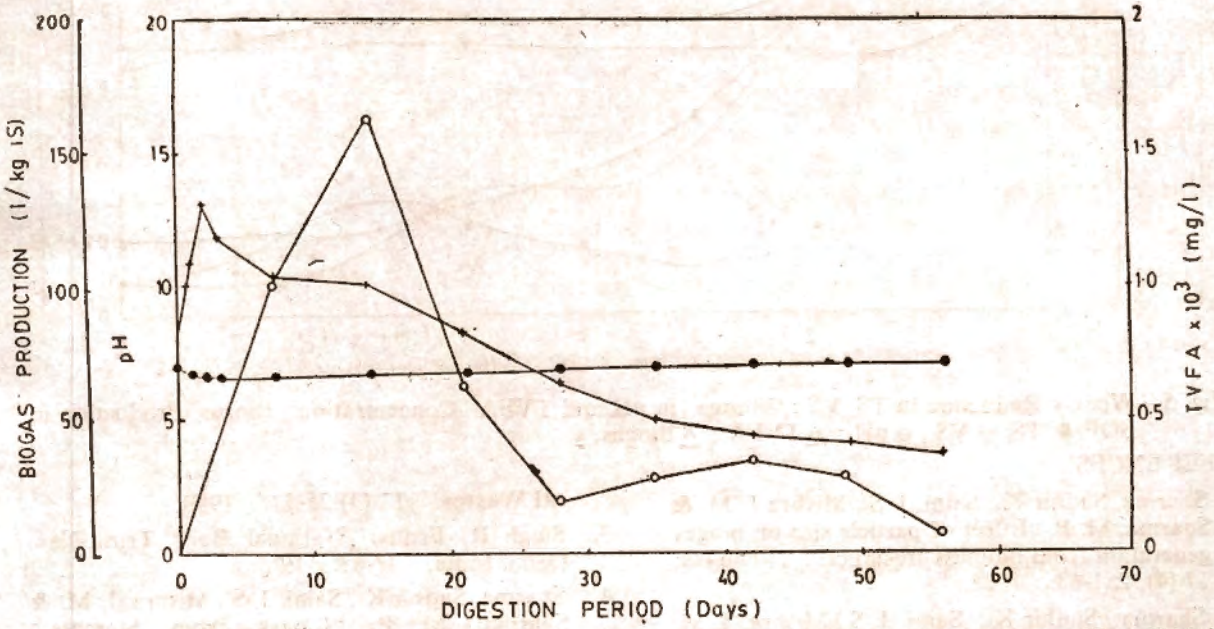

Fig. 3—Weekly Change in pH & TVFA and Biogas Production in LOP (pH Controlled). ● pH ; + TVFA; o Biogas.

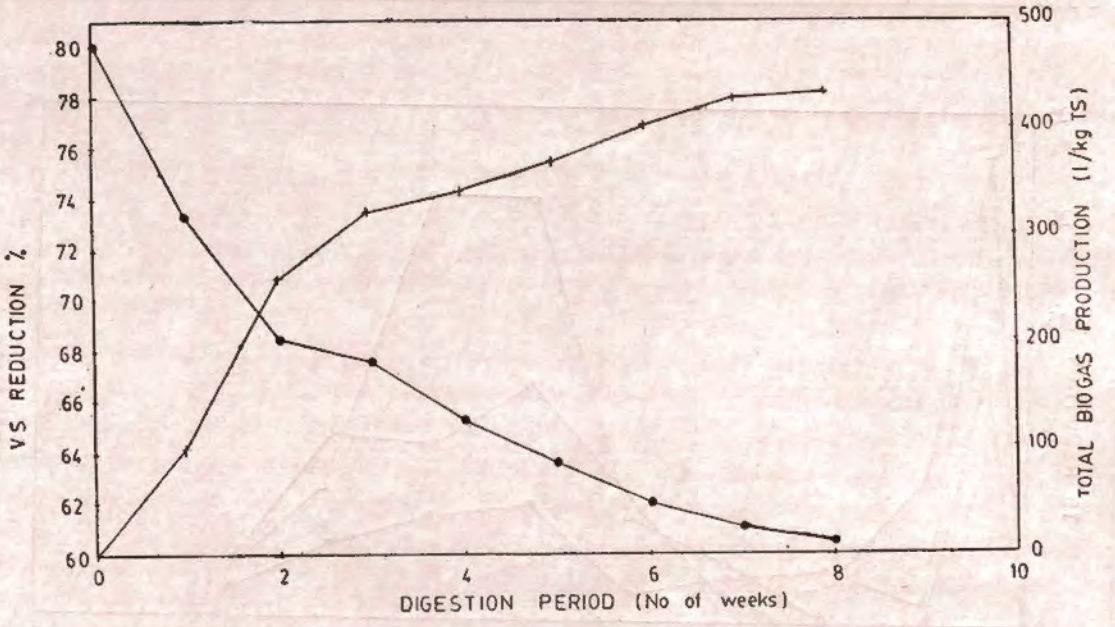

Fig. 4—Total Biogas Production and VS Reduction in LOP (pH Controlled). ● VS ; +Biogas.

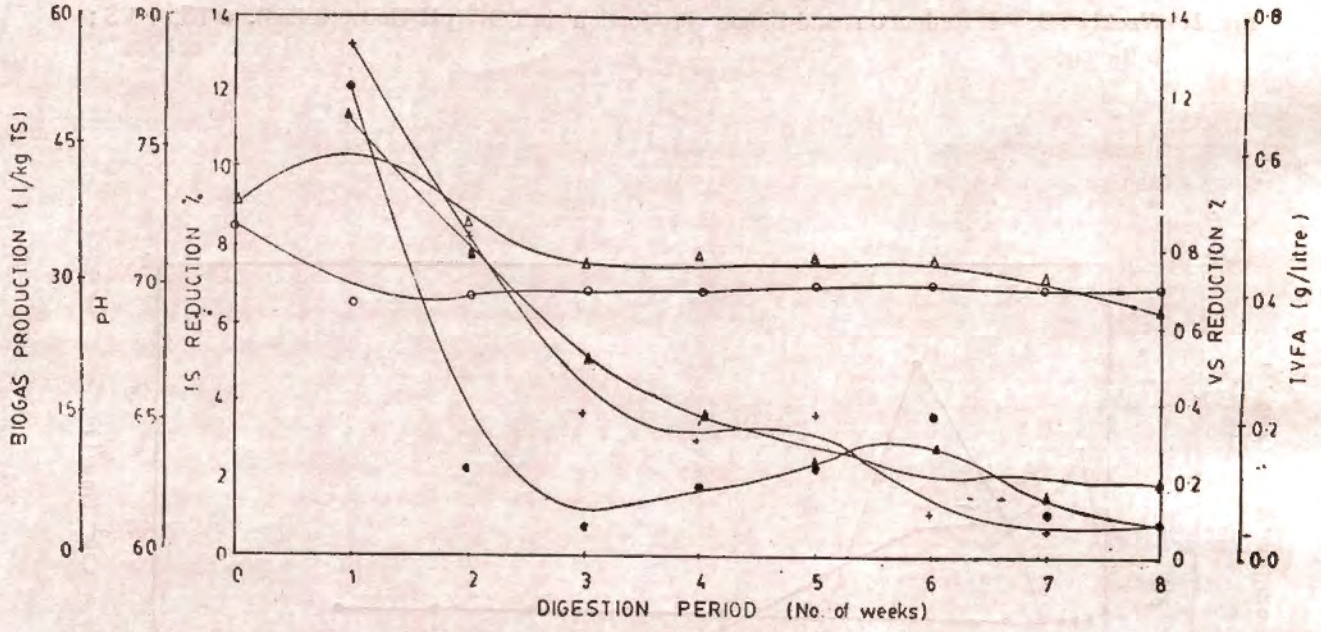

Fig. 5—Weekly Reduction in TS, VS ; Change in pH and TVFA Concentration ; Biogas Production in SOP. ● TS; + VS ; o pH ; △TVFA ; △Biogas.

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ROLE OF VOLUNTARY ORGANISATION IN THE FIELD OF LOW COST SANITATION

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The space requirement to dump the waste product and disposal of human excreta is a very common problem for the third world countries. India in particular is facing this problem in a big way. Pathogenic organisms, foul odour and other harmful vectors arising out of decaying wastes, garbage and human excreta pour serious threat to the environment and human health. If these wastes are in someway converted into energy and other useful products/bye products it will be eminantly beneficial from economic, environmental and many other considerations. The article highlights the poineering role played by Safai Vidyalaya of Ahmedabad in extension, education and training of techniques for on-site disposal of human wastes, conversion of latrines to pour-flush type etc.

1. INTRODUCTION :

One of the numerous challenges thrown by nature to man is the acute problem of the disposal of human waste, particularly in under-developed and the developing countries of the third world. Human excreta is the main cause of many enteric diseases and wide spread insanitary conditions, polluting the environment.

It is, therefore, high time to think at and plan for some techniques for the disposal and utilisation of human waste, considering the health, pollution and agricultural aspects of the problem.

Human excreta is the reservoir of causative agents of enteric disease and parasite infections which are transmitted through water, food and soil. Proper disposal of the human excreta is the only measure by which transmission of these diseases can be curbed. The high incidence of enteric disease and the prevailing insanitary condition in urban areas are primarily due to the fact that large section of the urban population do not have a satisfactory arrangement for the segregation, collection, transport and disposal of human excreta. They have either insanitary bucket privy or they retort to wide-spread soil contamination and filthy environment through open field defection resulting into exposure of excreta to flies.

In order to conserve the environment, the most important single measure to improve the sanitation and health of the urban communities is the provision of sanitary water seal latrines for the entire populations.

1.1. Sanitary Position :

The national water supply and sanitary programme was launched in 1954 in India. However, from the experience of the last 35 years, it emerges that very few towns have sewerage systems. Most of them have only partial coverage As per national sample survey (N. S. S.) only 20% of urban house-

holds in the country use toilets connected to a sewerage system, out of which only 7% have exclusive use of toilets and the rest either share with other householders or make use of public toilets. 14% of the households have water borne latrines connected to septic tanks. Nearly one third of the urban population is served by bucket privies. Household have no latrines account for the remaining one third of the population. In nine of the major states and two urban territories the percentage of households without latrine is around 4% or over. Only the States have a percentage less than ten (10).

Even the cities where sewers have been laid, W. C. connections to be sewer line have not been made, so that the sewerage systems serves a very low percentage of the population compared to what it has been designed for.

1.2 Social Aspects

One of the most challenging problems India faces in its National Integration is the old age practice of total segregation of 22% of its population, who are known as untouchables. Even among the untouchables the lowest are known as Bhangis, who do the scavenging for disposing of night soil from bucket latrines by head and carrying night soil on head to a dispending depot. It is a very common practice and is practised in almost 90% of the cities and the towns of India.

There can be no more shameful crime against humanity. It allows a caste of people to accept the dirtiest and most hazardous occupation and then to condemn them untouchables. Prolong condemnation and then to neglect has brought total degradation of Harijan's from generation to generation.

Further, with the increasing population and urbanisation, the problem of disposal of human waste has become more acute. People often defecate in the open and create serious health hazards to themselves and to the community around them.

The problems has been solved in developed countries by introduction of underground sewerage systems and disposal of the waste into rivers, sea and lakes after the required treatment. This system requires a very huge long term investment. Also an abundant supply of water is needed. There is also danger of pollution of these surface waters.

With a view to achieve this objective, there has been continuous experimentation of development nightsoil disposal system.

Government has appointed an All India Committee under the Presidentship of Prof. Malkani in 1957 to prepare a scheme for putting an end to the practice of carrying night soils in baskets and buckets as headloads.

The committees made a comprehensive study of the problem and recognised that the best system for disposal of the night soil through mechanised modes was the flush latrines in low cost system.

The immediate concern of any programme of environmental sanitation in India, has therefore, to be the replacement of these primative latrines, which are serious health hazard and which vitiate the atmosphere of most town and cities. It is necessary, simultaneously to work out and enforce a programme of provision of installation of service latrines and the provision of the facilities for flush latrines individually as far as practicable.

Past efforts of latrines conversion by the Govt. were governed by an erroneous concept that sewerage system independable for installing flush latrines. But the main reason for the failure to utilise installed capabilities or to, use other costly systems or other waste water disposal systems such as septic tanks, has been the poor economic condition of the households.

In a poor country like India, where 40% population lives below the poverty line where about 60% of its urban population with a household of 5 to 6 persons has a monthly income of Rs. 400/- and below are spending not more that Rs. 10/- per month as house rent, it is not possible for them to go in

for costly sewerage systems. The only viable and feasible alternative is the low cost water seal latrines.

In most of the existing dry latrines, conditions are most unsatisfactory and many of the households do not have proper bucket tins and sufficient water for cleaning. The system of cleaning adopted is also very crude and unhygienic. The night soil baskets are also in a very bad conditions. The programme of conversion of such dry latrine into water-borne type is the only permanent solution to the problem.

In the cities were a large number of households do not have latrines, the inhabitants usually defecate in the open wherever they find space. This has created a big problem of sanitation and health hazard through diseases like cholera, typhoid, disentry and diahorrea that have infested many urban areas at one time or another.

The programme of providing sanitary latrines facilities is very important and necessary as is the Family Planning Programme and therefore due important and priority should be given to this programme.

2. ROLE OF VOLUNTARY ORGANISATION

2.1 Activities of Safai Vidyalaya :

Harijan Sevak Sangh embarked on one programme of "Bhangi Kasht Mukti" to emelicrate the working and living conditions of sweepers and scavangers and established in 1963 in Ahmedabad a Sanitation Institute for the implementation of the Safai Programme.

The objectives of this organisation are all set for the betterment of the living as well as working condition of the scavangers and sweepers. The Safai Vidyalaya has carried out socio-economical programmes for the benefit of the scavangers and the working section of the society engaged in Safai work. Initially the area of the operation was the State of Gujarat, but with the enthusiasm and keen interest envinced by the Principal, Safai Vidyalaya, Shri Ishwarbhai Patel, it has extended to other States and even to the neighbouring countries of India.

2.2 Training

The Vidyalaya is engaged to conducting training classes for Sanitary Inspectors, Overseers, Sanitary Staff of Municipal Local Bodies, Sanitary Workers in primary health centres in rural areas and the social workers engaged in Bhangi Kasht Mukti Programme. The training also includes the practical demonstration of improved gadgets as implements in sanitary work and the techniques of covers on of dry and sweeper cleaned latrines into low cost water seal latrines needing no scavanger services.

Every year, about 200 trainees visit Safai Vidyalaya for about three days. Practical demonstration, films, models, charts etc. helps the trainees in imparting the proper know-how of the technical aspects of sanitation. However, about 1200 Panchayat members add some Chairman of District and Taluka Panchayat have also taken advantage of the training programme imparted by Safai Vidyalaya.

3. ROLE OF VOLUNTARY ORGANISATION IN CONVERSION OF DRY LATRINES WITH THE HELP OF LOCAL BODIES AND GOVT. OF GUJARAT.

1. A systematic survey of existing dry type latrines and collection of other basic data.
2. Adoption of model bye-laws for enforcement of conversion of dry type latrines and statutory provision in the law.
3. Publication of various type of water borne latrines design and financial assistance extended to the latrine owners and loan to local bodies.
4. Production and distribution and arrangement of sanitary wares.

5. Training of Sanitary Inspectors, Overseers, Masons, Social Workers, as well as sweepers and scavangers at Safai Vidyalaya, Ahmedabad.

6. Preparing demonstration ground through film and seminars and meeting with Municipal President Officers of the Govt. time to time.

7. Prohibition of new dry latrines and permission for new latrine construction to be granted only for water borne type.

4. COMMUNITY PARTICIPATION

The success of the programme under taken by the institution depends upon its acceptance by the urban community concerned with the project under taken and the degree of social emancipation and economic advantage it confers on the scavanger community. The urban householder with a bucket latrine looks upon it as only a necessary evil.

Sociologically, he is conditioned to prefer a water seal privy provided the cost of conversion does not become an economic burden to him. In Gujarat and in Bihar, where the cost is subsidised the programme has received good community participation and it has made a spectacular way.

Sulabh International Patna has done unique work for public latrines for construction and maintenance by the organisation and also conversion of dry latrine into water borne latrines in Patna and other States also.

Institute of Rajasthan Local Self Government has also carried out a low cost sanitation programme for the municipalities.

Brief note on Training & Orientation ranging from One day to One month and visit specially for Low Cost Rural Sanitation and Bhangi Kasht Mukti Programme at Safai Vidyalaya from 1963 to September, 1986

Sr. No.	Total No. of Persons	Name of Institution / Organisation
1	2	3
1.	5835	Students of Basic Education and NSS from different colleges.
2.	3264	Sweepers, Scavangers and Members of Social Justice Committee of different district of Gujarat.
3.	4103	Sarpanches and Members of Villages Panchayats.
4.	1817	Sanitary Inspectors & Overseers.
5.	2469	Youth Members of Youth Clubs.
6.	1965	Students from Polytechnic.
7.	2409	Field Workers from NGO from various States.
8.	1101	Professors, Students & Leader of NSS of Universities.
9.	427	Rural Artisans, Masons, Technicians & Contractors.

1	2	3
10.	371	Engineers from Rural Housing Wings, Railway and various organisations.
11.	612	Students from MSW.
12.	258	Field workers of UCD scheme of Urban areas.
13.	420	Engineers, Doctors, Sociologists & Technicians from abroad.
14.	342	Govt. Officers from different State/Countries.
15.	4017	Women workers from Anganwadi training centre for training.
16.	646	Training from Labour Education Centre.
17.	951	CDPO's, Supervisors, BEE's ICDS scheme & UNICEF.
18.	269	Staff of soccial inputs.
TOTAL : 31276		

TOMATO SEED EXTRACTOR

Function :

Extraction of seed from tomato without washing the pulp.

Developed at : Tamil Nadu Agricultural University, Coimbatore

Specification

Type : Power operated, continuous extrusion type seed extractor

Overall dimension : 1,020 mm × 615mm × 1,050mm

Test Results

Suitability for products : Extraction of seeds for tomato fruits

Capacity : 60 kg (fruits)/h

Labour requirement : One

Power requirement : 2 hp electric motor

Economics

Cost of equipment : Rs. 6,000 (US $ 480) with electric motor

Cost of operation : Rs 15.70/q of tomato fruit

Salient Features :

The machine is intended for extracting tomato seeds without wasting the pulp material. In order to utilise the pulp, the machine components are made of stainless steel. The process of extraction could be done only in batches. Each batch of operation could be continued up to 10 minutes with a loading capacity of 10-15 kg of fruits. The seeds obtained from this unit can be further treated with acids for removing the fuzz and jelly like substances.

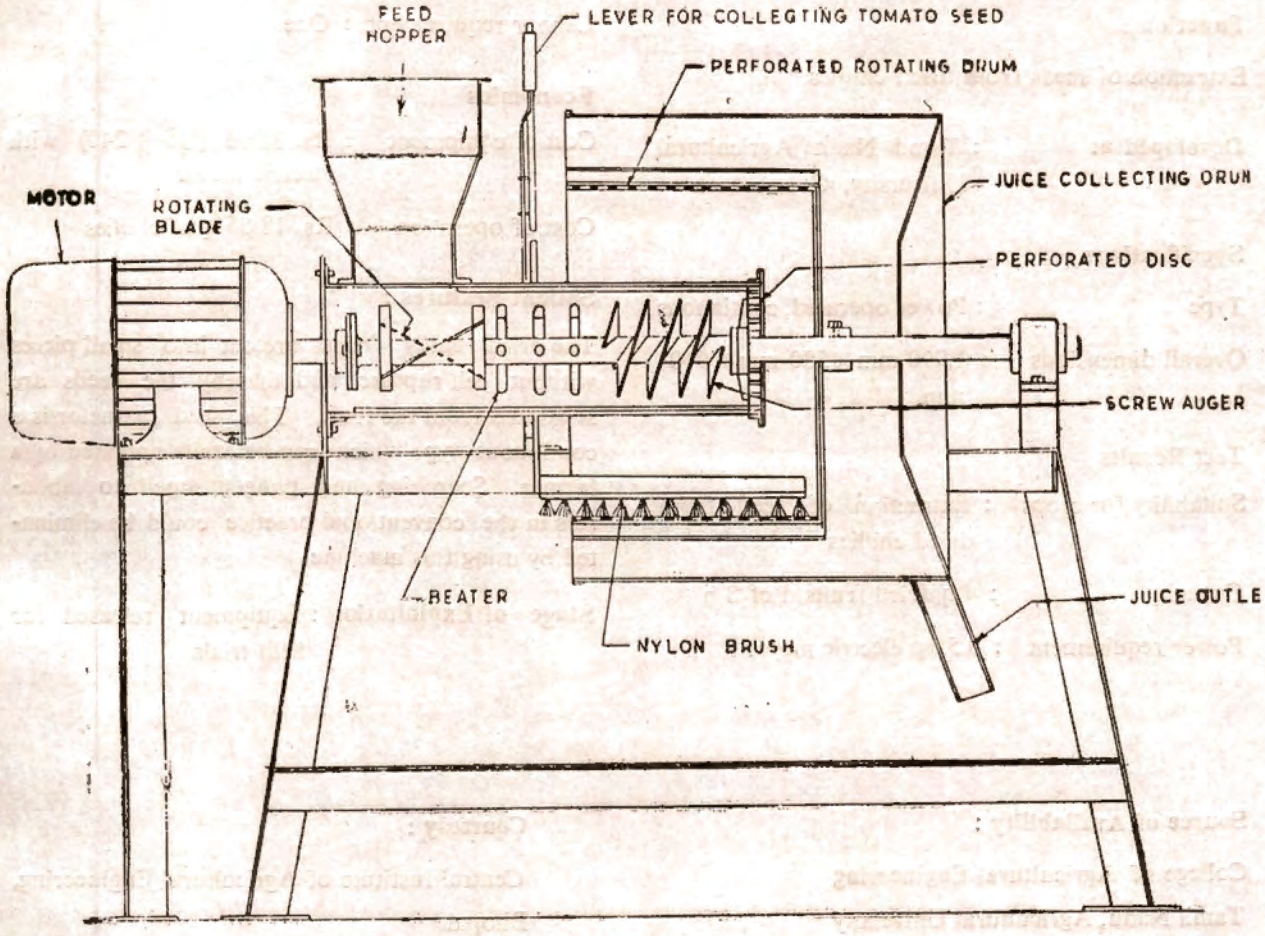
Stage of Exploitation : Equipment released for field trials.

Source of Availability :

College of Agricultural Engineering,
Tamil Nadu Agricultural University
Coimbatore-641003 (TN)

Courtesy :

Central Institute of
Agricultural Engineering.
Bhopal



TOMATO SEED EXTRACTOR

CHILLIES SEED EXTRACTOR

Function :

Extraction of seeds from dried chillies

Developed at : Tamil Nadu Agricultural University, Coimbatore

Specifications

Type	: Power operated, continuous
Overall dimensions	: 1,090 mm × 580 mm × 910 mm

Test Results

Suitability for crops	: Extraction of seed from dried chillies
Capacity	: 4 q dried fruits/d of 8 h
Power requirement	: 0.5 hp electric motor
Labour requirement	: One

Economics

Cost of equipment	: Rs. 3,000 (US $ 240) with electric motor
Cost of operation	: Rs. 18.85/q of chillies

Salient Features :

The dried chilly fruits are cut into small pieces without cell rupture and thereby the seeds are separated from the fruit. This seed extractor is a continuous type which can be easily operated by a farmer. Scorching and pungent smell to labourers in the conventional practice could be eliminated by using this machine.

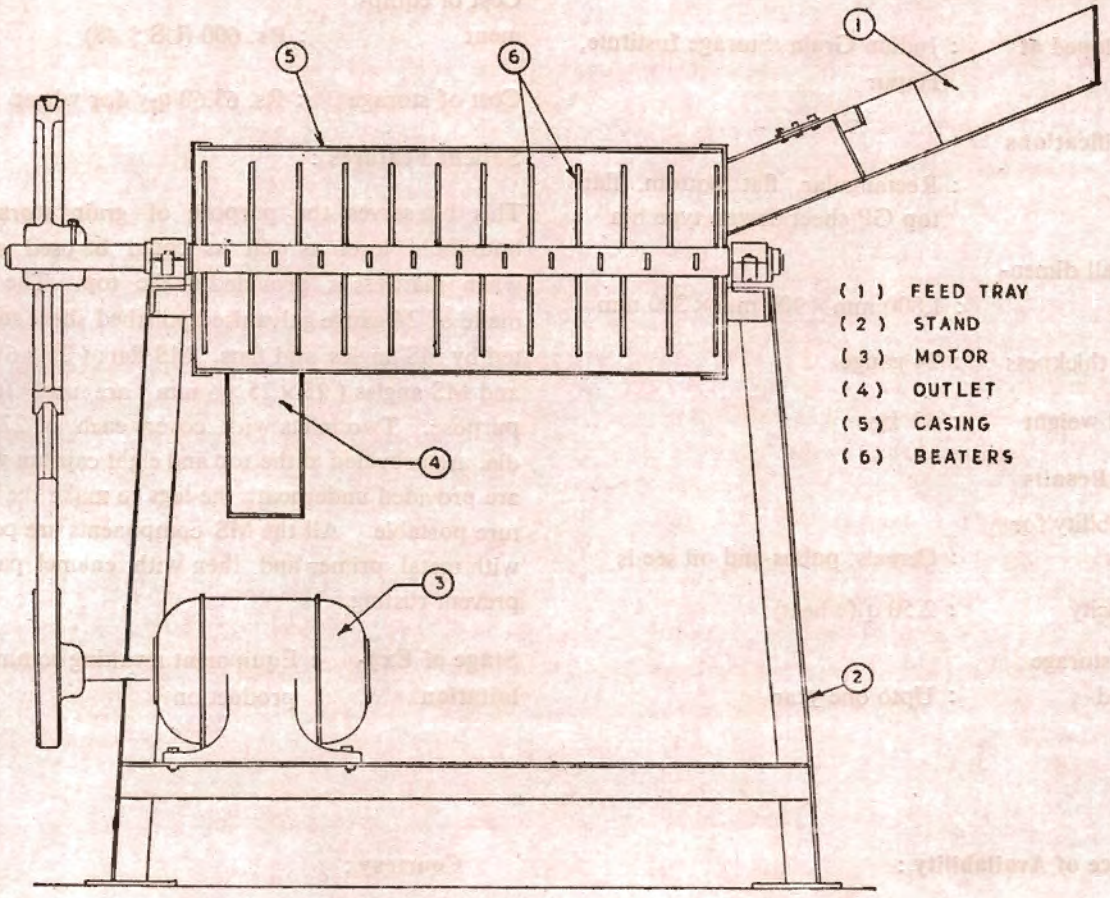
Stage of Exploitation : Equipment released for field trials

Source of Availability :

College of Agricultural Engineering
Tamil Nadu, Agricultural University
Coimbatore—641003 (TN)

Courtesy :

Central Institute of Agricultural Engineering, Bhopal



CHILLIES SEED EXTRACTOR

DOMESTIC METAL BIN (DEWAN TYPE)

Function :

Safe storage of food grains

Developed at : Indian Grain Storage Institute, Hapur

Specifications

Type	: Rectangular, flat bottom, flat top GP sheet dewan type bin
Overall dimensions	: 1,800 mm × 900 mm × 300 mm
Wall thickness	: 24 gauge
Total weight	: 65 kg

Test Results

Suitability for crops	: Cereals, pulses and oil seeds
Capacity	: 2.50 q (wheat)
Safe storage period	: Upto one year

Economics

Cost of equipment	: Rs. 600 (US $ 48)
Cost of storage	: Rs. 63.60/q-y for wheat

Salient Features :

This bin serves the purpose of grain storage at household level as well as could be used as bed when mattress is provided at the top. The bin is made of 24 gauge galvanised polished sheet supported by MS angles and flats. MS flats (25 × 6 mm) and MS angles (25 × 25 × 6 mm) are used for the purpose. Two inlets with covers each of 275 mm dia. are provided at the top and eight capstan wheels are provided underneath the legs to make the structure portable. All the MS components are painted with metal primer and then with enamel paint to prevent rusting.

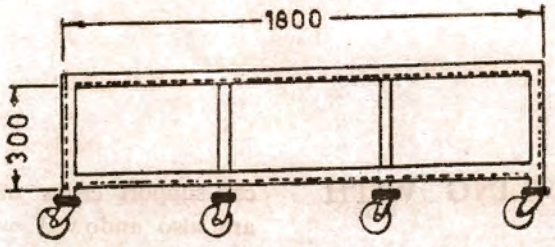
Stage of Exploitation : Equipment awaiting commercial production

Source of Availability :

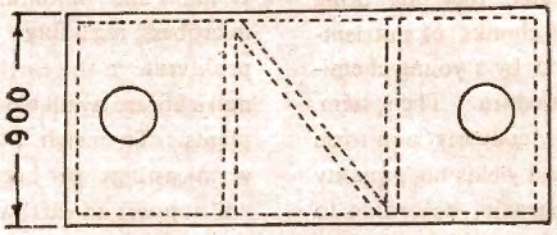
Indian Grain Storage Institute,
Hapur—(UP)

Courtesy :

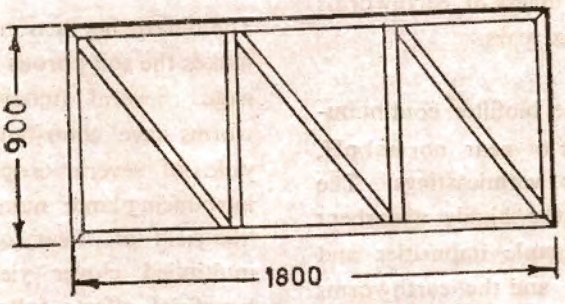
Central Institute of Agricultural Engineering, Bhopal



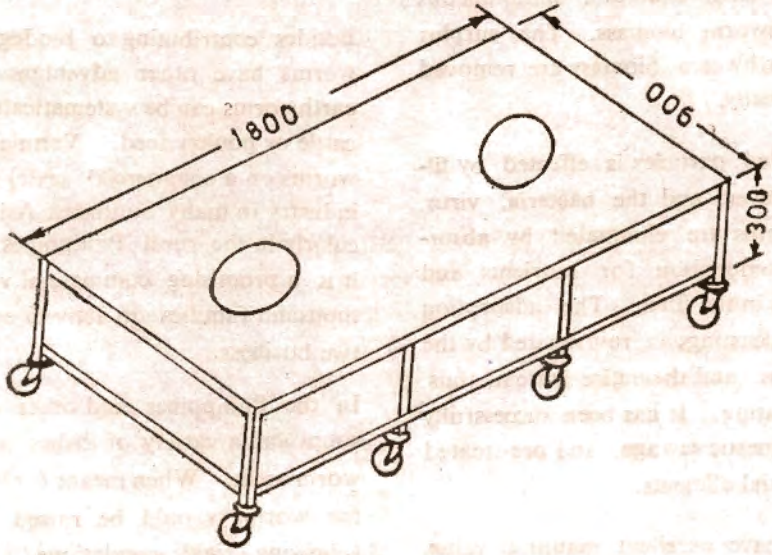
ELEVATION



PLAN



BOTTOM FRAME



DIMENSIONS IN mm

(DOMESTIC METAL BIN (DEWAN TYPE)

SPOT LIGHT

WASTEWATER RECYCLING WITH EARTHWORMS

A Simple system of wastewater recycling using earthworms, which churns out chunks of nutrient-rich 'castings', has been designed by a young chemical engineer from Pune, Maharashtra. The system, known as 'BERI Vermifilter', converts non-toxic wastewater into usable water and yields high quality manure and proteins in the bargain, according to Mr. Uday S. Bhawalkar, who has been conducting extensive research on the usefulness of earthworms and the biofilter for the last six years.

The earthworms packed in the biofilter continuously work on the effluent water of near normal pH, and clean up by recycling the vermicastings. The wastewater trickles through the highly absorbent mass of vermicastings, the organic impurities and pathogens get 'trapped there, and the earthworms help in regenerating the vermicastings by active feeding. Thus the system enables a simultaneous production of earthworm biomass. The surplus vermicastings and earthworm biomass are removed from the top periodically.

Removal of suspended particles is effected by filtration in the top layer, and the bacteria, virus, protozoa and helminths are eliminated by absorption, predation, competition for nutrients and due to other stresses in the filter. The adsorption capacity of the vermicastings is rejuvenated by the action of earthworms, and the entire system, thus, becomes self-regenerating. It has been successfully used to degrade domestic sewage, and pre-treated and non-toxic industrial effluents.

The vermicastings have excellent manurial value, with many beneficial traits attributed to them. With porous and moisture-absorbing qualities, they can support crops with fewer irrigations. They are also endowed with different enzymes and growth promoting substances besides being rich in vitamins and antibiotics. A number of beneficial microbes, including the nitrogen-fixing bacteria, proliferate in the earthworm droppings, and all the nutrients are available in a 'ready-to-use' form to the plants. To enrich the fields, about five tonnes of vermicastings per hectare should be added, and it will support an earthworm population of five lakhs in two months.

The burrowing action of earthworms in the field makes the soil porous improving aeration and drainage. Several studies have shown that the earthworms have contributed to significant increase-in yields of several crops. It has been proved that introducing large numbers into crop fields doubled 'the yield of wheat, quadrupled that of grass and multiplied clover yield tenfolds. A number of beneficial effects follow the activities of the earthworms.

Besides contributing to biodegradation, the earthworms have other advantages. The protein-rich earthworms can be systematically harvested to make cattle or poultry feed. Vermiculture (raising earthworms on a commercial scale) is a popular cottage industry in many Southeast Asian countries, particularly in the rural Philippines. In the U. S. also, it is a promising commercial venture, and several thousand families are actively engaged in this lucrative business.

In the Philippines and other countries, delicious soups and a variety of dishes are made with earthworm meat. When meant for human consumption, the worms should be raised in special mediums following rigid regulations. Not much care is required for livestock feed. Earthworms raised for food command a good market price and assure

high returns to the growers. When used in bio-filters to purify waste-water, they are generally fed to birds and animals as a protein-supplement.

BARC EVOLVES NEW RICE VARIETY

Researchers at the nuclear agricultural division of the Bhabha Atomic Research Centre (BARC), Bombay, have developed an improved high-yielding dwarf rice variety 'Hari'.

Originally designated as TR-RNR-21, 'Hari' is a selection from a cross between IR-8 and TR-5, according to a report in "Nuclear India".

IR-8 is popular dwarf high-yielding 'miracle' rice variety introduced from the International Rice Research Institute, Philippines. TR-5 is an irradiated dwarf mutant of a saline resistant variety SR-26-B. The new variety combines the dwarf and high yielding traits of IR-8 and the long slender grain without a white bulge of TR-5.

During trials at BARC, 'Hari give 54 and 19 per-cent higher yields during the kharif and rabi seasons respectively compared to the national check variety 'Jaya'.

It also gave 10 per cent higher yields over the average yields of seven other checks evaluated during tests at the Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad and under the All India Co-ordinated Rice Improvement Project.

'Hari' is a medium-duration variety that matures in 135 to 140 days and is erect, compact and non-lodging. The grains contain 7 per cent protein and their cooking quality is good, reports "Nuclear India". The variety also shows tolerance to several major pests and diseases and can be distinctly identified by its long and erect flag leaf that stands far above the panicle and remains green even after grain maturity.

CBARI DEVELOPS BLOCK-MAKING MACHINE

The Central Building Research Institute (CBRI), Roorkee, has developed a block-making machine which can make concrete blocks using any type and size of aggregate.

Machines available in India at present are not suitable for making blocks with aggregates larger than 12 mm in size. The new machine which can make standard sized blocks is currently being used to produce blocks $290 \times 190 \times 140$ cubic millimetres in size.

During extensive in-house trails, the machine produced 150 blocks every hour, which were stronger than those made manually.

The blocks can be compacted using the pressure-vibration technique. Two vibrators, operating at 0.5 kilowatts with a frequency of 300 vibrations per minute are used for consolidation. The total power consumption of the machine is only 3 kilowatts.

It is especially suitable for casting stone blocks of masonry, large aggregates and other normal concrete.

ELECTRICITY FROM ANIMAL POWER

Engineers from the National Institute for Training in Industrial Engineering (NITIE), Bombay, have developed an integrated system to produce electricity from animal power, which is otherwise being wasted today. The system produces sufficient energy for lighting two tube lights, running a table fan, a radio and a portable TV set working on 12-volts direct current.

The current produced is stored in conventional rechargeable 12-volts batteries used in automobiles. Designed for bullocks, it can be adapted to other animals such as the donkey, horse, mule and even a camel.

SPOT LIGHT

India has the largest number of drought animals-nearly 120 million, which only 80 million are in use. Of these the bullocks, which are also used ploughing and transporting agricultural produce form the la gest number.

A study by NITIE engineers found that the animals are generally under-utilised. An average pair of bullocks works only for 100 days in a year and therefore they can be used for generating electricity for the remaining 265 days easily. In rural areas a pair of bullocks costs six rupees a day for maintenance, and they are usually neglected on non-producing days.

Through the use of this technology, the farmers can utilise them for the whole year and get electricity to light their households in the process. In turn the bullocks can be looked after better. The farmers can also save on non-renewable berosene.

The engineers estimate that the average output per animal is about 0.5 Horse Power. So 80 million drought animals can produce 40 million H. P. Which is equal to a collosal 30,000 MW of electricity.

The basic cost of the system is about Rs. 15.000 and is expected to go down with mass production. This compares favourably with the cost of transmission and distribution lines as well as transformers to a remote village.

NEW ENERGY SOURCE

A British company has solved a long-standing waste disposal problem and discovered a new form of renewable energy.

The producers of sheepskins used in the making of coats and rugs have been storing natural fat extracted from the skins for the past six years because until now there has been no suitable method of disposing of it.

Now fat it being used to replace 20 percent of the company's tannery consumption of fuel oil. The skin grease is burned to produce steam for other production processes, including the degreasing cycle that recovers the skin fat.

For details : (*The Real Sheepskin Association, Harbour Cottage, Coast Road, Berrow, Burnham-on-sea, Somerset, England TA8 2QR*)

NEW COST-EFFECTIVE SOLAR PUMP

A Hyderabad-based engineer has developed a small solar pump which could prove handy for Indian farmers. Designed to work on a thermodynamic cycle, the solar pump can draw 2000 to 7000 litres of water per hour.

The unique feature of the solar pump is that it is extremely simple and can be manufactured in a small workshop in developing countries.
The pump uses a solar concentrator for collection of heat. It can also be modified to use other waste heats of low magnitude.

The solar pump is highly adaptable and can withstand severe field conditions. When produced in large quantities the small solar pump can be a viable option for small farmers even without the support of government subsidies.

Mr. Chandwalker (its designer) said that with proper research and deve lopment support, a model for field trials can be developed within two years and mass produced thereafter.

The solar pump prototype was displayed at the Hannover fair in May 1990.

EFFICIENT BIOFERTILIZER FOR RICE

Of the biofertilizers used for rice Azolla (Azolla pinnata), Blue green. algae (Composite cultures), Azotobacter (A chroococcum) and Azospirillum (A lipoferum) are especially recommended, Maintenance of Azolla in oppressive summer is, however

a major constraint. It requires more water and low temperature for growth. Maximum attention is needed for multiplication of Azolla in a nursery.

Blue green algae requires sunlight for good growth, a feature absent in samba/thaladi seasons. Its application is therefore, limited to somavari season only. Unless a location specific strain of BGA is developed, it cannot contribute to increasing rice yield. Azotobacter is a free living bacteria which needs oxygen and lots of organic matter for survival. It does not perform well in high nitrogen soils.

Azospirillum is considered the most efficient biofertilizer for rice. It is a symbiotic nitrogen fixing becterium which can associate itself with the plant root tissues. These tissues use the carbonaceous chemicals excreted by the growing rice roots and assimilate the atmospheric gaseous nitrogen and some growth—promoting chemicals ultimately used by the crop. Azospirillum can perform well in low oxygen conditions and in all soils, irrespective of the season prevailing. Experiments at the Tamil Nadu Rice Research Institute, Aduthurai focussed on (a) developing a suitable method of application Azospirillum (b) optimising the level of nitrogen requirement for maximum response and (c) evaluating the response of different rice varieties to Azospirillum.

Different methods of application of the biofertilizer to seed, seeding root or soil and a combination of all these were evaluated and found useful.

For seed treatment, two kg. peat based Azospirillum inoculent were mixed with sufficient water and those meant for planting in one hectare were soaked for 24 hours. The water was then drained and the seeds allowed to sprout prior to sowing in the nursery.

In seedling root dip at the time of transplanting, the roots of 25-day-old seedlings were dipped in 400 litres of water, which had two kg. of peat based inoculum, for 15-20 minutes.

For soil application two kg. of peat based inoculum were mixed with 25 kg. of well-powdered farmyard manure/sand and broadcast over a hectare in a thin film of water. Of these methods, seed+seedling root dip+soil application gave the highest grain yield of ADT 36 rice.

Azospirillum caused great yields only when it was applied with nitrogenous fertilizer (urea) at 75 kg. N/ha level. At 25, 100, 150 and 200 kg. N/ha levels, the response was not very significant.
The results stressed the need for the right quantity of fertilizer nitrogen for the best response from Azospirillum.

All the ruling rice verieties—ADT 36, ADT 37, IR 50, TKM 9, ADT 38, CO 43, IR 20 and White Ponni—responded well to Azospirillum when it was applied through seed, seedling root and soil with 75 kg N/ha level, Azospirillum in oculation to rice increased the grain yield besides reducing the fertilizer dose. When applied with 75 kg N/ha, an increase of 400 kg of grain was obtained against the normal practice of 100 kg. N/ha.

By just spending Rs. 60 ha for Azospirillum an increase in net profit of Rs. 1,500 can be had. It is a cheap and profitable biofertilizer for rice crop and growers will gain by using it.

G. Gopalswamy, Dr. V. Narasimhan
and Dr. A. Abdul Kareem
Tamil Nadu Rice Research Institute,
Aduthurai-612101

GALLMIDGE HAVOC IN SESAMUM

The gallmidge Asphondylia sesami, a mosquito-like insect, prevents the seed setting in sesamum capsules by forming gall-like buds in them. The size of the gall increases along with the intensity of feeding.

The larva feeds on the delicate internal fioral organs causing the corolla and stamen to degenerate. The feeding spawns : gall-like buds which do not develop into seed capsules. The infested buds wither and fall.

The gallmidge has a pink abdomen and lays eggs in batches of three to seven in newly formed flower-buds. A maximum of 20 eggs are laid per bud. The newly hatched larva starts feeding on the floral contents. There are four instars. The number of larvae per bud varies from three to 14. The fully fed one cuts a hole in the bud, drops out and pupates in the soil, five to seven cm underground. This is sometimes, done in the galls. The pupal period lasts about six days. At the end of sesamum's flowering season, the larvae enter the soil and diepause within the cocoons.

Following are some control measures :

1. The in-fested buds containing either larva or pupa should be removed and destroyed to reduce further incidence of the pest.
2. Staggered sowing of sesamum is to be avoided so that the period of availability of flowers for egg laying can be shortened This, inturn, reduces the number of generations and the infestation level.
3. Two rounds of spraying of endosulfan 0.07 per cent (2ml/l of water) one at 50 per cent flowering stage and the other at pod formation can aid in control.

R. K. Muralibaekaran, T. Senguttuvan and
S. Thangavelu
Regional Research Station,
(TNALD, Vridhachalam

USE OF PLASTICS IN AGRICULTURE

Plastics has an important role to play in the development and improvement of agricultural methods. Plastic materials have light weight, and ease of fabrication as compared to other conventional materials.

In fact the use of plastics in agriculture started quite some time ago. Today plastics find application in the following areas in the field of agriculture ; water management, packaging and storage of agriculture produce, canal lining etc.

It is observed that about 80% of the available water supply is used for agricultural purposes. If even a small amount of water can be saved from water used for agricultural purposes, this can be used for additional irrigation.

The usual techniques adopted for the prevention of loss of water in agricultural irrigation are :

- Reducing soil moisture losses in the field.
- Prevention of seepage during conveyance.
- Proper application of water.

In these techniques, plastics can certainly play a very important role.

It is though observed that not much of attention is being paid for minimising the loss of water. It may be that the concerned authorities are not fully aware of plastic material. Since water resources are becoming scarcer some sort of awareness is being generated by the concerned ministry.

It is seen that seepage losses of water is about 30 to 50%. There are though a number of material available for lining, they have their own advantages and disadvantages.

Experiments conducted by one of the agricultural Universities have indicated that with the use of polyethylene film of 400 gauge thickness and 2m width, has reduced the seepage from 19 to 3%. The film was laid 100 mm below the bed level of the channel and covered with soil.

Much work has been done in U. S. A. on canal lining using PVC and Polyethylene plastic film and butylcoated fabrics. However encouraging results

have been obtained by the use of PVC and polyethylene type of material. These materials are used as buried membranes and covered with earth to protect the plastic film from weathering and traffic.

The advantage in using plastic film is its light weight per unit area. Sheets are also available in long length and width, making it possible to line large canals with few joints in the lining material.

The irrigation and Power Research Institute at Amritsar has developed a suitable technique for existing earthen canals and channels. This technique is known as "Combination Lining" and in this, a low cost polyethylene film is laid at the bed of the canal or distributory agricultural production that can be expected from the use of plastic pipes. It is estimated that plastic pipes enable a farmers bring in an additional 30% of his land under irrigation, as a result of saving in percolation losses.

New water conservation systems such as drip irrigation and sprinkler irrigation have been ignored, in spite of their being highly efficients. They have yet to find large scale commercial usage.

The estimated consumption of plastic in this sector during 1982-83 was 2000 MT. The consumption seems to be saturated around 3500 MT.

The estimated potential of LDPE film in lining of canals distributories and water courses based on the existing system, works out to around 2,35,000 MT considering 400 gauge film. It is only recently some impact has been made and the responsibles have been encouraging, from the various state irrigation departments.

Plastic film are finding applications as lining material for lining of farm water ponds and water distribution canals. Plastic film of LDPE and PVC have received wide acceptance for these applications due to inherent flexibility, high extensibility and non-absorbent characteristics.

BACT-O-KILL FOR SAFE DRINKING WATER

BACT-O-KILL is a new domestic utility device designed and developed by the Indian Toxicology Research Centre (ITRC), Lucknow, to provide safe drinking water to homes.

The electronic device has been developed by a team of IIRC scientists led by Dr. P. K. Ray, to provide clean, disinfected water at a very low cost under the "Water Technology Mission Programme" launched by the government of India.

The scientists report that experiments conducted after treating the infected tap water in BACT-O-KILL gave "very encouraging" results.

They claim that all the bacteria are killed in 40-45 minutes of treatment. Analysis of the treated water showed that metallic contamination due to the presence of copper, zinc, lead and cadmium was reduced.

The operating cost of the new device is almost negligible, only 10 paise per hour per 10 litres of water. The treated water has prolonged microbicide effect, no health and electric hazards and the device does not require much maintenance, says a report by ITRC.

SUGARS FROM JUTE STICK

Jute stick, one of the abundant agricultural wastes in Eastern India, can be a potential source of sugars, according to a recent report.

Research at the Jute Technological Research Laboratories, (JTRL), Calcutta, shows that jute stick, on hydrolysis with concentrated sulphuric acid, yields significant amounts of reducing sugars. Extensive research is going on at JTRL to investigate the use of jute stick as a raw material for paper, particle board and by-products like oxalic acid, cellulose and hemicellulose portion into sugars.

Scientists at JTRL crushed the jute stick into tiny particles and extracted it with a mixture of alcohol and benzene for 10 hours.

They carried out primary hydrolysis of the dried extract powder by soaking it in concentrated sulphuric acid for a predetermined time at various temperatures. During this step, the cellulose moiety was converted into oligosaccharides, composite sugars containing two to eight monosaccharide units linked by glycoside bonds.

Their next step was secondary hydrolysis, where they diluted the suspension to 40 times its volume with water and refluxed for four hours. During this step, the oligosaccharides were hydrolysed into monosaccharides.

The experiments showed that the optimum conditions for acid hydrolysis of jute stick are : an acid concentration of 72 per cent, solid-liquid ratio of 1:4 soaking temperature of 40 degrees Celsius and soaking time of 30 minutes. The findings were reported by Dr. K. K. Sen, S. S. Reddy and S. K. Sen in the journal "Research and Industry".

The yield of reducing sugars from untreated jute stick was 59.8 per cent, and from delignified stick 64.7 per cent, which compares favourably with that from hardwood.

WHY SOLAR DRYING IS UNPOPULAR

The most common drying technique in developing countries is sun drying (i. e., directly exposing under the sun the materials to be dried on a pavement, platform or any open area). It is simple, cheap and convenient. However, the drying potential is reduced and this leads to mold growth and discoloration. Sun drying also requires that someone watches the crop to prevent theft or damage.

These problems can be reduced by using solar driers which operate by raising the temperature of air the by 10 to 30°C, thereby reducing the relative humidity. This air then moves through the drier by natural convection. High temperature, movement of the air and lower humidity increase the rate of drying. This means that the crop can be dried faster, the risk of mold growth and discoloration is reduced, dust and dirt are kept off the crop and a lower final moisture content can be reached.

Solar drying produces a higher quality product and less of the crop is lost. But why is it not popular with farmers ?

There are three main reasons why farmers do not like solar driers : capital is needed to build the drier, valuable ground area is used while the machine is in operation and extra labour is often required to load and unload them at regular intervals.

Supporters of solar drying say that these three disadvantages can be offset by the gain from producing a higher quality product. Farmers, however, may have a different perspective. Loss of quality does not necessarily mean a low-priced product. Some forms of reduced quality, such as poorer milling properties and minor mold growth are not easily identified. In this way, a lower-quality product can have the same value as a properly dried product.

There are, however, successful solar driers in Honduras used in drying cashew fruits and in Bangladesh for drying coconut. In both cases, the product is of relatively high value and large-scale driers are used. For high-volume, low-value crops, there seems to be little future for solar drying since the capital cost and higher labour requirements are not outweighed by sufficient increase in the value of the crop. Only large driers processing more than one tonne per day may have applications.

HYBRID POWER GENERATION SYSTEM

A hybrid power generation system that combines wind power, micro-hydro power and biomass

technology is being developed by a specialist team in Japan.

Intended for use by island populations or to supply power to medium-sized production plants, the system has the advantage of being able to operate in a wide variety of weather conditions. The test system is made up of a 10 kW wind turbine, a simple mini-hydro electric plant comprising three water wheels, and a biomass system where sawdust is burned to produce hydrogen and carbon monoxide to drive a turbine.

During periods of heavy rainfall this hydropower system works at maximum efficiency. In the dry season it ceases to work and power is supplied by the wind turbine and biom ss plants. Modification to the system to include a hot water boiler to use the lost heat could increase efficiency sizeably.

A regular supply of sawdust is a limiting factor. As the system will mainly generate electricity using wind and hydropower and biomass will supply only the deficiencies for the smooth flow of electricity, the consumption of large quantities of biomass can be avoided.

The team now envisages developing the hybrid system so that when running in parallel it would have a maximum rated capacity of 400 kW. It would comprise a 100 kW wind turbine, 200 kW biomass unit and 100 kW hydro-electric plant.

Perform best at about 350 degrees celsius. The tempature requires a heavier heating system, which lowers the power-to-weight ratio.

IMPROVED COKE OVENS

The Central Fuel Research Institute (CFRI), Dhanbad, has developed an improved version of its earlier fast-cooking, recuperative beehive oven popularly known as "Kumbraj" oven which is almost pollution-free.

The new oven incorporates some changes in the design which have made it more efficient.

The Kumbraj oven was designed by CFRI to successfully carbonise the low-volatile medium coking coals in the country. Improved carbonising conditions in the Kumbraj coke ovens totally eliminated the production of second quality coke which is very common in conventional beehive coke ovens.

The oven was expected to redeem the serious imbalance in the country's consumption pattern of the estimated 20,600 metric tonnes of medium cooking coal which are available in India.

The first demonstration plant which went into commercial production at Rajganj in August 1987, had eight ovens connected to a 55-feet high chimney.

But recent studies have shown that the economy and efficiency of the ovens improve considerably when a battery of 10 ovens with improved design are connected to a 80-feet high chimney. Accordingly, such a system was designed and commissioned in July 1989.

Necessary changes in the oven design were incorporated in the first battery installed in 1987, two more added to it and the chimney height was raised to 80 feet. The expanded first battery started coke production in March 1990.

The 10-oven battery was provided with 70 control dampers which ensure controlled flow of pre-heated primary and secondary air at appropriate places to achieve optimum heating of the oven for efficient coking of the coals. It can produce good-quality coke even from inferior coking coals which fail to produce acceptable coke when carbonised in some of the sophisticated "byproduct" ovens in steel plants.

Also, the capital investment required for installing Kumbraj coke ovens is less than 25 per cent of that required for installing the "byproduct" coke ovens of then same capacity.

A preliminary programme is being down up to conduct coking tests with the low-volatile, medium coking washed coals in Kumbraj ovens. If the coke

is found to be suitable, blast furnace trials with large quantities of Kumbraj coke oven coals would be undertaken in steel plants, says a CFRI release.

ENVIRONMENTAL BARRIER TO AGRICULTURE

An unfortunate feature of the recent debate on environment has been the preoccupation with issues where the protection of the environment comes into conflict with the rapid expansion of the economy. Environmentalists may prefer a definition of development which ensures that the demand to abandon large projects is not considered anti-development, but there is no denying that the acceptance of such demands will result in lower growth rates, Oddly enough, areas in which growth is threatened by environmental degradation have been pushed into the background. Of them, agriculture comes first.

Academic studies, especially over the last decade, have brought to light a number of specific cases where environmental degradation has led to a loss, of potential growth in agriculture. Deforestation has increased sedimentation thereby reducing the capacity of irrigation reservoirs. The degradation of land has led to a loss of potential foodgrain output. The government has not been unaware of these trends. There is little doubt that greater attention is now being paid to preserving the environment especially to issues like wasteland development.

Much of the emerging environment policy has, however, been conceived in isolation from the policy on agriculture. This is perhaps best seen in the fact that while several measures to control the expansion of wasteland have been identified, they have not affected the existing policy towards cultivation of land that cannot as yet be considered waste. The steps that are needed to arrest the rapid growth of wastelands are being introduced alongside a continuation of the government's policy of promoting the green revolution technology in agriculture. Implicit in this approach is the assumption that environmental degradation is not directly linked to decisions taken in agriculture ; that the interaction between agriculture and the environment is, at most, of only peripheral significance.

Some recent trends in land utilisation suggest that this assumption may be much too facile. Indeed, official data on land utilisation suggests the existence of a cycle of environment-agriculture interaction which, if it is not brought under control, can cause lasting damage to agriculture.

The land use patterns in the first half of eighties reveal a distinct shift from the first half of the previous decade. The pressure on land has seen a decline in land listed in official data under the categories : not available for cultivation, permanent pastures and other grazing land, land under miscellaneous trees and culturable waste. This decline is quite significant with the average for the first half of the eighties being over five million hectares below the average for 1970-75. But the decrease in these categories has not led to a corresponding increase in the net sown area. And a major reason for this is that fallows have increased with the average for the first five years of the eighties being close to two million hectares greater than the corresponding period of the previous decade. Even as the pressure on land has forced farmers to quite literally seek fresh pastures, they are simultaneously being forced to leave more of their land fallow.

This pattern suggests the existence of a downward agriculture-environment spiral in operation The pressure on land forces the farmers to encroach common lands. The resultant impact on the environment contributes to the degradation of land forcing farmers to leave an increasing portion of their land fallow. This in turn increases the pressure on land resulting in further efforts at trying to get previously uncultivated land under the plough. If this spiral continues uninterrupted, it could even lead to a decline in net sown area. Indeed, such a spiral may well explain the decline in net sown area in states like Bihar.

Estimating the exact magnitude of this spiral will of course require more detailed statistical analysis. All the more so since land use statistics are not the best data put out by official agencies. But there are at least two reasons why the pattern suggested by the evidence of the land use statistics is very likely to survive closer academic scrutiny. First, these trends at the macro level are quite consistent with observations of several field studies. And secondly, the existence of this cycle is also reflected in the different responses of Indian agriculture to the drought of 1987-88 and that of 1979-80. In the later year, the tendency to leave land uncultivated was more pronounced with gross area under foodgrains and oilseeds being over two million hectares less than in the previous drought year.

Far from helping Indian agriculture break out of this trap, some aspects of the present technological package may in fact accentuate the crisis. For instance, it is now fairly well established that the green revolution technology has resulted in increasing the costs of cultivation. In a situation of high costs, the decline in yields that a farmer can absorb is very limited. He is thus forced to protect his high yield or not cultivate at all. Not surprisingly, therefore, in the drought affected kharif season of 1987-88 the area under foodgrains declined by over six million hectares, but yields in fact increased marginally to 996 kgs per hectare, compared to 985 kgs in the previous year. In other words, the higher costs of the green revolution technology cause more land to be left fallow, hence hastening the movement down the spiral.

Breaking out of this pattern will thus call for changes in several aspects of the current policy package for agriculture. To begin with, it must be recognised that the green revolution technology which provided such spectacular results under conditions of assured irrigation, has severe limitations in dryland agriculture. In such areas, the need is for a technology which, instead of assuming the supply of adequate water, makes the best use of whatever water is available. This will in turn require suitable modifications in the role of fertilisers and other chemical based inputs in agriculture. The success of such a technology will improve yields on drylands and hence make the cultivation of relatively poorer quality land viable.

The changes that are required are, however, not confined to the level of the input decisions of the individual farmer. The movement down the spiral can also be broken by improving the quality of land. It is here that the demands of environmental protection and agricultural production coincide. To cite just one example, afforestation helps spoil conservation and thus has a positive impact on yields.

Such comprehensive integrated technology packages are not entirely unknown. States like Karnataka have experimented with implementing such technologies. But these technologies have largely remained at the experimental stage. The official explanation for this lack of progress is the inability to raise adequate resources.

There are, however, several reasons why the resource constraint for such technologies may be overestimated. The government has attempted to implement these technologies largely on the basis of its own resources. Such an approach is clearly unrealistic in the present Indian rural scene. If the green revolution technology spread as rapidly as it did, it was because a major part of the resources were provided by private investment in irrigation, mechanisation, fertilisers and high yielding varieties.

In implementing the new dryland technology little attention has been paid to linking individual beneficiaries with the required private investment The potential to get the beneficiaries to contribute to the implementation of this technology clearly exists. For instance, one component of this technology is to build a farm pond at the lowest point in a particular watershed. The entire watershed then acts

as a catchment area to supply the farm pond. If the farmer on whose land the farm pond falls is to get the benefit of this resource by, say, setting up a nursery, there can be no objection to asking him to meet at least a portion of its costs.

Even for those aspects of this technology such as contour bunding where the beneficiary is not an individual but all the farmers within the watershed, it should be possible to get the beneficiaries to contribute. A variety of measures ranging from betterment levies to the creation of cooperatives can be considered.

At the present moment, it is undoubtedly true that the new technology still raises a very large number of unanswered questions. But if the environmental barrier to Indian agriculture is to be overcome, the time may well have come to concentrate, on finding the answers to questions, rather than continuing to blindly enforce a technology which has outlived its utility.

C.D.R.T., NEWS

★ Two Seminars on Energy Conservation of 2 days duration have been organised for Bharat Pumps and Compressors Limited on 19th & 20th July and 30th & 31st 1990. The venue for seminar was Bharat Pumps & Compressors Limited, Naini, Allahabad and they were organised by C. D. R. T., I. E. R. T., Allahabad.

★ Rural Technology Survey Project sponsored by council of Science & Technology, Lucknow U. P. and taken up by C. D. R. T., I. E. R. T., Allahabad is near completion. The Rural Technology survey of sixty villages in six Districts of Uttar Pradesh has been done and the project report through computerised compilation of data is under process.

★ Demonstrations of Paddy Transplanter was carried out by C. D. R. T., I. E. R. T., Allahabad in village Andhawa, Sarpatipur & Imaligaon of District Allahabad and village Suketi of District Fatehpur in last Monsoon season. The demonstrations were effective and successful.

BIOGAS AND MANURE

An "International Course on Biogas and Manure" organised by Renewable Energy Centre (REC), College of Technology and Agricultural Engineering, Udaipur in collaboration with Department of Non Conventional Enerny Sources (DNES), Govt. of India, New Delhi, will be held from 22nd September to 26th October' 1990.

The course will be aimed at practical construction of various designs of biogas plants for individual household use. The programme is meant for persons having interest in the biogas technology or involved in the planning and implementation of biogas programms in their countries.

For further information contact :

Dr. K. C. Khandelwal
Director, D. N. E. S.,
Block No.—14,
C. G. O. Complex,
Lodi Road,
New Delhi

DRAUGHT ANIMAL POWER AND HUMAN ENERGY SYSTEMS

Central Institute of Agricultural Engineering, Bhopal in collaboration with ICAR, DNES and UNICEF will organise an "International Seminar on Draught Animal power and Human Energy Systems" from December 11-14, 1990 (provisional dates) at CIAE Bhopal. The aims of the seminar are :

* To review the state of art of R & D.
* To acquaint participants with the improved animal drawn and human operated equipments for various farm and domestic operations.
* To acquaint with findings of egronomics studies on animate sources of power to improve man animal machine system efficiency.
* To review the role of draught animal power and human energy in village eco-system.
* To acquaint participants with the socioeconomic and management aspects of draught animal power and human energy.
* Instrumentation for DAP and human energy research.
* Standards and methodologies for testing and evaluation of animal drawn and human operated equipment.
* To provide opportunities to participants to see various types of improved animal and human operated equipments.
* To identify gaps in R & D on DAP and human energy, and
* To develop strategies for extension and popularisation of proven implements.

The technical session will include the topics : Research on increasing draftability of draught animals, Recent developments on animal drawn equipment. Instrumentation for research on DAP, Utilisation and Economics of using draught animals, Planning and management of DAP, Improved hand tools and manually operated equipments and Egronomics of hand tools.

For further Information contact :

Dr. N. S. L. Srivastava
Director,
Central Institute of Agricultural Engineering,
Nabibagh, Barasia Road,
BHOPAL-462 018 (M. P.)

NATURAL HAZARD REDUCTION

The Institution of Engineers (India) will organise a "World Congress on Natural Hazard Reduction" at New Delhi from February 1-5, 1991. The congress will cover four sub-themes : Impact of natural hazards, Scientific and technical application

useful in mitigating the effects of natural hazards, Hazard management and preplanning and social strategies and socio-economic aspects.

For further information contact :

Mr. M. R. Majumdar,
Organizing Secretary,
World Congress of Natural Hazard Reduction,
The Institution of Engineers (India),
8—Gokhale Road,
CALCUTTA-700 020

DURABILITY OF REINFORCED AND PRESTRESSED CONCRETE STRUCTURES

MBM Engineering College, Jodhpur, will organize a "Conference on Durability of Reinforced and Prestressed concrete Structures" from January 18–19, 1991.

The purpose of the conference is to provide an international clearing house for information on durability of reinforced and prestressed concrete structures.

For further information contact :

Prof. S. Divakaran
Director,
International Conference on Durability of Concrete,
Department of Structural Engineering,
MBM Engineering College,
JODHPUR-432 001.

AGROECOLOGY PROGRAM

Apprenticeships in Ecological Horticulture are available from the Agroecology Programme at University of California. The 6 months apprenticeships from April 1st to September 27th, 91 will emphasize hands-on learning of composting, cultivation of flowers and vegetables, pest and disease control, and other techniques of organise farming.

For further information contact :

Agroecology Programme,
University of California,
Santa Cruz,
CA 95064 U. S. A.

DISASTER MANAGEMENT

Center on Integrated Rural Development for Asia and the Pecific (CIRDAP), Dhaka in collaboration with UNCRD / JICA, will organise a "Country Seminar on Disaster Management", from January 20–24, 1991 at Dhaka.

For further information contact :

Centre on Integrated Rural
Development for Asia and
the Pacific (CIRDAP),
Chaurdi House,
17, Topkhana Road,
GPO Box 2883
Dhaka–1000
BANGLADESH.

TRAINING OF RURAL WOMEN IN POST–HARVEST LOSS PREVENTION

CIRDAP's link Institution of Bangladesh, India, Philippines, Thailand and Sri Lanka will organize a "National Workshop on Training of Rural Women in Post–Harvest Loss Prevention (Phase –I)", in December at their centres.

For further information contact :

Centre on Integrated Rural Development for
Asia and the Pacific (CIRDAP),
Chameli House,
17, Topkhana Road,
G. P. O. Box 2883
Dhaka 1000
BANGLADESH.

RENEWABLE ENERGY : ENVIRONMENT AND DEVELOPMENT

Energy plays an important role in development and human welfare. With rapid growth in population and industrialization, energy in its various manifestations has become one of the most critical factors for substances and society. A direct correlation exists between economic development and energy consumption. The situation on the energy scenario is not very bright for the developing countries in particular, India being no exception in this respect. India represents complex picture of various renewable and non-renewable energy meeting a variety of demands. Inspite of its well recognized potential in respects of forms of energy e.g. hydroelectric, solar, wind, biomass, ocean etc. the country continues with the dismal record of its per capita commercial energy consumption being less than one tenth of the world average. It is a well accepted fact that the country must go through a massive effort in the future to utilise every exploitable alternative energy sources upto the highiest extent if it is to accelerate the speed of its economic growth. The essential prerequisites for this are to have a clear picture of the potential existing on various fronts to identify thrust areas and to choose the most appropriate ones among the various options available. This book is written by the leading energy expert of India, Dr. Maheshwar Dayal.

The book provides directions for development work in the area of renewable energy. The book is not a collection of technical data. It provides useful information about the techniques to investigate its potentials.

The book is divided in three parts. Part I deals with biological sources of energy and is subdivided into energy from biomass, biogas and improved wood stoves. A detailed coverage of areas related to energy from biomass, other biomass products, and conversion process is followed by two sections on biogas and improved wood stove emphasising on India's national programmes in these areas, sponsored by the Department of Non-Conventional Energy Sources, covering technology development, its commercialization and utilization and all other aspects.

Part II highlight direct use of solar energy and discusses the state of art in active and passive uses of solar thermal energy and photovoltaics. The Indian programmes in these areas are well covered. Part III discusses the other energy technologies, including wind, energy from falling and flowing water (mini and micro-hydel), hydrogen energy, oceans and geothermal energy.

"Economic Aspects of Renewable Energy Systems" gives information to the policy level decision makers on the related economics of technologies as recent studies conducted by various agencies and by individuals. At last recommendations to identify economically & strategically suitable technologies to specific situations are given. The concluding chapter entitled 'Global Warming and Climate Change' gives a warning about the disastrous consequences that are bound to follow indiscriminate use of energy its some traditional forms.

Renewable Energy : Environment and Development by Maheshwar Dayal, Pub. by Konark Publishers Pvt. Ltd., 4-194, Main Vikas Marg, Delhi—110092, Pp XI+244.

WORLD FOOD PROGRAMME : 1990 FOOD AID REVIEW

Food aid is a form of development assistance. To use food aid to combat poverty and hunger, it should be made part of the national development plans and programmes specifically aimed at those. For many millions of people living in the third world or developing countries properly focused

food aid can help to implement the four key elements of development strategy : accelerating growth, supporting human development, combating poverty and safegaurding the environment. These are the views highlighted in the World Food Programme's 1990 report. This report is a global review of food aid with an overview of the World Food Programme's work in 1990.

This report is divided into six Sections. First section shows the activities which had overcome Hunger and Poverty. Second section deals with the additional development actions started with help of assistance. The case of fisheries development in china and assistance to sub-Saharan Africa is quite interesting one. Section 3 and 4 deals about assistance to refugees/displaced people and emergency help. As started, nearly 8.4 million people in 24 countries received emergency food assistance through WFP in 1989. WFP is one of the major Transport users. The section gives an idea about the importance of transport to WFP and its own effort in this field.

Section 6 discusses total resources available to WFP for the 1989-90 biennium had reached nearly $ 1.4 billion, including approx. 3.6 million tons of food. Non-food resources are always ancillary to the programme's main activity-providing food aid. The report contains various annexes and statistical tables.

This 1990 report combines a global review of food aid with an overview of WFP's work in 1989. Previously these details appeared in separate reports. It looks nice and handy.

The report takes both a retrospective look at food aid in the present and the prospects for food aid in coming years.

World Food Programme : 1990 Food aid review ; World Food Programme, Via Cristoforo Colombo 426, 00145 Rome ITALY ; 84 Pages plus tables.

IREDA NEWS

Indian Renewable Energy Development Agency Limited, New Delhi (IREDA) has recently launched its periodical at 6 monthly interval entitled IREDA NEWS. It provides features like case studies, technology development and commercialisation news, manpower development programmes, marketing of New and Renewable Sources of Energy (NRSE) products, feed-back from entrepreneurs and consumers of NRSE products.

The newsletter enjoys the association as, member of its advisory committee, some of the countries leading experts in the various sub area of NRSE.

This newsletter fills an important gap of information dissemination in the field of commercialisation of NRSE technologies.

It is therefore an important step taken by IREDA and will be welcomed by all those concerned with rapid development and adoption of NRSE system and devices to meet the national goals of adequate energy supply for all.

For details please write to :

Editor 'IREDA News', IREDA
3 Ring Road, Kilokri, Opp. Maharani Bag
NEW DELHI-110014.

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4.	Futurama	—	(Forthcoming Events : Training Programmes, Seminars, Symposium, Workshop etc.)
5.	Book Bag	—	(News on Books and Publications)

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Centre for Development of Rural Technology
Institute of Engineering and Rural Technology
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1. The complete manuscript should be written in English and the desired order contents of Title, Abstract, List of symbols, Main Text, Acknowledgement, Reference and Appendices. The Standard International System of Units (SI) should be used.
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3. Two copies of the manuscript and illustrations (one set original) should be sent to the Editor.
4. The title should be brief (maximum of 150 characters including blank in between words or other non-alphabetical characters) and followed by the author's name affiliation and address.
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