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Editorial

Lot has been said about developing rural technology and its dissemination amongst masses. But one of the major impediments, besides those of a clear policy and adequate resource allocation, is that of lack of decentralised decision making apparatus. An apparatus which really devolves power at the grass root level, more precisely the village or Gram-Sabha level and not the sterile, media-backed and much talked about Panchayat Raj which at best has been a cropper. Whatever attempts have been made through other so called decentralised strategies have also not yielded expected dividends. They have rather decentralised some well-known problems and waste to a great extent. Drawing cue from successful models prevailing in certain European countries, the administrative set-up of villages, prevalent in ancient India, and the present day realities-one of the possible and pragmatic alternative could be formation of village councils of five person with one nominated member each from amongst big farmers, artisans, landless labourer, small & marginal farmer and traders/business persons. Each of these groups will be small enough to meet at a place and elect on the spot their representative to the council. The Council should be entrusted with development planning, creation and maintenance of community assets/infrastructural facilities etc., through annual block grants sanctioned for this purpose. Details of council's functioning can be worked out. A complete scheme can also be evolved for human resource development and awarenes generation, in a low-cost manner, for the members of the village-council so as to make them strong change-agents/instruments for development. The average population to have such a council should not exceed 1000. Hence for bigger villages suitable modifications, in the proposed system, can be devised for example grouping of hamlets in a way as not to exceed the above population size. A pilot trial can always be made in one selected districts in each state and based on the performance feed-back a really effective rural development administration system can be evolved.

Publication List 1993

1. Rural technology : Report of National Seminar, 1981, 20 papers on Rural/Appropriate Technology.
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RURAL DEVELOPMENT MODEL BASED ON INTEGRATED ENERGY SYSTEMS - A CASE STUDY OF SUCCESSFUL STORY

R.C. Maheshwari[1], R. Singh[2], Harpal Singh[3], C.P. Bohra[4], K.C. Pandey[5]

1. ICAR Krishi Bhawan, New Delhi
2-5. Central Institute of Agricultural Engineering, Nabi Bagh
Berasia Road, Bhopal-462 018 (MP)

In this paper the authors has discussed about rural development model based on integrated system. This system was developed and implemented in Islamnagar Village Distt. Bhopal. They have shown the steps through which this model was implemented.

INTRODUCTION

Agriculture is the back bone of Indian economy. About 70% of its population lives in rural areas mainly dependent on agriculture. In order to meet food, feed, fuel and fibre requirement of ever increasing population, it is essential to develop a system through which most of the needs of the people are met from the resources available within the village ecosystem to the possible extent, without disturbing its environmental and ecological balance.

Many programmes/plans have been developed and implemented for raising socio-economic status of the rural people, but most of them have not made any remarkable indent. The most logical and scientific approach of rural development should be based on management of natural resources on scientific and sustainable basis considering the whole ecosystem in its totality.

Dr. M.S. Swaminathan, Former, Director-General, IRRI, Philippines in his Inaugural Andrew Sherman Memorial

lecture on the "The Emerging Global Agricultural Scenario" at the Royal Society of Arts, London in April 1987 has advocated for a seven point action plan for achieving sustainable security in the world. These are, (i) local level code for sustainable and equitabler use of environmental systems (ii) Sustainable livelihood security for the poor (iii) Symphonic agricultural systems (iv) Application of science and technology (v) Knowledge and skill sharing (vi) Resource mobilisation and utilisation and (vii) Political commitment and accountability.

Since 1981 efforts are underway at Central Institute of Agricultural Engineering (ICAR), Bhopal to put the above kind of plan at a very micro-level i.e. at village level in the district of Bhopal. While formulating model to make self-reliant in food, feed, fuel and fibre from its own resources the Gandhian concept of village development was also kept in view.

Keeping in view the above facts a rural development model based on bio-energy sources was developed and implemented in village Islamnagar of Bhopal district under an ICAR Operational Research Project on Integrated Energy and Nutrient Supply System.

DESCRIPTION OF MODEL

The developed rural development model consists of following steps:

1. Energy census and resource assessment survey of the adopted village for studying the extent of self-sufficiency /deficiency in food, feed, fuel and fibre and also the extent of recycling/utilisation pattern of agricultural biomass in the village ecosystem.
2. Soil survey and land use planning of the village for preparing soil map as well as land use map.
3. Efficient soil and water management planning for sustainable agriculture development.
4. Planning for making village self-reliant based on renewable energy sources.
   (a) Domestic sector planning for meeting cooking energy needs involves—
   - Biogas, solar cooker and improved chullah
   - Biomass plantation

- Photovoltaic lighting.

(b) Planning for sustainable development in production agriculture involves—

- Crop planning based on suggested land use and available water resources to achieve self-sufficiency in cereals, pulses and oilseed production as well as to generate higher income to the farmers.
- Use of biodigested slurry and other organic manures as supplement to chemical fertilisers for meeting plant nutrients.
- Adoption of improved crop cultivation technology and planning for selective farm mechanisation with handtools and implements for increasing productivity of land, labour and animal in the village.
- Improved soil and water conservation measures such as hydraulic ram lift irrigation system, water harvesting pond, drainage, improved tillage practices for insitu moisture conservation, wind pumps, etc.
- Development of fish culture/ farming at village level.

(c) Planning for animal raising involves—

- Better use of pasture land/ wasteland of the village.
- Maximising grass and fodder production with the help of improved grass/fodder cultivation technology and use of high yielding varieties.

(d) Planning for post harvest operations involves—

- Setting up agro processing complex and rural industries at village level.

5. Implementation of various development programmes and their monitoring.
6. Simulation of the model for energy flow in village.
7. Formulation of co-operative society for maintenance and management of resources.

8. Socio-economic survey for assessing the impact of introduced technologies on the productivity of land, animal, machine and human being.

SELF-RELIANT DEVELOPMENT MODEL IMPLEMENTATION

Step-1: Energy Census and Resource Assessment Survey:

Energy Census and Resource Assessment Survey of the adopted village was carried out in 1981 to assess the energy use pattern by different categories of farmers for production agriculture, post harvest operations, cattle raising and domestic activities (Maheshwari et al 1981). The survey revealed that village was surplus with regard to cereals, vegetable, sugarcane and milk. However, there were deficit with regard to fuelwood by 20% (98.8 tonnes) cattle feed by 30% (812 tonnes), oil seeds by 71% (23 tonnes) and pulses by 32% (7.2 tonnes). Figure-1 illustrates the total energy and material flow in the village ecosystem at a glance. Figure-2 depicts utilization of solar energy and its flow in village ecosystem.

Step-2: Soil Survey and Land Use Planning:

A detailed soil survey of the village Islamnagar was carried out by the National Bureau of Soil Survey and Land Use Planning Nagpur (an ICAR Sister institute) following the procedure laid down in Soil Survey Manual (1970) and soil map consisting seven soil series was prepared. On the basis of soil survey, the suggested land use map was also prepared.

Step-3: Planning for Self-sufficiency:

These two survey became the main basis for planning of various aspects of village development. This plannings for making village self-reliant with respect to food, feed and fuel were carried out as under:

3.1 Planning for self-sufficiency for fuelwood

The village consumes 474 tonnes of wood and 448 tonnes of cowdung cakes annually for cooking. Besides augmenting the fuel wood supply, attempts have been made to reduce the demand of fuelwood

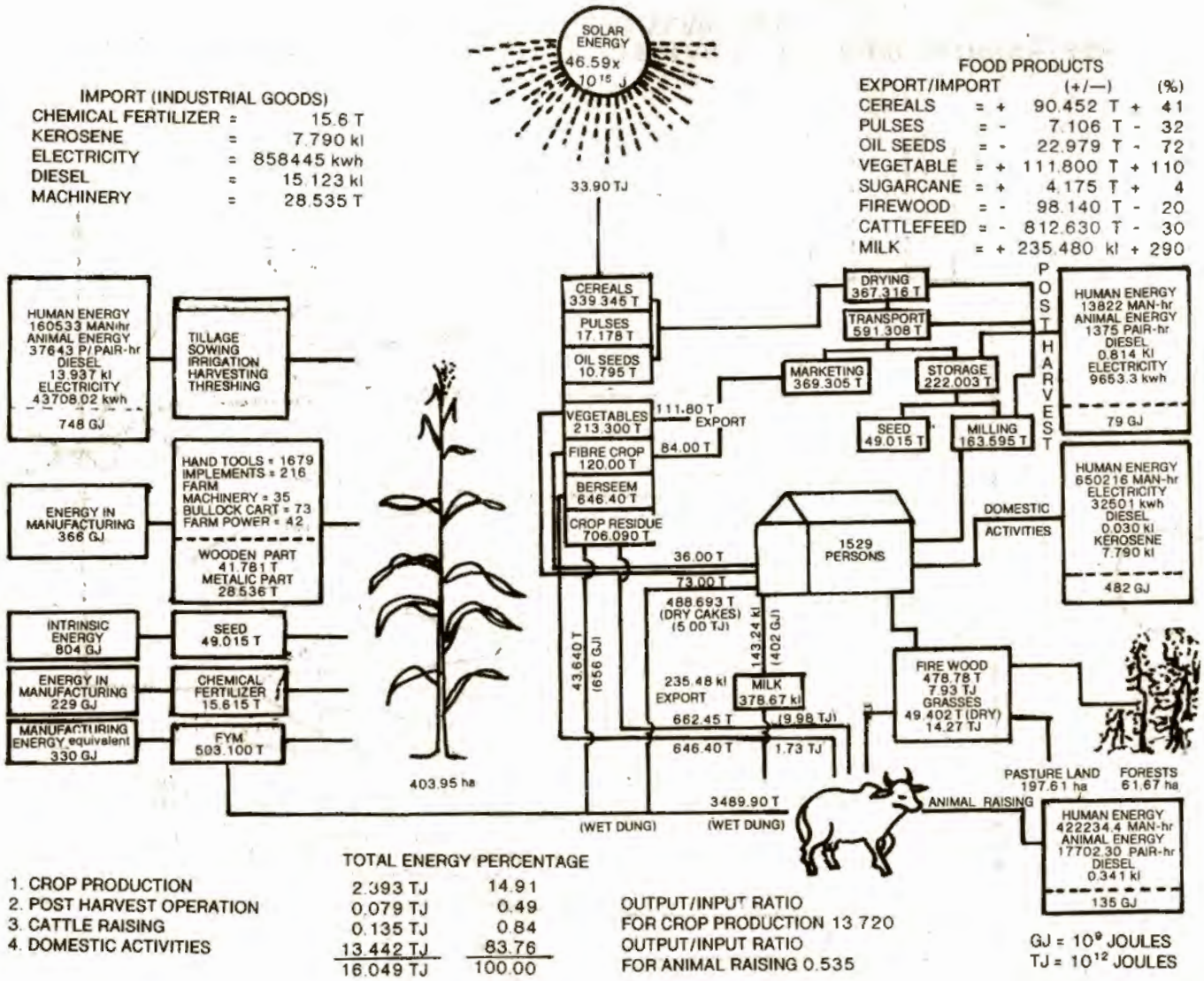

FIG. 1. ANNUAL ENERGY FLOW IN VILLAGE ECOSYSTEM

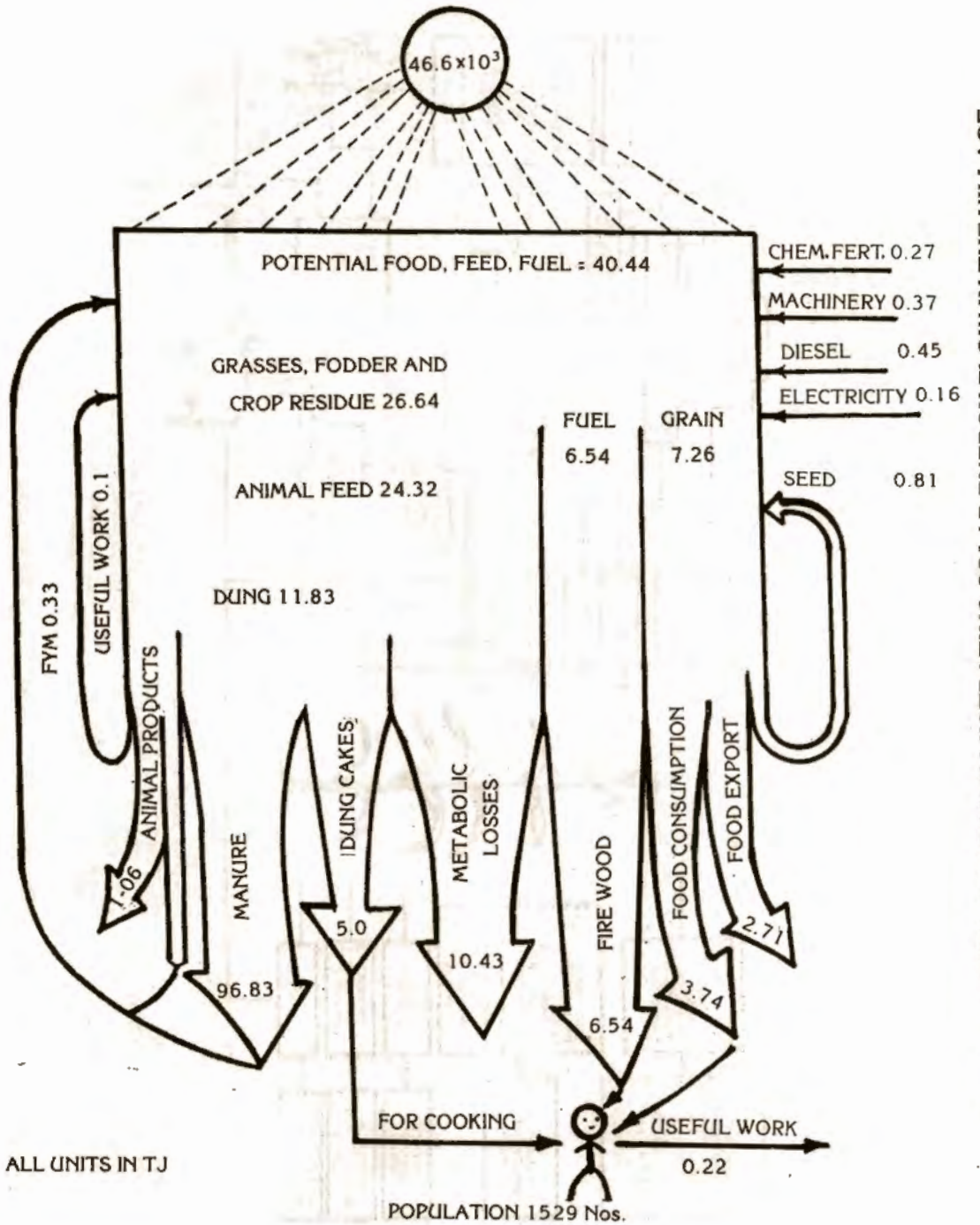

FIG.-2. SANKEY DIAGRAM ILLUSTRATING SOLAR ENERGY FLOW IN THE VILLAGE ECOSYSTEM (BASE YEAR, 1981)

and cowdung for cooking by (i) improving the thermal efficiency of wood stoves (ii) installing individual and community biogas plants. Hence planning for installation of 50 individual biogas plants (3 to 8 cum/capacity) and three community biogas plants of 35, 35 and 85 cum capacity was carried out. In order to remove the 20% deficit of fuelwood, the planning is as under:

(i) Total annual deficit	:	98.8 tonnes
(ii) Number of trees required (assuming 50 kg/tree/ year wood rate)	:	20,000 nos
(iii) Number of tree to be planted (assuming 50% mortality rate)	:	40,000 nos

3.2 Planning for self-sufficiency for cattle feed

The village ecosystem carries a total animal population of 1353 number and has a pasture land of 132 ha. The requirement of fodder on the basis of standard feed requirement works out to be 2740 tonnes (dry weight) About 1928 tonnes of fodder is available from the existing resources and crop cultivation practices. Thus, the shortage of 812 tonnes, can be overcome with the planting of high yield grasses on pasture land and available grasses and fodder from plantation (social forestry) done to meet out fuelwood demand.

3.3 Planning for self-sufficiency on oilseeds and pulses

The village has 224 households with a total population of 1529. In order to increase production and productivity cereals, pulses and oilseeds in the village, the reallocation of land in the village Islamnagar (based on the soil survey and land use planning map) has been done using systems engineering approach and input requirement for crop production namely seed, fertilizer, irrigation water and package of equipment has been worked out. The crop planning was also done on individual farmer basis based on his capabilities. A package of energy efficient implements and tools has been worked out for the village as a whole to increase the yield through timeliness of operations.

3.4 Efficient soil and water management planning

Planning for achieving self-sufficiency in irrigation water for crop production has been made and irrigation water demand for crop production worked out to be 209.16 ha-m for Rabi crops. The surveys of resources availability has shown the scarcity of irrigation water in the village to the extent of 28%. To overcome this problem, installation of six units of hydram lift irrigation system on Patra river and renovation and deepening of existing water harvesting pond of 3.53 ha-m capacity have been planned. Planning with regard to suitable drainage system for the village was also carried out.

3.5 Planning for post harvest operations & equipments required

In order to process the produce of different crops at village level, and generate employment to rural youth/ women, planning for the selected unit operations in post harvest sector was done. The unit operations include cleaning-grading drying, dry and wet milling, stripping, dehusking/ dehulling/ decortication, oil extraction, rice puffing etc.

Step - 4 : Plan Execution :

The plannings for self-reliant development in the villages were implemented to the extent possible under Operational Research Project on Integrated Energy and Nutrient Supply System as under :

4.1 Under domestic sector

(i) To meet out cooking energy needs of the village, three way approach was adopted.

- About 38 ha land was taken on lease for 10 years from MP State Revenue Deptt. and energy Plantation/Social forestry was raised on 21 ha.
- Sixtynine solar cookers and 261 improved chullhas were provided to the desirous farmers/villagers.
- 44 individual biogas plants (3 to 8 cum capacity) and three community biogas plants of 35, 35 and 85 cum capacity were installed

in the village.

4.2 Under animal raising sector

(i) About 21 ha of wasteland/pastureland was brought under silvipastural development in the village.

(ii) During first phase improved grass cultivation technology including high yielding varieties of grasses such as C setigerus C.cilliaris, Stylo hamata, Napier grass etc. was demonstrated on 13.0 ha land in the village.

(iii) Seeds and seedlings of the high yielding varieties of grasses were distributed among desirous farmers.

4.3 Under production agriculture sector

(i) In order to increase production and productivity of cereals, pulses and oilseeds, crop planning based on soil type and land use map and available water resources was done on individual farmer basis. Improved black soil cultivation technology was demonstrated on 23.0 ha land of 22 farmers (1 ha of each) continuously for three years from 1988.

(ii) Package of improved tools and implements including harvesting machinery were successfully demonstrated under improved cultivation technology programme.

(iii) In order to demonstrate significance of biodigested slurry in supplying plant nutrients, ORP trials on use of slurry as replacement to chemical fertilizer were organised at the farmers field for wheat crops continuously for three years from 1988.

(iv) Only 48.6% cultivable land is under irrigation at present from the existing sources of water. To overcome this problem, three units of 12" x 12.0" x 2.5 size double pipe hydram lift irrigation system have been installed. The water storage capacity of the existing pond has been increased from 3.53 ha-m to 7.14 ha-m through excavation. Installation of additional tubewells have been planned and measures have been taken.

4.4 Under post harvest operations sector

For processing of agricultural produce at village level and generating employment

to rural youth/women, an agro processing complex has been installed and commissioned in the village and is operated by the KVK unit (Krishi Vigyan Kendra) of CIAE, Bhopal.

4.5 Development of first farm/culture

To uplift the economic status of farmers of the village Islamnagar and supply of food nutrient, one private pond of 0.5 ha was brought under fish cultivation. Fish fingerlings of silver corp and catala were grown every year since 1986.

Step-5: Formulation of Co-operative Women Society for Maintenance and Management of Resources

In order to maintain, operate, repair and manage various technological inputs introduced into the village Islamnagar under the ORP on Integrated Energy and Nutrient Supply System, a housewives society, named as "Ekikrat Urja Evam Poshak Tatva Gramin Vikas Mahila Sahakari Samiti, (Maryadit), Islamnagar" has been organised.

Step-6: Mathematical Modelling of Energy Flow in Village Ecosystem.

Mathematical modelling is finding a variety of applications in decision making process in the management of agricultural systems. A linear programming model was conceptualize for solar energy flow at village level. The objective function was designed to optimize the solar energy harvest through various food crops, vegetables and fodder crops, and a set of constraint equations expiaining the limitation of farmers with regard to land, labour material inputs, electricity, diesel, food consumption pattern and marketing. The model was tested with the data collected for the year 1981 for village Islamnagar.

Step-7: Programme Monitoring and Evaluation:

The various programmes introduced in the village are being monitored continuously. For evaluating individual technology, separate proformas were developed to assess the performance of

technology. In order to assess the combined effect on productivity an individual farmers family record book was maintained and updated annually so as to analyse the data both for productivity and employment/income generation.

Step-8: Socio-economic Survey for Impact Assessment:

The energy census and resources assessment survey was repeated in 1986 to assess the impact of the introduced various technologies. In the productivity of land, animals, machine and human beings and the socio-economic changes that may have taken place during intervening period. The results of these surveys are summerised in Table-1 and 2. The following are the salient observation:

(i) The village has achieved self-sufficiency with respect to fuelwood, cereals, pulses and oilseeds. However, the village is still in deficit of cattle feed marginally (2.1%).

(ii) When the village ecosystem becomes a surplus one in terms of food, feed, and fuel the actual energy requirement goes down from 16 TJ to 15.5 TJ. This has been possible by (a) removal/reduction in wasteful use of thermal energy, and (b) harnessing of solar energy for additional fuelwood and grass and fodder production. With this increased vegetative cover, the solar energy conversion goes up from 42.44 TJ to 67 TJ and thus overall photosynthesis efficiency goes up from 0.0866 to 0.144%.

(iii) The employment potential in making the village self-reliant through production agriculture, post harvest operations and animal raising activities goes up about 12,500 man days. In addition to removal of drudgery in the domestic sector to the extent of 1,45,500 man-days, there is an increased activity in afforestation (15,000 man-hrs) and grasses (79,000 man-hrs) development programmes (Table-3).

(iv) Cropping intensity has increased from

99.5% to 135.43% and the overall productivity has also increased from 0.986 tonnes/ha to 1.43 tonnes/ha due to development programmes of production agriculture sector.

(v) Net return/ha (Rs/ha) has increased from 1769 to 3310 (base year-1989) and benefit cost ratio from 1.583 to 1.895 for production agriculture.

(vi) After realising the benefits of fish farming introduced under ORP on IE& NSS, the farmer has adopted fish farming at a large scale on 20 ha land at an initial investment of Rs. 27 lacs.

CONCLUSIONS

A bench mark survey for the assessment of resource availability and the total energy needs of Islamnagar village (on annual basis) for crop production, post harvest operation, livestock raising and domestic activities was carried out Self-sufficiency with regard to food, fodder and fuelwood was assessed. Self-sufficiency plans in terms of fuelwood, fodder, pulses and oilseeds were drawn based on natural resources available in the village and the same were implemented in the village in co-operation with State/Central government agencies. Except cattlefeed, the village became surplus in pulse, oilseed and fuelwood production. For the first time, efforts have been made to integrate renewable energy technologies with production agriculture, livestock raising and rural living. A simulation model has been evolved for maximizing solar energy harvest through food, fuel and fodder and minimizing energy input through commercial energy sources. The scientific planning based on natural resources and appropriate technologies has led to 65% increase in photosynthetic efficency (from an overall 0.0868% to 0.144%) for conversion of solar energy into food, feed and fuel. The developed rural development model demonstrates the manner in which various State/Central government agencies can be involved for accelerating an integrated rural development while optimizing human and material resources.

Table-1 : Impact on Productivity, Socio-economic Conditions & Employment Generation in the Village Islamnagar

Sl. No.	Item	Technological & Economic Changes		
		1981 Scenario	1986/90 Scenario	% Change
I.	Changes in Village Ecosystem			
	1. Total Villagers	1,529	1,726	12.9
	2. No. of households	224	253	11.5
	3. No. of farming households	131	121	-(4.5)
	4. No. of landless households	93	132	17.4
	5. No. of cattles	1,427	1,648	13.4
II.	Changes in Agricultural System			
	1. Net cultivated land (ha)	403.88	430.76	6.7
	2. Total cropped area (ha)	402.00	583.43	44.5
	3. Cropping intensity (%)	99.50	135.40	36.1
	4. Total irrigated area (ha)	196.27	267.28	36.0
	5. Use of chemical fertilizers (kg/ha)	39.00	110.72	183.9
	6. Productivity (tonnes/ha)	0.986	1.43	45.0
	7. Storage capacity of water harvesting pond (ha-m)	3.53	7.14	102.3
	8. Total diesel consumption (litres)	13,938	22,694	66.8
	9. Total electricity consumption (kWh)	43,708	75,399	72.5
III.	Change in Environment and Ecology			
	1. No. of trees possessed by the farmers	1,200	2,285	90.4

	2. Original rootstock regenerated due to protection	—	10,886	—
	3. Total trees in the ecosystem (No.)	1,200	25,897	2141.4
	4. Tree species in the ecosystem (No.)	20	44	120.0
IV.	Status of Biogas Technology			
	1. Individual biogas plants installed (Nos)	—	44	—
	2. Community biogas plants installed (Nos)	—	3	—
	3. Biogas generated (cum/yr)	—	40,647	—
		(Potential)	64,824	—
	4. Cooking energy met through biogas technology	—	32%	—
		(Potential)	52%	—
	5. Annual availability of slurry (tonne)	—	326.8	—
		(Potential)	518.6	—
	6. Plant nutrient (N) met through slurry	—	16%	—
		(Potential)	28%	—
V.	Employment Generated & Drudgery Removed			
	1. No. of man-days used for			
	(a) Crop production activities	20,079	23,127	15.2
	(b) Post harvest activities	1,628	2,915	68.7
	(c) Cattle raising	52,779	54,950	22.3
	(d) Energy plantation	—	14,412	—
VI	Changes in Economic Indicators			
	1. Net return/ha (Rs./ha) (base year 1988-89)	1,769	3,310	91.1
	2. Net return per farmer, Rs. (base year 1988-89)	737	2,125	188.4
	3. Benefit cost ratio	1.583	1.895	19.7

Table-2 : Attainment of Self-sufficiency and Energy Audit for the Village Islamanagar

Sl. No.	Item	1981		1986/1990	
		Shortage		Surplus	
		Tonnes	%	Tonnes	%
1.	Fuelwood	—98.8	—20.0	11.2	2.26
2.	Pulses	—71.8	—32.0	34.85	15.53
3.	Oilseeds	—23.0	—71.8	59.1	182.50
4.	Cattlefeed	—812.63	—29.65	—58.45 (deficit)	—2.1 (deficit)

Sl. No.	Energy Audit	1981	1986/ 1990	% change
1.	Output/input ratio (for crop production)	13.72	11.18	—18.5
2.	Output/input ratio for energy production	—	108.00	—
3.	Photosynthetic efficiency of the ecosystem (%)	0.0868	0.144	65.9

Table-3 : Annual Man Power Requirement for Employment Generation at Self-sufficiency Level

Sl. No.	Operation	Mannual energy at 1981 level		Mannual energy at self sufficiency level		Additional manual energy Generation/ reduction (±)	
		Man-hrs	GJ	Man-hrs	GJ	Man-hrs	GJ
1.	Crop production	1,60,633	28.75	1,85,020	33.12	+ 24,387	+ 4.37
2.	Post harvest activities	13,822	2.47	23,321	4.17	+ 9,499	+ 1.701
3.	Domestic activities	6,50,216	116.89	5,04,946	90.34	- 1,45,510	- 26.05
4.	Cattle raising	4,22,234	75.58	4,39,664	78.70	+ 17,430	+ 3.12
5.	Energy plantation	—	—	1,15,307	20.64	+ 1,15,307	+ 20.64
6.	Grassland management	—	—	78,944	14.13	+ 78,944	+ 14.13
7.	Milk marketing	24,984	4.47	24,984	4.47	Nil	Nil

Overall increase in man-hrs = 1,00,057

Hence, total man-days generated = $\frac{100057}{8}$ = 12,507 man-days/yr

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"Our problem is that we accept anything that is free-even a headache."

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ECONOMICS OF THE USE OF TREE LEAVES AS FODDER

A.N. Chaturvedi
Senior Fellow, Tata Energy Research Institute
101, Jor Bagh, New Delhi - 110 003

In this paper author has made comparative study of use of biomass which is fed to cows, buffallows from the economical point of view. He has briefly dissused about basic principles of photosynthesis, leaf structure, leaf shedding and how much wood can be obtained from trees.

The leaves of several trees are used as fodder for livestock. In case of animals like goats, the foraging is done directly by the goats which move from bush to bush. They are also fed by the leaves lopped from trees with human labour. In case of cows, buffaloes, it is mostly the lopping of leaves that provides the feed. Certain animals like camel can browse the leaves of trees even higher up on the crown. In all cases, however, the leaves get converted to the body weight or meat. The leaves are primary source of production of wood in trees. It is relevant to compare whether the feeding of domestic animals on leaf fodder is financially viable.

PHOTOSYNTHESIS

The leaves of trees produce carbon through photosynthesis. This carbon is deposited on the tree in the stem and branches and appears as wood. The equation of this conversion is :

$$6CO_2 + 12H_2O + 674 \text{ (Kilocalories)} \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Carbon dioxide + Water + Solar Energy $\longrightarrow$ Sugar + Oxygen

The organic carbon produced is deposited as wood. While Oxygen is released in the atmosphere, the water produced with this process is partly absorbed in the tree and partly released through transpiration. This chemical process is possible because of the presence of chlorophyll which is concentrated in minute bodies called chloroplast. The efficiency of conversion varies from tree to tree. There are many plants with different biochemical pathways of photosynthesis. Some of these

pathways are more efficient than others. These different photosynthetic efficiencies are reflected in the fast growth and slow growth trees.

LEAF STRUCTURE

Outside of leaf is lined by a protective skin or cuticle which can often be shiny and is water proof. Underneath the cuticle is the epidermis. Various structures are attached to or arisen from the epidermis, the most important are the minute pores, or stomata that are scattered all over the leaf surface specially in the lower surface. The stomata are minute breathing pores which can open and close allowing gases to enter and leave the leaf. Through them the CO_2 enters the plant for photosynthesis and through them the excess water vapour leave the plant through the process of transpiration. Lower surface of an apple leave has about 24,000 stomata per sq. cm. A normal sized birch tree with its 2,00,000 leaves will evaporate 20,500 litres of water through its leaves in a single summer. One hectare of forest can transpire about 3,00,000 litres of water per week during summer months. The process of transpiration releases so much water in the atmosphere that it is a major factor in rainfall pattern. The studies carried out in Amazon forests have shown that 50% of all rainfall in and around Amazon forests is formed by transpiration. The destruction of all tropical forests in Ethiopia resulted in reduction of total rainfall in that country and recurring famines.

LEAF SHEDDING

Most trees shed their leaves either during winter or during summer to survive the frost or severe drought. In certain trees, the leaves can stay longer than 12 months. Therefore, leaf shedding in such trees follows the emergence of new leaves. Such trees are classed as evergreen. Even though they shed leaves like any deciduous tree but they do not have any period of total leaflessness. Before the leaves are ready to fall off, abscission begins when a zone in the petiole called the abscission zone becomes active and corky material below the zone begins to seal off the scar. The leaves contain many valuable minerals and nutrients. Before the leaf is

cut off from supplies these substances are substantially transported out of the leaves to avoid their loss. when the transport of materials begins, the leaves stop producing chlorophyll and other components and photosynthesis ceases. The chlorophyll gradually bleaches away and other pigments that have been in the leaf all along begin to show through. These are the yellow Xanthophyll and the orange and red Carotene. The process of transfer of nutrient from leaves to stem is called translocation. In North India, most trees shed their leaves during winter months. The new flush of leaves comes out in spring season - February - April. During this period, the leaves use the stored food in the stem for their emergence and growth.

LEAF-WEIGHT RATIONS

The quantity of wood produced in a tree is related to the weight of leaves. This ratio varies from species to species. It also varies with the age of the tree and the site but the variation within species due to age is very little. Studies carried out in several species have shown that the ratio of stem wood weight to leaf weight varies from 2.6 in case of *Terminalia arjuna* to about 8 in case of *Acacia nilotica.* The total wood weight and the leaf weight ratios vary from 4.4 in case of *T. arjuna* to about 17 in case of *A. nilotica.* These ratios are for green weights. If oven dry weights are considered, the ratios are much higher because the moisture percent in leaves is higher than that in wood. For total wood this ratio on the basis of oven dry weight is around 7 in case of *T. arjuna* and about 18 in case of *Acacia nilotica.* On an average it can be said that one kilogram of air dry leaf produces about 10 kg of air dry wood.

ECONOMICS

The leaves are harvested in the green condition. Consequently, the harvesting of leaves create injuries on the trees. During this process the sap which ascends up during the growing season, oozes out at points of injury. This sap attracts large number of fungi and insects which find easy entry into branches and stem of the tree through these injuries. Consequently, the life of trees which are frequently lopped gets reduced.

Studies carried out by me have indicated that the trees of *Albizzia lebbek* which are lopped after eight years die by about 18th year while the trees which are not lopped live to about 80 years. The leaves which are normally shed on the forest floor cover the ground and protect the soil from the hot winds. They conserve mosture and are responsible for micro biological activity which converts several non-assimilable minerals to assimilable from specially Phosphorus, Zinc and other micro nutrients. The humus formed from the leaves is a very important source of supply of nutrients both macro and micro to the plants. In certain forest areas this humus is swept away and used either as energy or as fertiliser in agricultural fields. Such forest areas are sure to degrade. The removal of humus from the ecosystem will first result in reduction of leaf weight either by reduced number of leaves or size which, in turn, will slow down the wood formation.

GROWTH DATA

The data of *Prosopis juliflora, Acacia nilotica, Eucalyptus hybrid, Terminalia arjuna, Acacia auriculiformis and Dalbergia sissoo* given in attached table shows that the ratio that the ratio of wood to leaf is fairly consistent within a species. This ratio is low in case of *A. auriculiformis* because what looks like leaves in *A. auriculiformis* are actually phyllods and their efficiency compared to leaves is very poor.

DEFOLIATION AND ITS IMPACTS

Leaves of serveral forest trees are damaged by insect pests. *Hapalia machaeralis*- The teak skeltoniser and *Hyblaea puera* the teak defoliator cause extensive damage to natural and planted teak. Studies in Nilamber teak plantations showed that a single stripping of leaves by these insects resulted in 30% loss of increment. Three complete stripping of a young teak crop in one season cause a loss of 65% of the normal increment (The Ecology and Control of the Forest Insects of India- By CFC Beeson, 1941 473 pp.) The lopping of leaves of Neem trees during one season stops seed production. In several parts of Rajasthan where Neem trees are extensively lopped for fodder, no

seed is produced. Sandan *(Ougeinia oojeinensis)* and Bakli *(Anogeissus latifolia)* valuable timber trees of hills do not produce viable seeds due to excessive lopping of trees for fodder. *Carpinuus viminea* (Hornbeam) the most valuable timber tree of Himalayas is getting extinct due to excessive use of the leaves of this species for fodder. The banj *(Quercus incana)* forests in the Himalayas have in many places been lopped to death. Due to the disappearance of these forests the underground water springs have dried up creating serious water famines in Almora, Tehri, Uttarkashi, Simla and several other districts in urban and rural areas. The ecology of the Siwaliks has changed due to excessive lopping of trees of Asna (Terminalia arjuna), Bakli (Anogeissus latifolia), Pula (Kydia calycina), Khair (Acacia catechu), Haldu (Adina cordifolia), Sal (Shorea robusta) etc. There are very few species now left in the category of non-fodder trees.

ECONOMICS OF MEAT AND MILK

MEAT : In India the animals largely used for meat are the goats. The meat/biomass feed ratio is about 1% as the animals spend large amount of energy in movement. With one kg. of leaf fodder the meat obtained is about 10 gms. The price of this meat at Rs. 70/- per kg. (present market price) is only 0.70 paise. The same quantity of leaves will produce about 10 kg of wood, the price of wood will be Rs. 10 at the market rate of Re. 1 per kg. This is 14 times better than the economy of meat production.

MILK : For cows the annual lactation is about 200 days. The cows in hills where the dependence is primarily on leaf fodder give on an average of 2 litres of milk per day. Thus the annual production per cow is 400 litres which at the local market rate of Rs. 5 per litre is Rs. 2,000. The amount of leaf eaten during 365 days at 10 kg per day will be 3650 kg. Thus the value of milk per kg. of leaf consumed will be 2000/3650=0.55 paise. In case of wood per kg of leaf will produce about 10 kg of wood. At the local market rate of Rs. 25 per kg., the value of wood will be Rs. 2.5. This is about 5 times more than the economics of producing milk. Gujars located largely in Shiwalik forests feed

their buffaloes exclusively on lopped leaves of Asna, Bakli, Sal, Shisham etc. These all are valuable timber trees. Gujar buffaloes produce on an average about 10 litres of milk per day and have a lactation period of about 250 days. Thus the milk produced during one year is 2500 litres which is valued at Rs. 12,500/- at Rs. 5/- per litre. Normal Gujar buffalo consumes about 50 kg of leaves per day. Total leaves consumed during the year will be 18250 kg. Income from milk per kg of leaf is, therefore, 12,500/18,250 = 0.68 paise. One kg of leaf will produce about 10 kg of wood worth about Rs. 5.00 at local price of 0.50 per kg. Thus preserving leaves of trees is about seven times more profitable.

CONCLUSIONS

In spite of the above facts, the number of goats are on the increase. The maximum increase is in fragile eco-systems where the damage is severe. All talk about bio diversity conservation become meaningless when goats are introduced into such areas. The use of leaves of forest trees for fodder or for any other purpose in which substantial portion of the leaves goes out of the eco-system is undesirable both financially and ecologically. Nature never meant the green leaves to be used as fodder. It is misuse of trees and must be stopped if forests are desired to be protected for future generations. The system continues to thrive because individuals reap the benefits while society pays for the cost of feed. The real sufferer is the Nation and the future generations, some of whom are not yet born. Keeping livestock is a business activity and should not be permitted in the forest areas for National interests.

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Age of measurement	GREEN WEIGHT (TONNES/ha)			RATIOS		OVEN DRY WEIGHT (TONNES/ha)			RATIOS	
	STEM	BRANCH	LEAVES	STEM WOOD/TOTAL	WOOD/ LEAVES	STEM	BRANCH	LEAVES	STEM WOOD/TOTAL	WOOD/ LEAVES
Prosopis juliflora										
2	10.68	10.30	1.22	8.75	17.20	6.42	6.23	0.47	13.66	26.91
3	24.28	23.42	2.92	8.32	16.34	14.62	14.25	1.15	12.71	25.10
4	42.47	41.10	5.17	8.21	16.16	25.59	24.97	2.09	12.24	24.19
5	60.58	58.49	7.44	8.14	16.00	36.50	35.66	2.93	12.46	24.63
6	68.64	66.28	8.47	8.10	15.93	41.40	40.47	3.34	12.40	24.51
7	67.57	65.24	8.34	8.10	15.92	40.75	39.84	3.29	12.39	24.50
8	77.72	75.04	9.60	8.10	15.91	46.87	45.83	3.79	12.37	24.46
Acacia nilotica										
2	2.30	2.76	0.30	7.67	16.87	1.34	1.56	0.15	8.93	19.33
3	6.76	8.17	0.88	7.68	16.97	3.97	4.59	0.45	8.82	19.02
4	11.17	13.35	1.42	7.87	17.27	6.58	7.61	0.75	8.77	18.92
5	20.70	25.00	2.66	7.78	17.18	12.22	14.13	1.39	8.79	18.96
6	33.98	42.23	4.37	7.78	17.44	20.08	23.20	2.29	8.77	18.90
7	40.45	49.13	6.21	6.51	14.43	23.91	27.57	2.71	8.82	19.00
8	44.38	53.98	5.37	8.26	18.32	26.24	30.28	2.98	8.81	18.97
Eucalyptus Hybrid										
2	6.67	0.62	1.08	6.18	6.75	3.03	0.20	0.49	6.18	6.59
3	11.64	0.82	1.45	8.03	8.59	5.08	0.43	0.78	6.51	7.06
4	13.50	3.55	1.94	6.96	8.79	6.97	0.56	1.04	6.70	7.24
5	20.45	5.35	2.87	7.13	8.99	10.57	0.82	1.55	6.82	7.35
6	25.09	6.55	3.49	7.19	9.07	12.96	0.98	1.89	6.86	7.38
7	33.21	8.65	4.59	7.24	9.12	17.16	1.28	2.47	6.95	7.47

Cont.

Terminalia arjuna

2	3.93	2.42	1.35	2.91	4.70	1.82	0.89	0.54	3.37	5.02
3	6.00	3.85	2.15	2.79	4.58	2.71	1.30	0.85	3.19	4.72
4	7.26	4.73	2.63	2.76	4.56	3.25	1.56	1.03	3.16	4.67
5.	10.56	7.00	3.90	2.71	4.50	4.66	2.22	1.53	3.05	4.50
6	13.26	8.88	4.93	2.69	4.49	5.82	2.76	1.93	3.02	4.45
7	17.38	11.75	6.51	2.67	4.47	7.58	3.59	2.54	2.98	4.40
8	24.77	16.88	9.35	2.65	4.45	10.73	15.8	3.65	2.94	7.27

Acacia auriculaeformis

2	1.33	1.70	0.86	1.55	3.52	0.69	0.91	0.38	1.82	4.21
3	2.95	4.77	2.04	1.45	3.78	1.54	2.52	0.96	1.60	4.23
4	7.30	12.86	5.20	1.40	3.88	3.81	6.81	2.46	1.55	4.32
5	14.61	26.41	10.49	1.39	3.91	7.64	13.97	4.99	1.53	4.33
6	19.94	36.31	14.36	1.39	3.92	10.42	19.21	6.84	1.52	4.33
7	28.19	51.67	30.33	0.93	2.63	14.73	27.34	9.70	1.52	4.34
8	29.67	54.46	21.42	1.39	3.93	15.51	28.81	10.22	1.52	4.34

Dalbergia sissoo

2	2.01	1.92	0.22	9.14	17.86	1.06	1.08	0.09	11.78	23.78
3	5.23	5.32	0.53	9.87	19.91	2.81	2.89	0.25	11.24	22.80
4	9.48	9.82	0.93	10.19	20.75	5.11	5.20	0.45	11.36	22.91
5	17.00	17.86	1.64	10.37	21.26	9.23	9.59	0.81	11.39	23.23
6	32.32	34.04	3.08	10.49	21.55	17.50	18.24	1.53	11.44	23.36
7	35.42	37.31	3.36	10.54	21.65	19.18	19.99	1.67	11.49	23.46
8	49.76	52.46	4.72	10.54	21.66	26.96	28.09	2.35	11.47	23.43

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PUNCHING TECHNOLOGY : AN AGRO-PROCESS MODEL & HOME BASED INDUSTRY

P.D. Sharma,[1] S.C. Jain,[2] C.K. Teckchandani[3]

1, 2 & 3 P.H.T. Scheme, College of Agril. Engineering, J.N.K.V.V., Jabalpur (M.P.)

A punching machine developed by authors under Post Harvest Technology Scheme at J.N.K.V.V., Jabalpur, can be used as agro based model or home industry to earn profit by the farmers. This technology of punching not only reduces the cooking time & energy but also improves the cooking quality & taste of the whole pulses. This paper deals with the cost economics of the technology, when used as Home Industry. A farmer by using this technology as home based industry may earn about Rs. 7000-8000/- against the work of one month for pea-punching & dehydration only.

The dry whole pulses take very long time to get cooked and consume too much energy. Green pulses like pea, cowpea, Rajma, Lobia, Gram, Kabuli gram etc are relatively soft, taste better and need less energy to cook. To make whole pulses available in the off season the matured hard seeds of these pulses are generally dehydrated and sold in the market. If we take the example of pea, dehydrated pea don't aquire the same softness as seen with cooked green peas, due to slow water reabsorption rate. Moreover, these dehydrated peas take comparatively much longer time to get cooked. A few companies do sale dried pre-processed peas in packets which attain the same taste as that of green peas after cooking. But these are quite costly and thus are generally out of reach of common public.

The farmer who takes all the pains & risks against fire, draught, flood, insects, pests, theft etc., to produce the crop, earns very little while the middle man who takes away the major share of profit of agricultural produce. The Scientists and agricultural engineers are now-a-days busy in developing the agro-based models & equipments which can be installed at farm level for the benefit of the farmers.

This machine for punching whole green peas is very simple & can be operated by a single operator with case. The only thing is to put the peas at the bottom plate & press the handle which guides the needles to find their ways through the holes made in the middle plate and penetrate the peas at bottom plate. These needles are welded at the bottom surface of the upper plate. Springs attached help the plate & needles to operate easily. When the pressure is released the needles go back to their original position leaving the grains at bottom plate after punching. Fig. shows a line diagram of punching machine.

This paper gives the analysis of the technology, when used as agro-process model or home industry for pea punching & dehydration. The pre-punched green peas when dehydrated takes less time to get dehydrated and can be preserved for a longer time. Such pulses aquire almost the same character as the green pulses during cooking. Here the cost calculation and profit has been given only for dehydration of green peas. However, on similar lines cost-economics for other pulses can be easily worked out.

For dehydration of green peas one will have to follow the following flow process as suggested by CFTRI, Mysore, except the two steps suggested by the investigators.

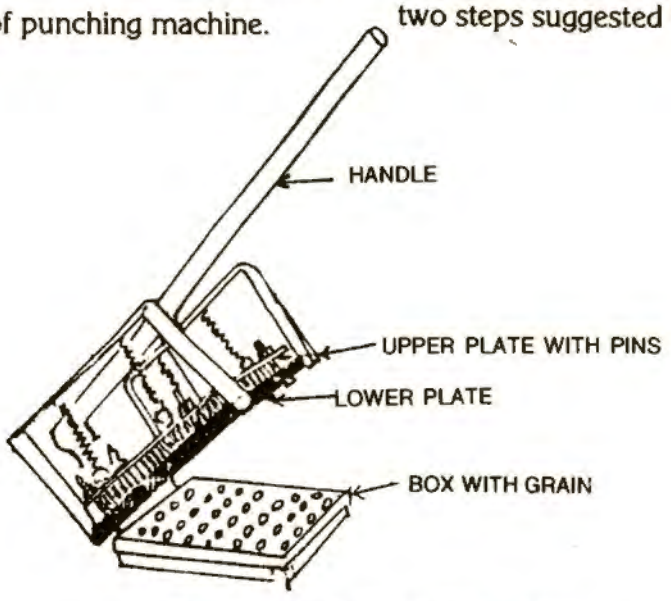
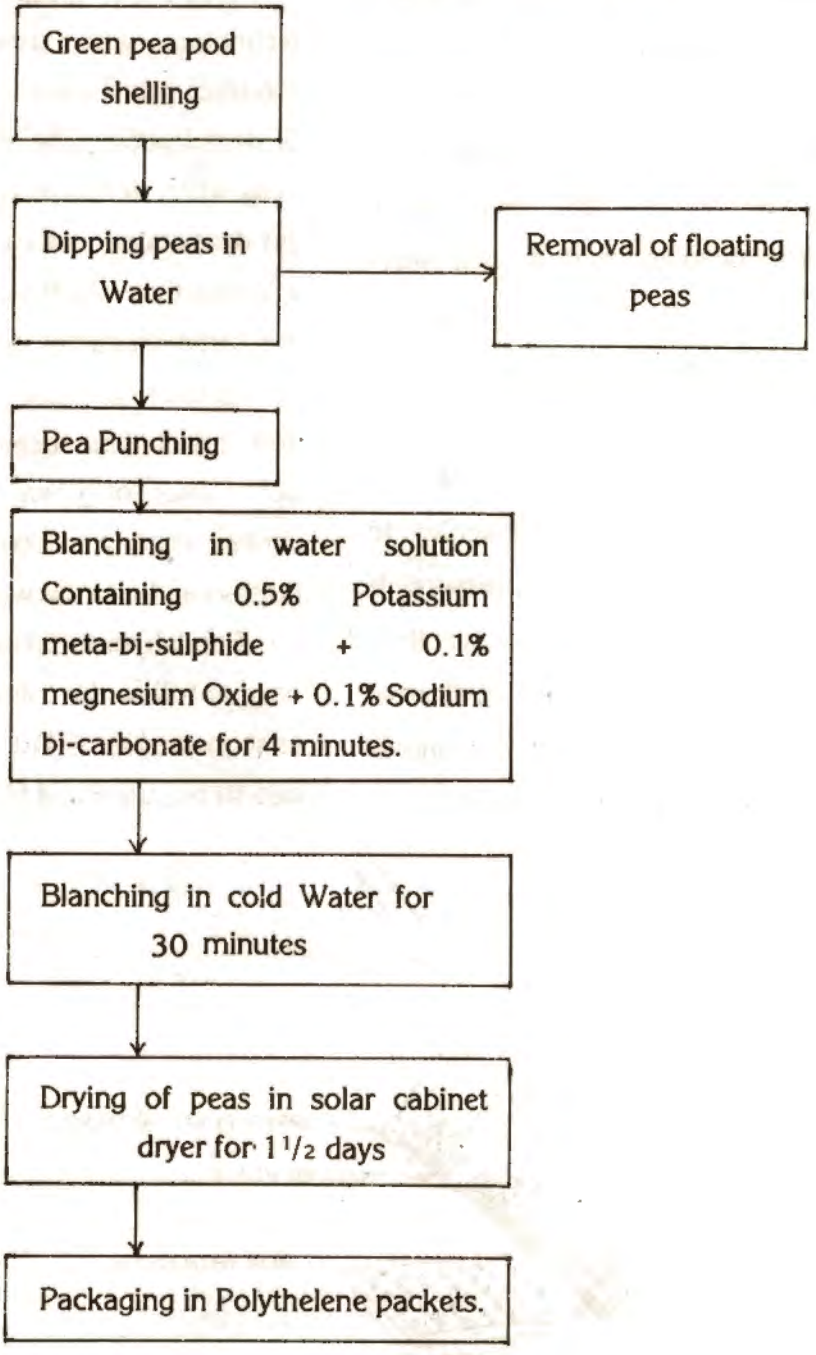


Fig. - Grain Punching Machine

Flow Process Chart for Dehydration of Green Pea



Following assuptions are made for calculation of cost economics for home based pea dehydration industry :—

(1)	(a) Pea punching machine @ Rs. 400/- per piece	3 Nos.	Rs. 1200.00
	(b) Plastic/G.I. tubes, 50 litre capacity @ Rs. 100/- per piece.	4 Nos.	Rs. 400.00
	(c) Solar cabinet dryer, bamboo made (1m x 1 m) floor area @ Rs. 40/- per piece.	10 Nos.	Rs. 400.00
		Total	Rs. 2000.00
(2)	Capacity of punching machine	10-12 kg/hr.	
(3)	Life of machine, tubs, solar cabinet dryer.	5 years	
(4)	Labour requirement for 1 months	3 Nos.	
(5)	Labour rate	Rs. 15/- per day	
(6)	Interest of bank	20% per annum	

A. Fixed Cost

(1) Annual depreciation :

(a) On Machine = Rs. 2000/5 = 400/-

(b) Interest on fixed Capital = 2000x10/2x100 = Rs. 100/-

Total fixed cost per year = Rs. 500/-

B. Running Cost

(i) Labour Charge (3 Nos.) for one month	= Rs. 1350/-
(ii) Cost of peas 30 quintals @ Rs. 200 per quintal	= Rs. 6000/-
(iii) Cost of chemicals, plastic bags etc.	= Rs. 150/-
	Total Rs. 7500/-

Total cost of dehydration of 30 quintals of peas (in green pod form) i.e. 506.25 kg of dehydrated peas = (A + B) = Rs. 8000/-

Cost of 1 kg of dehydrated peas = Rs. 8000/506.25 = Rs. 15.80/-

Cost of dehydrated peas sold in the market in packeted form = Rs. 80/- per kg.

through renewable energy system.

Crop residues represent one of the other major energy resource for the rural sector in almost all the developing countries. The amount of crop residues produced depends upon the types and variety of crops planted and their subsequent yield which varies from year to year depending upon the farming methods and climatic conditions. The table below gives a clear picture of crop residues in the developing countries.

Table - 1

Production of Residues from Cereal Crops in Developing Countries

	Crop yield Tonnes/ha/yr		Crop : Residue Ratio	(Per hectares) Residue Production Tonnes/ha/yr	
Crop	Range	Average		Range	Average
Rice	0.7-5.7	(2.5)	1:2	1.4-11.4	(5.0)
Wheat	0.6-3.6	(1.5)	1:1.75	1.1-6.1	(2.6)
Maize	0.5-3.7	(1.7)	1:2.5	1.3-9.3	(4.3)
Barley	0.4-3.1	(2.0)	1:1.75	0.7-5.4	(3.5)
Millet	0.5-3.7	(0.6)	1:2	1.0-7.4	(1.2)

Source : Biomass for Energy in the Developing countries: D.O. Hall, G.W. Barnard, P.A. Moss, Pergomon Press 1982.

This table indicates that the range of crop residues productivities on per hectare basis is very large and the crop residue ratio is almost double. This ultimately focuses that the significance of crop residues for renewable energy sources can never be denied-hence crop residue production for the development of rural

sector in terms of energy becomes an unavoidable reality in developing countries.

Another most valuable resource of energy in rural areas is animal dung- which has a similar energy content as compared to other resources. It can be used directly or by anaerobic digestion to produce biogas- a bio-energy source for the development of rural sector. The table below gives a picture of manure production by domestic animals. Use of animal manure for the production of energy depends upon the ways of collection and existing storage facility. It is generally estimated that 4-5 animals can provide enough dung for a family unit of smallest size.

Manure Production by Domestic Animals

Animal	Manuare Production Tonnes/head/yr
Cattle, Buffalloes, Camels	1.00
Horses, Donkeys, Asses	0.75
Pigs	0.3
Sheep, Goats	0.15
Chicken, Poultry	0.05

Source : World Bank, Prospects for Traditional and Non Conventional Energy Sources in Developing Countries.

Food processing wastes are another sources of renewable energy development which are agricultural activities such as residues from husks and shells. Though they are not much in required quantity, yet their contribution in the production of energy can not be ignored. The table below estimates the amount

of waste for selected crops in the developing countries.

Table - 2

Estimates of Production of Selected Food Processing Wastes in Developing Countries

By Product	Estimated Production 10^6 tonnes/yr	Approximate total Energy content 10GJ/yr	Present Level of use for Energy purposes
Sugar Cane Baggasse	110	1060	H
Rice husks	55	790	L
Coconut husks	13	185	L
Cotton husks	6	110	H
Ground nut shell	6	100	H
Coffee husks	2	35	L
Oil palm husks	2	35	H
Oil palm fibre	3	20	H

Total 2330 x 10^6GJ = Equivalent to 2.5% of total Energy use in developing countries.
Source : FAO (1979) Energy for World Agriculture BA Stout.

From the above table's we can easily come to the conclusion that for the energy production at rural level, resource base should be increased through the rapid growth of grass root resource like forest productivity and development in the level of nutritional health of domestic animals. Besides, research should be intensively done to identify the tree species which can be grown on short rotation and utilising unproductive and barren lands for highly productive energy plantations including variety of plants with high energy potential in developing countries.

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1. Biomass for Energy in the Developing Countries D.O. Hall, GW Barnard and P.O. Moss Pergomon Press, 1982 New York.
2. FAO (1979) "Energy for World Agriculture, B.A. Stout
3. World Bank (1980) Ethanol Production from Biomass in Developing countries.

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"True sustainable participation is possible only when the present trend of "top-down" planning is reversed to "bottom-up" planning and when decision-making power is handed over to the community. The basic requirement of community participation is that the people should be involved in conceiving, planning, implementing and evaluation all development programmes.

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CEMENT TREATED GUNNY BAG ROOF AND DRUM

Today the increasing cost of construction materials has created a serious problem to construct even a single shed. Now the necessity has arisen to use low cost materials for buildings as well as other house hold storage drum/bins e.g. drums for storage of water, grains, cattle feed trough etc. With the addition of some other locally available materials, empty cement bags can be use for the construction of roof or drum/bin or cattle feed trough, which is also very cheap with comparison of other traditional one.

ROOF

In comparison to other low cost roof, cement treated gunny bag roof are cheap, durable, and easy to construct. The requirement of materials and method of construction are as follows :

MATERIAL LIST FOR 3m x 3m (10'x10') ROOF

Bamboo (3" diameter) 25' long	6 nos.
Cement	2 bags
G.I. wire 16 SWG	2 kg.
Empty gunny bag	30 nos.
Painting Brush 4"	1 no.
Medium Sand	8 bags
Sutli	1 kg.
Nails (3", 2", 1")	1 kg. (Total)

CONSTRUCTION METHOD

1. Mark the lines on the ground as shown in fig. 1. Sutli, Wooden piece and pointed stone piece etc. can be used for marking purpose. Correct marking can be done with the use of measuring tape. Dig holes of 45-60 cm for erecting pillars.

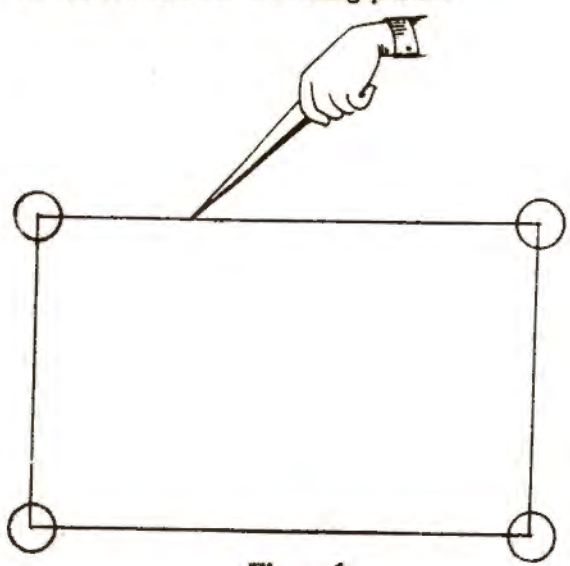


Fig. - 1

2. Errect bamboo pillars on the four corners. Roof must be supported on at least four pillars. Fig. 2 (b) these pillars can be of bamboo, cement pipe, G.I. pipe and bricks. If bamboo is used as pillars then its diameter should not be less than 3 inches (7.5 cm). If cement pipe is used then reinforce it with steel rod and cement concrete. The steel rods should be projected for at least (30-45 cm, or 12"—18") at the top (Fig. 2c) so that horizontal members can be strengthened later on. Bitumen coating should be applied on bamboo pillars before grouting them. This will protect the bamboo from white ants. Fig 2(a) shows bitumen coats bamboo.

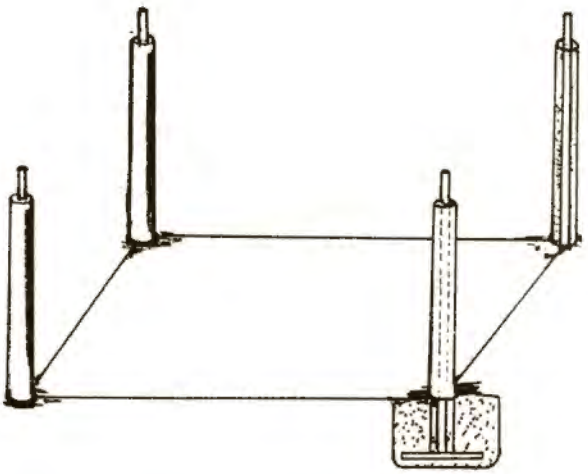


Fig. - 2 (c) Cement Concrete and steel bar in cement pipe

3. Prepare frame work of roof with bamboo. The joints should be strong. Steel strips, nails can be used for preparation of joints, see fig. 3(a), 3(b) and 3(c).

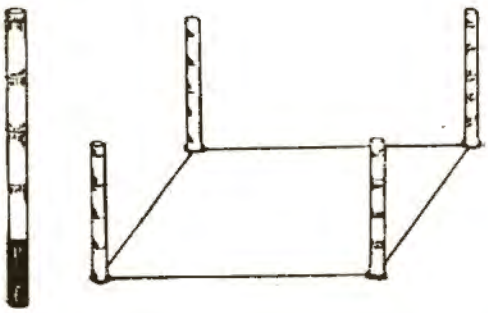


Fig. - 2 (a)

Fig. - 2 (b)

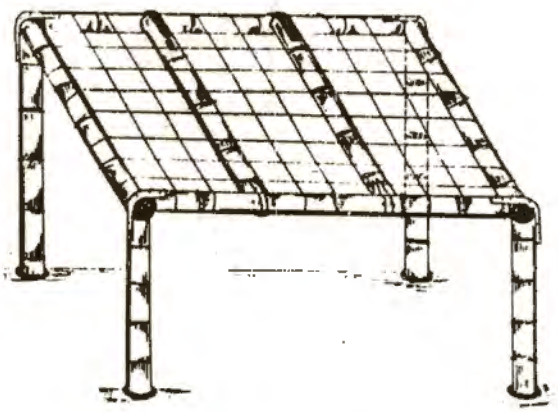


Fig. - 3 (a)

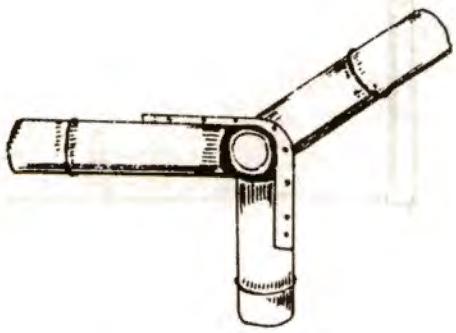


Fig. - 3 (b)

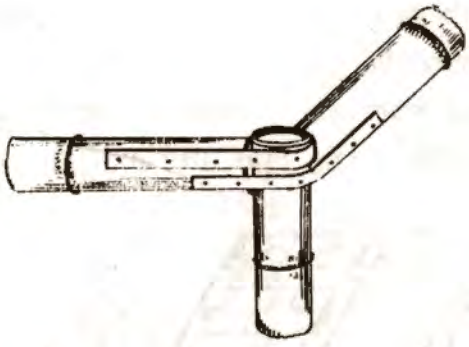


Fig. - 3 (c)

The jute gets sagged by the application of Sand Cement mortar. In order to reduce it, bamboo wedges are fixed and a wire mesh of 16 gauge is made. The distance between two wires is kept about 22 cm. (9 inches). The distance will depend upon thickness of wire. Steel rods, bamboo can be used in place of G.I. wire to provide more strength and more flexibility but the cost will increase.

4. The cement bags are first opened and then, sewed together. Fix the sewed bags or hessian cloth on frame work with nails and screws. See fig. 4.

Fig. 4

5. Moist the cloth with water because cement solution will not adhere on dry cloth. Apply the cement solution on inner side of roof first so that pores of gunny bag are covered with cement. Best method

to check that the holes are covered with cement is by looking from inside the ceiling to top. If sky is visible that means cement has not been applied properly. (See fig. 5)

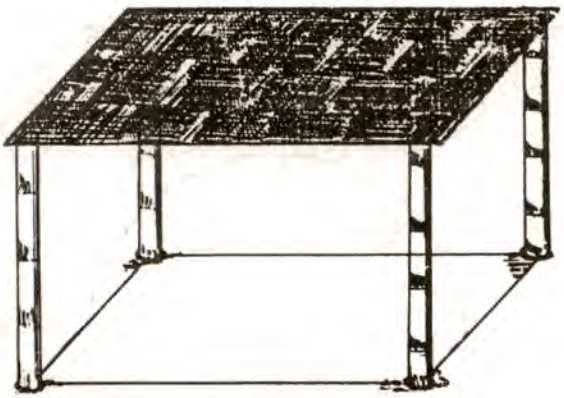


Fig. - 5

6. Allow the cement to dry. After this apply the cement and sand morter (1:2) on exterior surface. Sprinkle water next day. Continue it for 5—7 days.

In this way gunny bag roof is prepared.

MAINTENANCE

1. Apply the cement solution on interior as well as exterior on roof before rains once every year or in two years as needed. (It does not require more than 1/4 bag of cement for 3mx3m surface).

2. If holes are there on roof, then apply cement solution on any type of cloth and cover the hole. It will stick on the roof.

REMARKS

It has been assumed that it is necessary to construct walls on three sides of roof in order to protect the roof to fly off from heavy winds and storms. If the walls are not constructed then it is advisable to contact roof as per fig.—6. The roof as in fig.—6 will not fly off during storms and it will also protect from rain water.

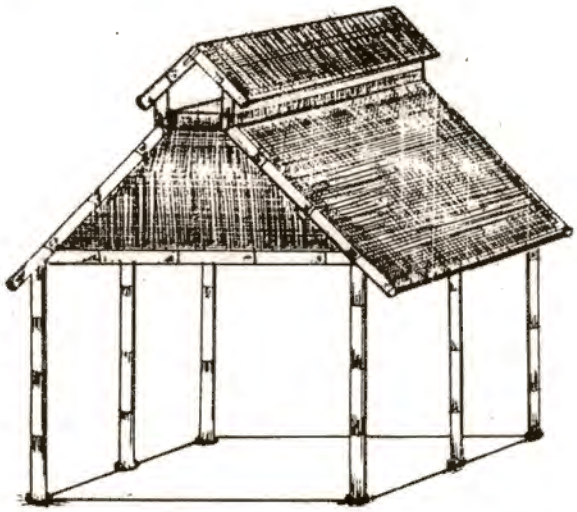


Fig. - 6

LIST OF MATERIALS FOR A TANK OF 200 LITRES CAPACITY :

Dimensions, dia = 60 cm.
height = 80 cm.

(i) G.I. wire (8 SWG)	2 kg.
(ii) G.I. wire (18 SWG)	200 gm.
(iii) Cement	12 kg.
(iv) Sand	as per 1:2 ratio
(v) Empty cement bags	6 Nos.
(vi) Jute Thread	100 gm.
(vii) Socket (if tank is for water storage)	2 Nos.
(viii) Water top (if needed)	1 No.

CONSTRUCTION METHOD :

(1) Make three rings of equal diameter for 8 SWG wire. These rings will be used for top, bottom and middle of drum. Number of rings may be increased or decreased according to the height of the drum (See fig.-1). In any case the number of rings should not be less than three.

Fig. - 1 (Rings of equal diamater of 8 SWG wire)

(2) Weld spokes of 8 SWG in one ring to be used for bottom. number of spokes will depend upon diameter. Number of spokes will be more if the diameter of the drum is more. In any case the number of spokes should not be less than six. (See Fig. 2)

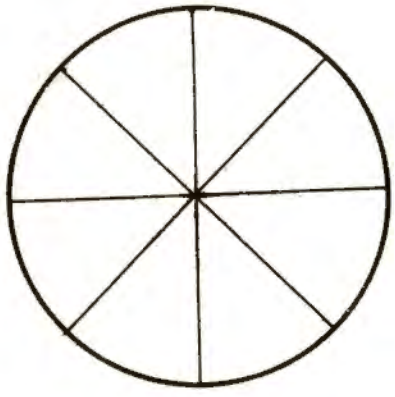


Fig. - 2 (Bottom Ring with welded spokes)

(3) Cut the wire (8 SWG) of the length of which the drum is to be made. These thick wires will provide strength to the side wall of the drum where they will be used. The number of the wires depend upon the diameter of the drum.

(4) Weld the above wires with the top, middle and bottom rings and fabricate the structure as shown in fig.-3 (a). If the drum

is to be used for water storage then weld two sockets, one at top and one at bottom by providing small vertical member of 8 SWG wire at top and bottom adjacent to the member from which the socket is to be welded [See fig.-3 (b)]. After this attach thin wire (about 16 SWG) in between the members vertically and in peripherial direction as shown in fig.-3 (b).

Fig. - 3 (a)

Fig. - 3 (b)

(5) Take empty cement bags and open them by removing the stiches. Wrap the opened cement bags in the inner periphery and inside bottom and tide the cement bag with side wall vertical members and bottom with the help of thread as shown in fig.-4 (a) and (b).

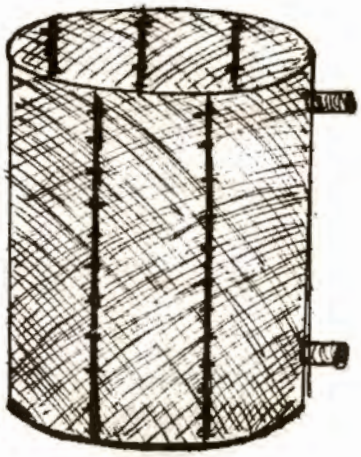


Fig. - 4 (a)

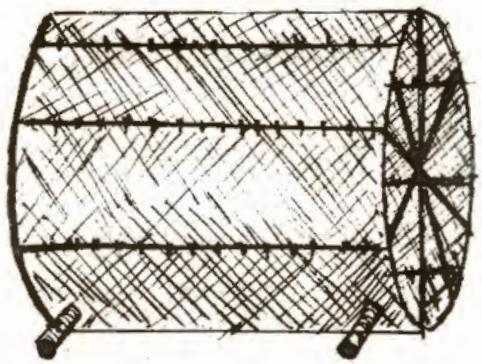


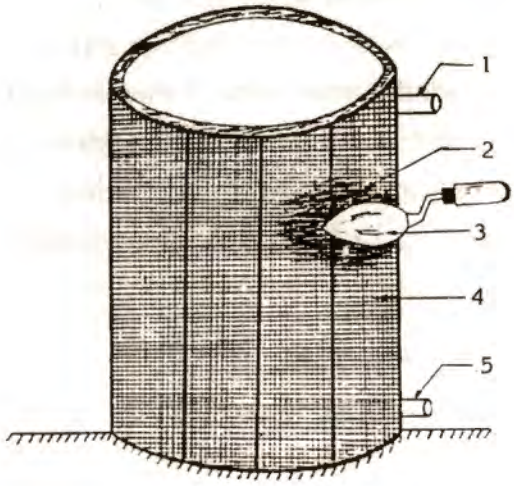
Fig. - 4 (b)

(6) Prepare cement sand mortar in the ratio of 1:2 for plaster. The drum cloth

(bag) is wetted before the application of cement sand mortar so that it adheres with the gunny bag surface (side wall and bottom) properly. First the mortar is plastered from inside and then left for setting [See fig. 5(a)]. Second day the mortar is applied on the out side of the wall and left to set. [See fig. 5 (b)].

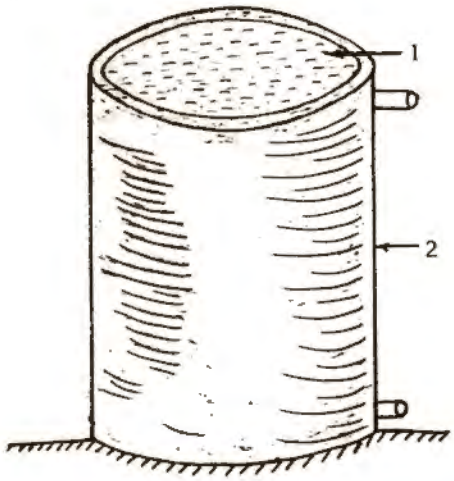
Fig. - 5 (a) (Plastering inside wall with Kanni)

Third day the drum is completely filled with water. In case any leakage is found, then water is removed and the mortar is applied at the place where leakage was observed. After filling water for 4-5 days the drum is ready for use. [See fig. 5 (c)].



1. Socket 2. Empty Cement Bag
3. Kanni 4. M.S. Bar 5. Socket

Fig. 5 (b)



1. Water 2. Cement

Fig. - 5 (c) [Water filled Drum]

MAINTENANCE

It can be repaired with the application of cement-sand mortar at same place.

In very few cases the drums were emptyed and kept for few months and it was observed that due to shrinkage in peak summer they developed small cracks at one or two places.

It was also found that if these drums are not shifted frequently from one place to another then cracks do not developed. These drums can be very well used as small overhead tanks in houses.

★ ★

Start by listening

Spreading the word about what people should do to be healthy is important. But this is not enough. We have to understand that, in many situtation, it is not only the individual who needs to change. There are other things that influence the way people behave : the place in which they live, the people around them, the work they do, whether they are able to earn enough money—all these things have a great influence, and we must take them into consideration. Our first effort must be therefore to listen, to learn, and to understand.

— Education for Health

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BIOTECHNOLOGY BASED 'ALTERNATIVE AGRICULTURE'

The alarming enlarging global population has necessitated increased production of agricultural products. Constraints of limited cultivable space, prevention of further damage to the dwindling forest areas and ever engulfing urbanization, all lead to the only alternative— intensified agriculture for food, fodder and fuel wood needs.

The crop productivity is the net result of interaction of factors like its genetic capability, fertilization, irrigation plant growth promotion and pest and weed management etc. Biotechnology has its role in all these factors. The improvement of genetic capability of crops through traditional breeding or through protoplast fusion and tissue culture technologies have lead to the "green revolution" waves in India. Yet, even with the improved irrigation and fertilizer inputs available, the productivity of wheat and rice have reached a plant of around 3.5 tonnes per hectare.

It is here that biotechnology offers a multifarious scope of improvement in crop productivity through products what can be termed as "Agrobiologicals". The term "agrobiologicals" would include— biofertilizers, biopesticides and biological growth promoters. These natural and biotechnology products are the non polluting substitutes for the various hazardous and poisoning "chemical" inputs to the agriculture.

More than often the availability of Nitrogen, Phosphorus and balance of trace elements in soil is a limiting factor. The expenditure on Nitrogenous and Phosphatic inputs is not only enormous but it heavily depends on the petroleum consumption and it is estimated that globally around 10% petroleum is spent on chemical fertilizers. Therefore, there is urgent need of alternatives— biofertilizers, whether "symbiotic", "associative" or "mycorrhiza".

So far such biofertilizers are not available in enough quantities to Indian farmers and the quality of these has always been suspect because of non-standard manufacturing infrastructure and methodologies, particularly on the "carriers".

Biofertilizers based on latest technologies, radiation sterilized carriers, synthetic and cheap carriers and nitrogen fixing strains producing plant growth promoting and fungistatic substances are the "State of the Art" products now being introduced by some Indian biotechnology companies including biotech International Ltd. (BIL). Such efficacious products have immense value as agriculture inputs in India. These "microbes" also reduce the ground water pollution, preserve soil fertility and discourage soil salinity and loss of top soil, the problems associated with the over use of chemical fertilizers. These are highly cost effective since a 300 gm material per hectare application will significantly cut down chemical fertilizer input equivalent to 50-60 kg per hectare mineral Nitrogen.

It is estimated that in India over 30% crop yields are lost whether in pre-harvest stage or during storage, the value of such losses being over Rs. 10 thousand crores per annum. The use of over 90,000 tonnes chemical pesticides annually in the country has resulted in diverse problems.

The example of Indonesia should be an eye opener, where the major policy decision of "minimising the use of chemical pesticides" and using natural & biological control of pests" resulted in maximised rice production of about 6.5 Tonnes per hectare.

Biopesticides are ecologically safe products with no residual effects like those shown by DDT, BHC and many chemical pesticides. Toxic levels of chemical pesticides have been found in vegetables, grains, fruits, water and even in mother's milk and breast tissues and many of these are potent carcinogens. Some multinational companies and universities have tried to bring in a few biopesticide products into India. In the quest of mosquito control products from all these except one company (BIL) have failed due to lack of appropriate technology. Two promising products from this company are now on large scale field trials in ten ecologically different regions now bringing in a variety of highly efficacious, target specific and safe products for agriculture and forestry sector for field evaluations through the nodal agencies to finally decide on appropriate products, their commercial production and availability in the country for cost effective applications.

APPLICATIONS OF BIOTECHNOLOGY IN ANIMAL HUSBANDRY

The contribution of livestock to the country's health and livestock development programme a upcoming sector in the present global economic context for the countries like India, whose major economic growth depends on agriculture.

Biotechnology includes our knowledge of biology, micro-biology and molecular biology to enhancing the potential of animals or strengthening their resistance to adverse factors in their environment. It is a new promising field in animal health and production which can be used for disease diagnosis, as well as production of safe inexpensive and effective vaccines. Biotechnology is the industrial exploitation of biological process for production of goods (products) and services (diagnostics).

The increase in the milk production is being achieved through crossbreeding programme using artificial insemination. It is through improvement of genetic make-up of indigenous livestock.

Biotechnology is a new promising field in the animal health and production which can be used for disease diagnosis as well as production of safe, inexpensive and effective vaccines.

Biotechnology in Disease Diagnosis :

The diagnosis of viral and bacterial diseases can be made possible either through antigen or antibody detection. The antibody to the causative agent of the disease can be detected using enzyme immuno assays e.g. ELISA which is highly sensitive and specific. The rapid diagnostic kits based on indirect ELISA are coming to the market for field use.

Biotechnology in Vaccine Development :

Biotechnology is the industrial exploitation of living process for the welfare of animals and human beings. Through recombinant DNA technology vaccines can be improved by cloning for immunogenic protein in an expression vector.

BAIF has also initiated molecular biological approaches to develop immunobiologicals so as to utilize above technological advances in the area of disease diagnosis, surveillance and prevention. Hence, BAIF is contributing to the whatever little it can through these

modern biotechnological approaches to upgrade the socio-economic status of livestock farmers in the present day world scenario.

BIOGAS CAN SOLVE NATION'S ENERGY PROBLEMS

AN ANSWER to the country's deepening energy crisis could be biogas, which besides a non-polluting energy source, also provides enriched manure and improves local sanitation and health standards.

Biogas consists largely of methane gas and it is produced through the anaerobic fermentation of cattle dung and other organic wastes. It is an energy option in rural areas, afflicted by high oil import bills and growing deforestation. A number of family and community biogas plants have been installed and today India is second to only China in the extent of its biogas programme.

However, a limitation of biogas is its dependence on cattle dung. As a result, a technology meant to help the weaker sections of society, with limited access to a variety of resources, has resulted in most biogas plants being owned by the rich.

Several government and voluntary agencies are involved in disseminating biogas technology. The department of non-conventional energy sources (DNES) under the Union ministry of energy is the nodal agency in charge of the national programme on biogas development (NPBD). DNES has adopted a multimodel, multi-agency approach. It installs plants suited to local conditions and works with NGOs and state government officials upto the district level.

Many voluntary, organisations are involved in NPBD's Action for Food Production. Technical and training support in provided by nine regional biogas centres. Its subsidy programme involves a lead bank in each district, selected by the DNES, which coordinates with other banks and institutions to give loans to approved applicants.

NPBD claims a success rate of 85 per cent and contains the 1.4 million biogas plants it has set up saves 4.38 million tonnes of fuel wood and produces 21.08 tonnes of enriched manure annually. But their claims have been discounted to some extent by Tata Energy Research Institute and the Comptroller and Auditor General.

TAPPING SOIL WATER THROUGH SOLAR ENERGY

Two scientists from NARI (Nimbkar Agricultural Research Institute), Phaltan, Maharashtra, India, are using solar energy to tap inaccessible water in soils and feed it to tree seedlings in the arid region of Maharashtra. Their method essentially involves digging a pit in the ground and covering it with a solar water evaporation still which traps the sun's heat. The heat makes the soil water evaporate and condense to liquid form which is collected and later fed to seedlings surrounding the pit.

HIGH ABRASION RESISTANT URETHANE COATING

Indian defence scientists have developed a new polyurethane coating which can be applied on various metals and fibre-reinforced plastic items to offer resistance against abrasion.

The two-component compound has been developed by the Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur.

It offers resistance against normal solvents, mild alkalies and acids.

The coating prevents fibrillation of composite structures which may otherwise lead to their failure a serious drawback. It can be applied like any other normal paint.

SUN-SOAKED WICKS PURGE SALTY WATER

An improved design for solar stills that can make salt water or waste water drinkable using only the power of the sun has been developed by Dr G.N. Tiwari of the Indian Institute of Technology, New Delhi. The cheapness and simplicity of the design makes it ideal for purifying water in rural areas of developing countries and this design has been nominated for an international award for intermediate technology. The core of the still comprises sheets of black polythene sandwiched between sheets of black jute. The sandwich is laid in the bottom of vessel made from fibre-reinforced plastic. The top of the vessel is sealed with a large sheet of glass. Sunlight heats the interior of the vessel and evaporates the water deposited on the sheet. The water vapour rises and condenses on the underside of the glass. The pure condensed water runs down the

glass and collects in a reservoir at the bottom of the still. Another advantage of the design, is that the glass sheet and the underlying sandwiches of jute and plastic are always parallel, so by tilting the whole device, the maximum amount of sunshine can be captured.

SELF-RENEWING ENERGY DEVICE

Using the principle of levitation, a device capable of supplying and uninterrupted source of energy, without using any kind of external energy, has been devised by a businessman. According to the device is environmentally safe and cost effective which could be used for driving secondary systems such as pumps, water wheel, windmills and turbines, and for electricity generation. The design consists of an ordinary ring made of non-ferrous material, with an axle at its centre. The ring is fitted with two arm-sets. The two arms of equal length are fixed on a shaft at one end, perpendicular to each other. This shaft is mounted on bearings on both sides. Using one suspended magnet and another bar magnet of the same weight and field strength, the former is fitted on one of the arm-sets on the ring. The other arm locks itself when the set is on the side which has to remain heavier. Effectively, one of the magnets will be away from the axle by an arm's length, while on the lighter side the other arm unlocks itself and the magnet becomes suspended weight. Hence the weight will now be at a distance from the axle to the bearings.

CLEANER FRIDGES

A company from the former East Germany looks set to launch its own solution to one of the West's environmental problems.

The company's product, known as 'Greenfreeze', is a conventional domestic refrigerator but, instead of ozone-damaging CFCs, it uses a mixture of butane and propane. Propane fridges and butane fridges have both been proposed before but both have their problems. The new fridge uses a mixture of the two, which is claimed to solve all those difficulties. Greenpeace, who are supporting the development, claim that the new product is both safe and energy-efficient as well as ozone friendly.

The only losers would appear to be the giants of the multi-national chemical industry. Having spent millions on developing ozone-friendlier versions of CFC coolants, they are now facing the prospect of a cheap and green alternative based on widely available chemicals, an alternative so simple that they cannot patent it.

GOVERNMENT BANS OZONE DEPLETING CHEMICALS

The Governemnt of India has prohibited import and export of certain chemicals, which cause depletion of the ozone layer, with the countries which are non-parties to the Montreal Protocol.

India has become a party of the Montreal Protocol on substances that deplete the ozone layer which came into effect in September 1992. The Government has issued notifications prohibiting import and export of eight chemicals in order to comply with the provisions of the Montreal Protocol, specially banning trade in the controlled substances with non-parties.

NEW WASTE DISPOSAL PROCESS

For combating pollution in the industry, VSI (the Vasantdada Sugar Institute) of Pune has developed a feasible process. It is a modified incineration technology process which is claimed to be economically viable. Its advantage is that this technology will be able to generate energy and potash as byproducts while disposing of the industrial wastes. The scientists of VSI claim that its drying incineration and energy generation technology eliminates the need for any external source of energy in teh distillery and its effluent treatment plant.

PETROL FROM PLASTIC

The National Industrial Development Laboratory of Japan at Hokkaido in collaboration with a local private company, Fuji Recycle Industries K.K., have found a method to transform certain types of plastics into gasoline and kerosene. The technique uses a catalyst to reverse the process that turns oil into plastic. The process first takes place in a melting vessel at 300^{0}C, then in a cracking

reactor at 400-420°C and finally in a catalytic reactor at 200-350°C. The types of plastic that are convertible into oils include polyethylene, polypropylene, and polystyrene. Fuji Recycle claims that the octane rating of the fuel produced is very high—between 90 and 100. It can be put directly into an automobile engine.

For Futher information, contact :

Kazuo Izumi, Research Planning Section, National Industrial Development Laboratory, 17-2, Higashi 2-JO, Tsukki-Sammu, Toyohiraku, Sapporo-shi, 061-01, Hokkaido, Japan.

WMO REPORTS ALARMING OZONE DEPLETION

The World Meterological Organisation (WMO) has reported significant Arctic spring ozone depletion. At the end of January 1992 total ozone levels over North America, and Northern, Central and Eastern Europe were more than 20% below normal for a few weeks. The average ozone levels for January over the entire 45-65 N belt in North America were 12 to 15% below normal, an average deficiency never seen before in 35 years of ozone observations.

And in the Antarctic, the WMO reported up to 65% ozone destruction in the second half of September and early October, for nearly four consecutive weeks, there was complete ozone destruction in the layer between 14 to 19 km from the South Pole. NASA's Upper Atmosphere Research Programme, has confirmed the average ozone abundance in 1992 were upto 3% below the lowest seen in any previous years.

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TRADITONAL SCIENCES AND TECHNOLOGIES OF INDIA

Centre for Technological Alternative for Rural Areas (CTARA) IIT, Bombay in collaboration with the Patriotic and People-Oriented Science and Technology (PPST) Foundation, Madras will organise a "Congress on Traditional Science and Technologies of India, at Bombay from 28th Nov. - 3rd Dec '93.

The main objectives of the course are :

— To put together a comprehensive picture of our scientific and technological heritage with particular emphasis on its living aspects.

— To present an integrated picture of our scientific and technological traditions by focussing on the general concerns and principles under lying them, from the most concrete of technologies.

— To recognise and identify complete technological systems that give birth to the products of our technologies.

— To help in initiating a serious dialogue between practitioners and experts of our traditional science technologies and their modern counter parts.

— To raise the issue of and intiate a serious debate on the question of the contemporary relevance of our scientific and technological traditions to the task of national development and progress as understood at present.

The congress will cover the topics Health and Life Science, Agriculture, Forestry and Water Management, Architecture and House Building, Textiles, Leather and Paper, Metals and Materials, Abstract Science and Social Organisation.

For further information contact :

Prof. H.S. Shankar
CTARA
Indian Institute of Technology
Powai, Bombay - 400 076

SUSTAINABLE DEVELOPMENT

South Pacific Regional Environment Programme, Western Samoa, will organise first "Global Conference on the Sustainable Development of Small Island Developing States" to be held in Barbados in April '94.

This Programme will cover : Climate change and sea level rise, Natural and environmental disaster preparedeness, Management of Wastes, Coastal and marine resources, Freshwater resources,

Land resources, Energy resources, Pourism resources, Bio-diversity resources, Science and technology, Human resource development including education, Health and population, Environmental legislation.

For further information contact :
Gerald Miles
Sustainable Development Officer
South Pacific, Regional Environment Programme
P.O. Box 240, Apia
Western Samoa.

RURAL WATER SUPPLY AND WASTE MANAGEMENT

Department of Sanitary Engineering, International Training Network, All India Institute of Hygene and Public Health, Calcutta will organise its Fourth Training Course of the year 1993 on "Rural Water and Waste Management" at its centre on 13th - 18th December 1993.

For further information contact :
Prof. K.J. Nath
Chief Cordinator ITN
Prof. of Environmental Sanitation and Head Deptt. of Sanitary Engineering
All India Institute of Hygiene and Public Health
110, CR Avenue
Calcutta - 700 073

LOW COST BUILDING AND CONSTRUCTION

Tara Nirman Kendra, New Delhi, offers following Artisan Training and Introductory Courses in the month of December, 1993.

First Artisans Training will be held on "COMPRESSED EARTH BLOCKS" (operation of TARA BALRAM) from 6-11 December '93. The next artisans training will be on "MICRO-CONCRETE TILES (Operation of TARA MICRO-CONCRETE TILEMAKER) from 13-18 December '93. These courses are useful for Artisans/ Semi skilled workers. These training will be provided free of cost to operators from organisation that have already purchased both machines.

An another introductory course on "COMPRESSED EARTH BLOCKS AND MICRO-CONCRETE ROOFING TILES

TECHNOLOGIES" will also be held from 28-30 December '93. The course will offer basic information to potential users on the local suitability, production process and utilisation of compressed earth blocks.

For further information contact :
Sri Shrashant Patara
Programme Co-ordinator
Tara Nirman Kendra
C/o Development Alternatives
B-32, TARA Crescent
Qutab Institutional Area
New Delhi - 110 016

New Delhi - 110 016

RENEAWABLE ENERGY, CLEAN POWER - 2001 :

JEE Conference Services, London will organize an "International Conference on Renewable Energy : Clean Power - 2001" at London from 17-19 November 1993

For further information contact :
Jane Cloping
IEE Conference Services
Savoy Place
London - WC2 ROBL

SOLAR '94

American Solar Energy Society, will organize a Conference "SOLAR 94", at San Jose, California, USA, from 25-30 July '94

For further information contact :
American Solar Energy Society
2400 Central Avenue
Suil G-1, Boulder
Co - 80301

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BIOGAS : A MANUAL ON REPAIR AND MAINTENANCE

India has great potenital to install biogas plant. It provides cheap fuel and high quality fertilizer. Therefore it is essential to ensure that biogas plants installed in the country are not only working to the satisfaction of the users, but also continiuously utilized to their optimum capacitites. When the plant is in use, frequent checks and maintenance are essential.

Present manual is the result of the study conducted by Vivekananda Kendra, Kanyakumari, Tamil Nadu, under the project "Defective Biogas Plants - Survey, Faults, Rectification and preparation of repair and maintenance manual", & Sponsored by Ministry of Non Conventional Energy Sources. The manual is very practical, illustrative and simple in language. The contents of the manual are divided into eleven chapters and eight annexures. Chapter one describes Popular Biogas Plant Designs. Proceeding chapters explains very well about Defective Biogas Plant, Organisation, Operational and Installation Problems, Defects and Methods for Detecting Installation Defects and Solutions for Repair. Last two chapter describes Economics of Repairs and Tips for Construction and Maintenance.

The manual is useful for voluntary organisations, self employed workers, supervisors, biogas managers and government field functionaries involved at the grass root level in the implementation of the National Project on Biogas Development.

'Biogas - A manual on repair and maintenance" by Biogas Cell of Vivekananda Kendra Nardep, Kanyakumari, Pp 64, 1993. English.

HUMAN RESOURCE DEVELOPMENT AND ENVIRONMENT

Man through his own indiscrete exploitation of the natural resources and scientific and technological advances without casting for their side effects on the environment has created conditions which if allowed to deteriorate any further will pose a challenge to the very survival of life on this planet. Only recently this

realization has come in the form of green house effect and the depletion of Ozone shield. The consciousness of a global need for environmental education and a scientific approach to the tacking of the problems in the area of the preservation, sustenaince and development of environment so as to be in tune with survival of life is gradually gaining ground.

The present book is a modest effort for the dissemination of essential information about topics of current interest in the field of environment. The book is divided in six sections viz : Environmental Technology, Environmental Health, Environmental Psychology, Environmental Education, Environmental Management, Environmental Conservation. The papers presented in these section aims at the presentation of techniques, ideas, and applications to enable those who are not specialist in a particular subject to appreciate their applicability to their own work.

"Human Resource Development and Environment" by R.D. Sharma (Ed.), Published by Commonwealth publishers, New Delhi, PP 329, 1991, English.

ENVIRONMENTAL PROBLEMS : PROSPECTS AND CONSTRAINTS

Environment is understood today as a comprehensive scientific and practical trend and as a certain general aspect of the vital activity of modern civilisation. Human beings like other living creatures, live, depend on and influence the environment. On global level, increasing population pressure, urban development, industrialisation and ever growing technologies are creating newer demands on every facet of the environment. They are using more resources, more rapidly, also, consequently, producing more wastes more rapidly than any previous civilization. The main problems related to the deterioration of man's natural environment are through industrialisation and urbanisation of his mode of life including the danger of genetic degeneration of mankind himself.

The book is the fruit of reflection of a group of teachers and researchers who

are engaged in such problems. The book examines the solution, being attempted and suggests fresh and possible alternatives. The book is divided in six chapters, first chapter defines aims and objectives, chapter two covers some characters of environmental problems, chapter three and four describes environmental impact assessment techniques and certain case studies. Chapter five and six deals the pollution appraisal and control respectively, which also contains findings and suggestions by the author on his own observation.

"Environmental Problems— Prospects and Constraints by R.N. Trivedi, Published by Anmol Publications, Pp 225, 1992, English.

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At least 30,000 people in United States are involved in the recycling of aluminum alone.

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CENTRE FOR DEVELOPMENT OF RURAL TECHNOLOGY
INSTITUTE OF ENGINEERING & RURAL TECHNOLOGY, ALLAHABAD

Offers :

★ Prototype development services.
★ Setting up Rural Technology Centres.
★ Organising State-level National & International workshops, seminars & training programmes.
★ Training & Promotion of rural entrepreneurs to undertake rural technology projects.
★ Training of engineers, supervisors & skilled workers in rural technology Product manufacture & maintenance.

Some achievements :

Design & Development of over 2 dozen rural technology products like transportable charcoal kiln, pyroliser, fuel briquetting machine, solar still, solar sterilizer; fiber glass-cattle feed trough, tasla, sanitary fittings, transportable biogas plant, paper slate etc.

Organised National Seminar on Rural Technology (1981), on behalf of Ministry of Rural Development, Govt. of India. State level workshops on technology transfer for state Govt. of Himachal Pradesh (1983) & Karnataka (1984), International Training Programme on Appropriate Technology sponsored by Unesco (1983), A.T. Orientation Programmes for senior officers of Science Policy Centre of Govt. of Iran etc.

Trained over five hundred personnel of Community Polytechnics, Centre for Development of Rural Technology, Voluntary agencies, Govt. Departments etc. in rural technology product manufacturing, maintenance etc.

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Rural Technology Journal is published by Information Service Division, Centre for Development of Rural Technology, Institute of Engineering and Rural Technology, Allahabad (India). The purpose of Journal is to provide a forum for exchange of views, information and create awareness in the field of Rural Technology, its development and transfer to the rural areas, technological products and processes, methodologies and approaches etc. Effort is being made to ensure that this Journal become relevant not only for this country but to all those nations, groups and individuals, in any part of the Globe who have concern to contribute towards the welfare of the under privileged rural communities. The Journal is divided into following main sectons :—

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Telex : 540-260 IERT-IN
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