APPLICATION OF SCIENCE AND TECHNOLOGY FOR TRIBAL DEVELOPMENT

B.N. BORDOLOI

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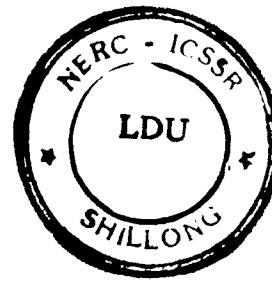

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GUWAHATI

APPLICATION OF SCIENCE AND TECHNOLOGY FOR TRIBAL DEVELOPMENT
A book containing the proceedings, recommendations and papers presented in a seminar on "Application of Science and Technology for Tribal Development" held in Guwahati on July 29-31, 1987, edited by B. N. Bordoloi, Director, Tribal Research Institute, Assam, Guwahati-781028.

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Contents

Role of Science and Technology, area of new Technologies, their potentialities, transfer, utility and applicability in the context of Tribal Development.

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Science and Technology are bodies or inventories of knowledge and experience to useful purposes. Science, on the one hand, embraces the entire stock of our current knowledge of the physical and living elements in the world around us. Technology, on the other hand, contains our current knowledge and experience about how to use scientific knowledge for practical purposes. So, precisely, science is 'know-why' while technology is 'know-how'. Industrially advanced nations recognise that their economic future depends to a large extent on their ability to transform scientific knowledge into exploitable technology.

Tribal development concept

The issue of tribal development has been a subject of great concern for the policy makers in India. The problems of development, both social and economic, involve complex issues in formulation, implementation and evaluation of plan for development of tribal regions. Majority of the tribals are engaged for their sustenance in farming on their own

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small holdings. A substantial number of the tribals are also engaged as agricultural labour. They are generally landless labourers or have extremely small and uneconomic land holdings. They have been unable to enjoy the fruits of science and technological development due to their low level of education, skill and awareness. Thus a vast majority of the tribal population continues to persue the traditional occupations despite the existence of employment avenues in the new industrial ventures located in that region.

Causal aspects of tribal poverty

A proper enquiry into the causes of poverty of the tribal population must also take into consideration the following four factors as well :

1. Forest and environment—tribal life is greatly conditioned and influenced by forest and other natural resources on which they depend upon for their supply of food, fedder, fuel wood and animals. Forest is also an important source of their income.
2. Infrastructural facilities—an important determinant of development of any area is the availability of infrastructural facilities. Among such facilities, irrigation assumes great importance followed by rural electrification and so on and so forth.
3. Employment opportunities elsewhere—the tribal belt in our country has large deposits of minerals and other natural deposits. The victims of these exploitations are the tribals. The large capital intensive units in the tribal areas have not only failed to provide them employment opportunities but have also caused heavy immigration of people from other parts of the state and even from outside.
4. Rural urban break up—Urbanisation is closely associated with the process of industrialisation. A comparative account of rural and urban total population and rural urban tribal population in the different census reports

brings out the pattern of tribal population in the direction of reduction compared to the non-tribal population.

Poverty alleviation parameters

System approach to alleviate poverty includes four steps. They are : (1) to fix criterion for defining poverty line, (2) to lay down the methodology of identifying the families living below the poverty line, (3) to estimate the quantity and quality of resources and technological, managerial and financial resources which are needed by an individual family for achieving the desired objective, and (4) to evolve investment plan and functional mechanism for providing the required inputs.

Application of S & T

The role of scientist/technocrat in rural development is primarily to provide scientific knowledge and skills, conduct demonstration and training in the application of selected technologies and provide expert guidance and advice on the application of S & T under user/consumer conditions.

The council of Scientific & Industrial Research (CSIR), the country's premier scientific and industrial organisation through its 39 national and 2 associate laboratories, has done considerable work on the generation, development and demonstration of new technologies with potential for ameliorating the conditions of people living in the countryside. As CSIR is a technology developing agency and is not adequately equipped for extension work to cover vast rural areas of the country, there is, therefore, a need for 'load' agency like the Council of Advancement of Rural Technology (CART), State Councils of S&T and Social Voluntary organisation, etc, which may derive help from the concerned CSIR laboratories and use the fecilities of local technical and engineering institutes for promotion and advancement of these in their operational fields.

Regional Research Laboratory, Jorhat (RRL Jorhat) is the only major multi-disciplinary national establishment of CSIR in the north eastern region. RRL Jorhat has been

contributing considerably in association with the state'governments of the north eastern region for the socio-economic uplift of the rural people through its technological innovation input.

Areas of new technologies & their potentialities

The techniques and technologies developed at CSIR laboratories serves manifold purposes for human welfare and community services. The list of technologies is presented here in certain order of classifications like agro-based, forest based, poultry based and so on (please see the tables). Few related and precise information like, sources of technology, raw material, scale, cost plant capacity, employment, potential utilisation status, etc, are also mentioned based on the year 1983 index.

Transfer of technology

Using S & T for the welfare of rural masses needs a different promotional and management approach. It required blending of Research & Development (R&D) results with demonstration, training and implementation of well defined projects in an integrated mannar. Since risk-taking capacity and entrepreneurship are minimum among the rural people, especially the tribals, the project formulation for promotion of such technologies should as far as possible be sieved through the following steps :

1. identify local problem and needs and isolate priority areas requiring application of S&T :
2. study existing levels of technologies practised and identify significant gaps, the overcoming of which may immediately attract the attention of the people :
3. study priority areas among the ongoing programmes initiated by rural development agencies and identify technological gap, if any :
4. harness matching techniques/technologies to bridge the above gap and study the scope of working out a mix of both traditional and new techniques :

5. prepare an integrated project proposal for community and/or individual family use aimed at (i) direct application of known knowledge, (ii) modification of a known technology to make it adaptable to the local situation, (iii) upgradation and nationalization of traditional skills, (iv) development of new techniques required ;
6. interact with local leaders, target groups, development staff, voluntary agencies, etc. for finalizing the programme ;
7. ensure supply of inputs for implementation of improved/ new technology ;
8. involvely the target groups/beneficiaries to participate actively in demonstration/training programmes ;
9. arrange training of key personnel and trainers to facilitate dissemination, diffusion and replication of the technology;
10. monitor the project in the initial stages of implementation, help in the solution of any teething troubles, and provide expert counselling to eliminate risks of failure ; and
11. provide regular feedback to the generators of technology.

Promotional approach

In mass and community adoption projects it would be advisable to organise campaigns to explain the 'know-how' and 'know-why' of the project in advance. Local teachers and students should be involved in this task. Some projects (e.g. rodent control based on CSIR technology) may require a whole village or even the involvement of a cluster of villages. Here, the dynamics of human behaviour and the advantages of resources and management services will have to be fully explolited. Local people will have to be educated, inspired and induced to give a trial to the technologies being effored through discussions, visuals, demonstrations etc. Women should invariably be involved to function as motivators.

Investment decision

Any improved or new technology demands some investment. A person should weigh the expected benefits over those of traditional practices, whether they relate to adoption of an improved *chullah,* or a latrine, or a shelter. The advantages of these techniques and technologies will, therefore, need explanation in terms of appropriate direct/ indirect socio-economic benefits and impact on tribal families or the village community as a whole. While a number of projects need comunity participation and responsibility, others need public funding, incentives or motivation of one kind or another.

Support services and action research

Diffusion of technologies for human welfare in general and tribal welfare in particular require an integrated approach and continuous educational programme supported by needed inputs within means and easy reach of the target groups/ beneficiaries. Convincing local tribal leaders and change agents taking the lead in adopting such technologies may perhaps complement the extension efforts.

TRIBAL DEVELOPMENT AND RRL JORHAT—A CASE STUDY

In view of the prevailing agro-climatic condition, RRL Jorhat took up the socio-economic development activities for the tribals residing at rural areas mainly in the form of (1) promotional aspects of aromatic and medicinal plants ; (2) training entrepreneurs to develop technical manpower for the rural industry and (3) conducting science motivation courses. In recognition of the above mentioned programme, RRL Jorhat bagged, the 1985 Federation of Indian Chambers of Commerce & Industry (FICEI) award for rural development activities.

The villages selected by RRL Jorhat are Yaongyimsen and Kohima suburbs in Nagaland ; Tawang, Lumla, Senua

and Pasighat in Arunachal Pradesh ; Balat in Meghalaya ; Sepahijala in Tripura ; Montripukhuri in Manipur ; Boko, Meleng/Nakachari, Kenduguri, Pengeri and some other villages in Assam. It is not possible to discuss in detail all these villages individually because of time limitations. But, still a brief resume in few cases are cited here.

During 1970, RRL Jorhat opened a sub-station at Yaongyimsen village (Nagaland) by procuring 3 acres of land. An experimental-cum demonstration plant for distillation of citronella grass was started and the villagers were motivated to take up training in citronella cultivation. In 1971 out of 350 families of the village only five families took cultivation and brought an acre of land under cultivation.

Gradually more families of the village started participating in the RRL programme by bringing more land under cultivation. The Department of Industries, Government of Nagaland was brought into the scene and at their instance the Laboratory designed, fabricated and installed a distillation plant of 200 kg/batch capacity in the village. Government run units started distilling the grass supplied by the villagers. They also started earning money. With the increase in area under citronella cultivation, distillation plant was found inadequate to distil all that produced. Another unit of 200 kg/batch capacity was then installed. As the cultivation further extended, new distillation stills of the higher capacity had to be installed to meet the increased demand. The progress and enthusiasm shown by the villagers impressed the Government of Nagaland who provided Rs. 2·6 lakhs to RRL for design, fabrication and installation of a sephisticated distillation plant of turn-key basis, Accordingly, in 1979, another distillation plant (55 kg/batch) was installed in the village by the Government of Nagaland. Thus in 1971, the villagers produced 30 tonnes grass valued at Rs. 1500·00. Consequently till 1984, because of promotional activities of RRL, 257 families of the village brought 215 hectares of land under cultivation of citronella and produced 614 tonnes of grass valued at Rs. 30·57 lakhs (approx). Apart from

selling citronella grass, the villagers got the opportunity to sell fire-wood for the distillation plant. Some villagers were also got job in these distillation units as skilled and unskilled labourers who were trained by RRL.

The activities in Yaongyimsen village acted as a catalytic agent. Persistent requests were received by RRL to introduce such programmes in other villages of the region.

In the village of Yaongyimsen, a paper slate manufacturing unit has been installed by RRL and the local youths were trained. Three local youths not working in the unit have not only mastered the technology, but have also brought about some innovation like sun-drying of the slates in a six tier trays made of bamboos. The industry directly employed 3 semi-skilled labourers (trained by RRL Jorhat) and one skilled (carpenter) for making wooden frame for the slates. It employed a few more unskilled labourers who sell the slates in the nearby areas. Thus this industry with an investment of Rs. 5000·00 provided employment opportunity of 5-6 people. The paper slate making technology has been licensed to more than 100 parties in rural and semi-urban areas in different parts of the country which has generated employment opportunities to more than 500 unemployed youths.

RRL Jorhat with the financial assistance of Appropriate Technology Unit, Ministry of Industry, Govt. of India, New Delhi and Department of Industries, Arunachal Pradesh Pasighat worked out certain rural development programmes. The laboratory supplied the improved strain of Java citronella slips to the growers. A distillation still of 500 kg/batch capacity for extraction of oil was installed at Pasighat.

Pengeri village in Tinsukia sub division of Upper Assam is a cluster of nearly fifteen tiny villages with an area of more than 3000 hectares. The people, represented by different economic groups thrived gradually on citronella cultivation. The citronella cultivation at Pengeri was initiated in the year 1973 in a few patches of waste land. The idea caught up as an individual farmer could earn about Rs. 800.00 a month

from one hectare land under citronella cultivation by way of selling the grass at 50 paise/kg to nearby distillation units.

In order to meet the distillation demand of the area more than 50 stills of different capacities ranging from 50 kg/batch were installed. In 1984, all total 723 farmers brought around 2053 hectares of land under citronella cultivation and produced about 62,000 tonnes of citronella grass valued at Rs. 2·77 crores. The prosperity derived by the village people by adopting RRL technology is quite visible. It would be interesting to note that the Pengeri area is surrounded by thick forest and the villagers could not cultivate paddy or sugarcane due to depredation by wild elephants. Since, citronella grass is not eaten by elephants, the villagers are cultivating it safely.

AGRO-BASED TECHNOLOGIES

S.No.	Technology/ technique (laboratory)	Man feed stock/raw material	Status/scale of technology	Cost/capacity of plant	Energy source requirement	Employ-ment potential	Utilisation Status number of parties	
							released to	in production
1	2	3	4	5	6	7	8	9
1.	Anti-fungal paste (CFTRI, Mysore)	Banana, high polymorisation diluent accelerator, fungicide, food colour	Available (cottage)	Rs. 15,000/30kg per day	Electricity 6 KW/day	4	—	—
2.	Castor oil dehydrated (RRL, Hyderabad)	Castor seeds	In production (small)	Rs. 4,00,000/ 500kg per day	Electricity 300 KW/day	20	4	2
3.	Cocoa mass, refined Cocoa powder (CFTRI, Mysore)	Cocoa beans.	In production (small)	Rs. 5,33,000/ 0·25t beans per day	Electricity 350KW/day water 800 liters/day	11	4	1
	Coconut, desicated (CFTRI, Mysore)	Coconuts	Available (small)	Rs, 1,45,000/ 1000 coconuts per day	Electricity 75 KW/day water 6,000 gal/day	45	—	—

1	2	3	4	5	6	7	8	9
5.	Coconut water bottling of, (RRL, Trivandrum)	Ripe coconuts	Released (small)	Rs. 14,10,000/ 1000 litres of coconut water per day.	Electricity 41 Kw/day Light diesel oil 14 litres/day	10	1	—
6.	Coconut oil and defatted gratings (RRL, Trivandrum)	Fully matured coconuts.	Released (small)	Rs. 1,10,000/ 2000 coconuts per day	Electricity 400 Kw/day	18	3	—
7.	Cotton, chemical (RRL, Hyderabad)	Cotton linters	In production (small)	Rs. 30,00,000/ 4.5 t per day	Electricity 3,000 Kw/day	50	1	1
8.	Food, weaning malted (for infants) (CFTRI, Mysore)	Ragi and green gram	In production (small)	Rs. 4,00,000/ t per day	Electricity 85 Kw/day Fuel oil 120 litres/day water 20,000 liters/day	40	3	2
9.	Food colours, Plant based (CFTRI, Mysore)	Turmeric, Kokum, Beetroot, etc.	Available (small)	Rs. 15,00,000/ 2.8 t of raw material per day	Electricity 350 Kw/day Water 12,000 liters/day oil 400 litres/day	20	—	—

1	2	3	4	5	6	7	8	9
10.	Fruits & vegetables, debydration of (CFTRI, Mysore)	Fruits & vegetables	In use (small)	Rs. 7,18,000/ 500 kg per day	Electricity 200 Kw/day Water 15,000 liters/day.	54	Several	Several
11.	Grapes, sun dried (CFTRI, Mysore)	Grapes, preserva-tive	In pro-duction (cottage)	Rs. 3,000/100kg per day.	Solar	Self employment	1	1
12.	Liquid fruits (CFTRI, Mysore)	Apple banana, guava, grape etc.	In produc-tion (small)	Rs. 1,00,000/ 1000 bottles (200ml) per day	Electricity 25 Kw/day Water 2,500 litres/day	8	10	1
13.	Maize mill including destoner (CFTRI, Mysore)	Maize	Destoner in produc-tion (small)	Rs. 2,00,000 400kg of maize grain per hour	Electricity 304 unit/day	8	46	3
14.	Papain (CFTRI, Mysore)	Papaya latex	In produc-tion (small)	Rs. 1,50,000/ 25 kg. of latex per day.	Electricity 135 Kw/day	39	12	2
15.	Papain, crystaline and concen-trate (RRL, Hyderabad)	Papaya latex	In produc-tion (small)	Rs. 9,00,000/ 500 kg of crystaline and 500 kg of concent rate per annum	Electricity 700 Kw/day	28	4	1

1	2	3	4	5	6	7	8	9
16.	Pactin, peel oil, and calcium citrate (CFTRI, Mysore)	Lime (citrus aurentifolia)	In production (small)	Rs. 16,00,00/ 4 t of lime per day yielding i) cal. citrate 24 t ii) peftin 15 t iii) Oil 1800 litres	Electricity 350 Kw/day steam 7t/day water 50,000 litres/day.	73	4	1
17.	Potato chips, dehydrated (CFTRI, Mysore)	Potato	In production (cottage)	Rs. 15,000/50 kg chips per day	Solar (sun drying)	4	Several	Several
18.	Potato chips, fried (CFTRI, Mysore)	Potato refined groundnut oil	In production (cottage)	Rs. 7,000/20 kg chips per day	Negligible	3	1	1
			(small)	Rs. 2,00,000/ 500 kg chips per day.	Electricity 100 Kw/day Water 25,000 litres/day Fuel oil 600 t/day.	7		
19.	Pulse mill, modern (CFTRI, Mysore)	Pulses.	In production (small)	Rs. 3,00,000/8 t pulses per day.	Electricity 680 units/day Water 350 litres/day	12	8	2

1	2	3	4	5	6	7	8	9
20.	Raisins (NBRI, Lucknow)	'Pusa' Seed-less grapes.	Available (small)	Rs. 80,000/ 30-40 kg of raisins per day	Electricity 5 Kw/day	5	—	—
21.	Rice mill, mini (CFTRI, Mysore)	Paddy (Rough Rice)	Plant in Production (small)	Rs. 50,000/500 kg of paddy per hour	Electricity 65 Kw/day	5	43	2
22.	Sesame seed, dehulling of, (CFTRI, Mysore)	Sesame seeds.	Released (small)	Rs. 20,00,000/ 5 t seeds per day	Electricity 450 Kw/day steam 16 t/day Water 50,000 gal/day.	35	1	—
23.	Walnuts, processing of (CFTRI, Mysore)	Green walnuts	Machine in use (cottage)	Rs. 25,000/t per day.	Electricity 300 Kw/day	10	Several	Several.
24.	Wax emul-sion for increasing shell life of fruits and vegeta-bles (CFTRI, Mysore)	Fruits and vegeta-bles, emulsifi-ers, fun-gicides and wax.	In produc-tion (cottage)	Rs. 10,000/20 litres per day.	Electricity 5 Kw/day	4	3	1

1	2	3	4	5	6	7	8	9
25.	Wheat milling (CFTRI, Mysore)	Wheat	Released (cottage)	Rs. 35,000-40,000/ 300 kg wheat per day (8 hours shift)	Electricity 25 Kwlday	4	11	—
				SPICE-BASED TECHNOLOGIES.				
26.	Asafoetida (Hing), powder tablets (CFTRI, Mysore)	Asafoetida (Oleo-gum resin obtained from root of Ferale plants).	In production (small)	Rs. 1,10,000/ 200 kg resin per day.	Electricity 160 Kw/day.	12	1	1
27.	Chilli, drying of (CFTRI, Mysore)	Chillies	In use (small)	Rs. 61,000/130 kg per day.	Solar Water 1,500 litres /day.	50	1	1
28.	Chilli oleoresin high pungent fraction and colour of (RRL, Trivandrum)	Dried Chillies	Released (small)	Rs. 22,00,000/t chillies per day.	Electricity 475 Kw/day Light diesel oil 70 litres/day.	30	3	—

1	2	3	4	5	6	7	8	9
29.	Garlic power (CFTRI, Mysore)	Garlic bulbs	In production	Rs. 1,30,000/ 225 kg powder per day.	Electricity 500 Kw/day water 5000 litres/day	25	17	3
30.	Ginger, drying & powdering of (CFTRI, Mysore)	Ginger	In use (small)	Rs. 3,80,000/ 1.2 t of raw ginger per day	Electricity 1,500 Kw/day	7	Several	Several.
31.	Mustard powder (CFTRI, Mysore)	Mustard seeds	In production (small)	Rs. 3,45,000/ 500 kg mustard seeds per day.	Electricity 150 Kw/day steem 1 t/day Water 5,000 litres/day	8	3	1
32.	Pepper, green, canning and bottling of (RRL, Trivandrum)	Fresh green pepper	In production (small)	Rs. 9,50,000/ 60 t per annum (60 working days)	Electricity 30 Kw/day Light diesel oil 120 litres/day Water 5,000 litres/day	16	5	5
33.	Pepper green, dehydrated (CFTRI, Mysore)	Fresh green pepper	In production (small)	Rs. 3,28,000/t pepper per day 150 working days	Electricity 1,20,000 Kw/ annum coal 20 t/annum	18	23	4

1	2	3	4	5	6	7	8	9
34.	Pepper, green dry packed (RRL, Trivandrum)	Fresh green	Released (small)	Rs. 1,55,000/ 15 t per annum	Electricity 5000 Kw/annum	6	2	—
35.	Pepper, powder (white) from black pepper (RRL, Trivandrum)	Dry black pepper	Released (small)	Rs. 6,30,000/ 300 kg of black pepper per day (8 hours shift)	Electricity 185 Kw/day Lightdiesel oil 100 litres/day	12	1	—
36.	Spice oleoresins (CFTRI, Mysore)	Pepper, ginger turmeric, chillies,etc.	In production (small)	Rs. 12,00,000/t of raw material per day	Electricity 180 Kw/day fuel oil 300 litres/ day Water 8,000 litres/day	27	26	7
37.	Spice oil (CFTRI, Mysore)	Cardamom, pepper and ginger.	In production (small)	Rs. 2,50,000 500 kg per day (100 working days)	Electricity 300 Kw/day	10	7	2
38.	Turmeric, curing and polishing (CFTRI, Mysore)	Turmeric gingers.	In use (small)	Rs. 90,000/500 kg raw material per day.	Electricity 300 Kw/day	10	Several	Several

1	2	3	4	5	6	7	8	9
			MUSHROOM CULTIVATION AND FROCESSING					
39.	Mushroom, cultivation of (NBRI, Lucknow) (RRL, Jorhat)	1) *Volvariella.sp.* Spawn and paddy straw.	Released (cottage)	Rs. 15/bed for cultivation of 3 kg mushroom	—	Self employment	Several	—
		2) Button (*Agricus bisporus)* spawa, wheat straw sawdust and wheat bran	-do-	Rs. 30-25/tray for cultivation of 3kg mushroom (period about 60 days)	—			
		3) Dhingri (*Fleurotus saiorcaju*) spawn and paddy straw	-do-	Rs. 15/try for cultivation of 3kg mushroom (period about 30 days)	—			
		4) *Pleurotus flabbelatus* spawn, paddy straw, oat meat and polythene bags.	-do-	-do-	—			
40.	Mushroom, preservation of, by canning, dehydration, pickling and soup manufacture (RRL, Jammu)	Fresh mushroom	Released (small)	Rs. 2,75,000/ 450 kg fresh mushroom for 180 days.	Electricity 20 hp Water 2 kl/day	24	Several	—

1	2	3	4	5	6	7	8	9
41.	Mushroom, dehydration of (RRL, Jammu)	Fresh mushroom	Released (cottage)	Rs. 12,000/ 180 kg fresh mushroom per day.	Solar Wood & coal marginal	4	Several	—
42.	Mushroom, cultivation* and processing of (EFTRI, Mysore)	Master spawn, nutrients, paddy straw and packaing material	In use (cottage)	Rs. 50,500/ 50 kg fresh mushroom per day.	Electricity 5 units/ day Water 1000 litres/ day Fire wood 20 kg/day	Self employment	1	1
			FERMENTATION-BASED TECHNOLOGIES					
43.	Amylo-glucosidase (CFTRI, Mysore)	Strain of *A. niger* wheat bran	In production (small)	Being estimated	—	—	3	2

* **Fleuretus saiorcaju** variety of mushroom can be cultivated and harvested within 20-25 days in thatched hut under moderate conditions of 20-28°C temperature and relative humidity of 55-75 per cent. It can be grown for 6-8 months in a year at an estimated cost of Rs. 5/kg of mushroom.

1	2	3	4	5	6	7	8	9
44.	Curd, ready mix for quick setting of, (CFTRI, Mysore).	Chemicals.	Released (cottage)	Cost of mix works out to be 35 paise for making curd out of 1 litre of milk	—	—	1	.
45.	Microbial rennet (CFTRI, Mysore)	Strain of rhizopus.	Released (small)	Being estimated	—	—	1	—
46.	Orange, comminuted beverage base (CFTRI, Mysore)	Mandarin oranges.	Released (small)	2.8 t oranges per day.	Electricity 100kw/ day. steam 1 t/day	10	1	—
47.	Pectic enzyme (CFTRI, Mysore)	*Aspergillin* wheat bran	In production (small)	Rs. 4,60,000/ 35 litres concentrate per day	Electricity 300kw/ day Coal 0'05 t/day Water 30,000 litres day	12	4	2
48.	Vinegar from pineapple waste, or any sugary material (CFTRI, Mysore)	Pineapple ceels, corncobs, nutrients, bottles, etc.	In production (cottage)	Rs. 30,000/t per day	Water 5,000 litres/day	Self employment	1	1

1	2	3	4	5	6	7	8	9
49.	Board, fibre, for packing purposes (RRL, Jammu)	Pire needles	Released (small)	Rs. 25,00,000/ 4.8 t raw material per day	Electricity 250 hp Coal 1 t/day	50 direct 100 indirect	5	—
50.	Board, paper (RRL, Jammu) (RRL, Jorhat)	Paddy/wheat straw, hagasse, pine needles, etc.	In production (small)	Rs, 8,00,000/ 2.5 t per day	Electricity 120 hp Coal 1 t/day water 150 kl/ day	16	8	4
51.	Board, straw (RRL, Hyderabad)	Waste paper, grass and straw	In production (small)	Rs. 3,00,000/ 500 kg. of board per day	Electricity 500kw/ day water 250 kl/ day	12	Several	Several
52.	Cedarwood oil (RRL, Jammu)	Cedrus deodara	In production (small)	Rs. 2,50,000/ 20 kg. per day	Electricity 5hp coal/ fuel wood 100 t/ annum	10	10	3

1	2	3	4	5	6	7	8	9
53.	Gum from 'dhaincha' (sesbania bispinosa) (NBRI, Lucknow)	Dhaincha seeds	Available (small)	Rs. 2,50,000/t seed per day	Electricity 20kw/day	50	—	—
54.	Pine wool (RRL, Jammu)	Pine needles	Released (small)	Rs. 3,80.000/ 1.6 t day needles per day	Electricity 50hp coal 100/t annum	16	4	—
55.	Resin, distillation of, and hardened resin, production of (BRL, Jammu)	Chir-resin	In production (small)	Rs. 5,00,000/t per day of resin distillation and Rs. 10,000,000/t per day of hardened resin	Electricity 15hp coal 100/t annum	20	5	3
56.	Tamarind powder (CFTRI, Mysore)	Tamarind pulp	In production (small)	Rs. 3,00,000/ 500 kg per day	Electricity 450 km/ day water 7,000 litres/day	25	17	5

1	2	3	4	5	6	7	8	9
57.	Broilers, dressing of (CFTRI, Mysore)	Broiler chicken	In use Poultry dressing gadgets developed (cottage)	Rs. 30,000/ 150-200 birds per day	Electricity 10 kw/day Water 2,000 ltrs/ day	10	Several	Several
58.	Egg albumen flackes	Egg	In production (small)	Rs. 4,00,000/ 40 kg flakes per day	Electricity 100 kw/ day water 10,000 ltrs/day	8	8	1
59.	Egg coating oil (CFTRI, Mysore)	Petroleum product, preservatives	Released (small)	Rs. 1,00,000/ 1000 litres per day	Electricity 40 kw/day	6	3	—
60.	Egg shell powder (CFTRI, Mysore)	Egg shells	In production (small)	Rs. 60,000/ 100 kg per day	Electricity 60 kw/day water 4,000 ltrs/ day	7	1	1
61.	Egg washing powder (CFTRI, Mysore)	Detergent	Released (cottage)	Rs. 2,000/ 10,000 to 15,000 eggs per day	Electricity 30 kw/day water 2,000 ltrs/ day	4	2	—

1	2	3	4	5	6	7	8	9
62.	Poultry feed CFTRI, Mysore)	Cereals, millets oil seed cakes and molasses	In production (small)	Rs. 3,70,000/9 t feed per day	Electricity 90kw/day	10	5	1
			FISH-BASED TECHNOLOGIES					
63.	Chitosan (CFTRI. Mysore)	Prawn and squilla waste	Released(small)	Rs. 9,90,000/ 10 t per day	Electricity 300 kw/ day water 15,000 ltrs/day Stem 4 t/day	30	1	
64.	Fish mackeral and Bombay duck, sun drying and curing of (CFTRI, Mysore)	Fish	In use (cottage)	Rs. 7,000/100kg fish per batch	Solar	3	Several	Several
65.	Fish meal and oil from sardine (CFTRI, Mysore)	Sardine and fish waste	Released (small)	Rs. 8,76,000/ 30 t of raw material per day	Fuel oil 330 kl/ day Electricity 160 kw/ day	36	1	—

1	2	3	4	5	6	7	8	9
66.	Fish meal for poultry feed (RRL, Bhubaneswar)	Low grade fishery wastes	In production (cottage)	Rs. 6,700/50kg fish meal per day	Firewood 150kg/day	6	—	—
67.	Fish pickle, improved processing of (CFTRI, Mysore)	Fish (fleshy) cooking oil salt & spices	Released (cottage)	Rs. 20,000/100 kg per day	Electricity 50 kw/day	10	1	—
68.	Fish sausages (CFTRI, Mysore)	Fish & animal casings.	In use (small)	Rs. 1,10,000/ 40kg sausages per day	Electricity 40 kw/day	3	Several	Several
69.	Paddy-cum-shrimp culture (in paddy fields near sea shore (NIO, Goa)	Fast growing shrimp seeds (P. indicus) fish and shrimp waste meal ground nut oil cake, rice, wheat bran and tapioca flour	Available (field)	Rs. 6,500/965kg shrimp per hectare per year (NOV-April)	—	Self employment	—	—
			OTHER MARINE-BASED TECHNOLOGIES					
70.	Agar-agar from Indian sea weeds (CSMCRI, Bhavnagar)	Sea weeds (Gracilaria)	In production (small)	Rs. 4,23.000/ 10kg per day	Electricity 75 kw/day Water 65,000 t/ day steam 1 t/day	5	10	5

1	2	3	4	5	6	7	8	9
71.	Jajoba (Simmondsia chinensis) Cultivation of, for liquid wax (CSMCRI, Bhavnagar)	Jajoba seed coastal sand dune and water	Available (field)	Rs. 15.000 for cultivating 2.5 ha/year	Diesel 12.51 litres/day Electricity 12-17 kw/day (for lifting water for irrigation 120 acre inch per annum)	6250 may days for 10 years		Being cultivated in the farm of the Institute.
72.	Vegetable and crops, cultivation of (CSMCRI, Bhavnagar)							
	i) Bajra, Babapuri (*Pennisetum typhoides*) (17,000-24,000 ppm of sea water)	Seeds, sand dunes, sea water	Available (field)	Rs. 4,070 for cultivating 2.5 ha yielding grain 14-16 q/ha. Fodder 3-4 t/ha	—	Additional employment generation project		Being cultivated in the farm of the Institute
	ii) Onion (white) (*Allium cepa linn*) (10,000 ppm of sea water)	do	do	Yield 10-15 t/ha	—	150 man days for 150 days		do
	iii) Sugar beet (10,000-15,000 ppm of seawater)	do	do	Yield 12 t/ha	—	do		do

1	2	3	4	5	6	7	8
73.	Belladonna (Atropa sp.) (CIMAP, Lucknow)	Deep fertile soilof medium texture and temperate climate	3 years	Leaves 100kg/ yr Roots after 3 years 100kg.	Ist year Rs. 3,500 Subsequent years Rs. 2,500	Rs. 7,500 after 3 years (leaves @ Rs. 5/kg Roots @ Rs. 10/kg	Grown at CIMAP Farms.
74.	*Dioscorea Species* (CIM-AP, Lucknow) (RRL, Jorhat)						
	i) *Dioscorea floribunda* Mart & Gall.	Medium loam deep soils	2 years	Dried tubers after 2 yeajs —6 t	i) Ist year Rs. 12,500 2nd year Rs. 5,500 ii) Capital cost for erection of trellis Rs. 20,000	Rs. 12,000 after 2 years (@ Rs. 5/kg of tubers	Grown by one firm in Bangalore
	ii) *Dioscerea deltoidea* wall	Medium loam deep soils	3 years	Dried tubers after 3 years —5 t	i) Ist year Rs. 10,000 subsequent yearsRs.4,000 ii) Capital cost for erectio n of trellis Rs. 20.000	Rs. 12,000 after (3 years @ Rs. 6 /kg of tuber)	

1	2	3	4	5	6	7	8
75.	Pyrethrum *Chrysanthemum cinerariafolium vis.)* (CIMAP, Lucknow)	Fertile deepand well drained soil, mold cool climate 10-24° C ; Annual rainfall 1000 mm, but well distributed	5 years	i) Flowers 200 kg/yr, with pyrethrins content of10 percent in Kashmir. ii) Flower 440 kg/yr in Nilgiris with pyrethrins contents of 1.5 percent	Ist year Rs. 1,600 susequent years Rs. 1,000 (average) Rs. 1200 do	Rs. 1,000 (@ Rs. 6/kg of flowers) Rs. 4,000 (@ Rs. 12/kg flowers)	Being cultivated in Kashmir.
76.	Periwinkle *(Catharanthus roseus)* L.G. DON) CIMAP, (Lucknow)	All types of soils, except saline/alkaline	1 year	Roots-750kg Leaves-2000kg (rainfed)	Rs. 2,000	Rs. 7,500 (@ Rs. 10/kg of roots; @ Re. 1/kg of leaves)	Released to 50 farmers
77.	Serpentina root *(Rouvolfia serpentina* Benth *ex* Kurz) (CIMAP, Lucknow)	Sandy alluvial loam to red lateritic, loam acidic and meutral soil hot and humid tropical climate.	2 years	Dried roots after 2 years 100kg	Rs. 7,500 for 2 years	Rs. 12,500 after 2 years (@ Rs. 20/kg) Seeds are also saleable (@ Rs. 100/kg)	

1	2	3	4	5	6	7	8
78.	Geranium *(pelargonium graveolens* L. 'Her *ex* Ait) (CIMAP, Lucknow)	Well drained porous soil ; mediterranean type of mild climate with low humidity, warm winter and mildsummer temperature, annual rainfall 1000-1500mm	4-5 years	Oil-18kg/ annum	Ist year Rs. 7,000 Subsequent years Rs. 6,000	Ist year Rs. 10,700 Subsequent years Rs.12,000 (@ Rs. 800/kg)	20 t
79.	Japanese mint *Mentha arvensis L subsp, haplocaly* Briquet var *piperascens* (Holmes) (CIMAP, Lucknow) (RRL, Jorhat)	Medium, deep soil pH 6-7.5 with adequate irrigation, tropical and subtropical climate	8 months	Oil-75kg/ annum	Rs. 3,000/ annum	Rs. 5,000 (@ Rs. 100/kg)	400 t

1	2	3	4	5	6	7	8
80.	Java citronella (*Cymbopogon-winterianus* Jowitt) (CIMAP Lucknow) (RRL, Jorhat)	Sandy loam pH 5.8 to 8, tropical and sub-tropical climate annual rainfall 200-250 cm, well distributed or assured irrigation. altitude 180-1200m	4 years	Ist year Oil-100kg Subsequent years Oil-150kg	Ist year Rs. 7,000 Subsequent years Rs. 6,000	Rs. 6,000 (@ Rs. 800/kg of oil)	400 t
81.	Lemon grass (*Cymbopogon flexuosus* (Stued wats) (CIMAP, Lucknow) (RRL, Jorhat)	Sandy loam soil ; warm & humid climate, attitude 900-1200m ; annual rainfall 250-300 cm, well distributed or assured irrigation	6 years	Oil-75-100kg/ annum	Rs. 3,000/ annum (@ Rs. 70/kg of oil)	Rs. 3,000	650 t
82.	Palmarosa (*Cymbopogon martinii var, motia*) (CIMAP Lucknow) (RRL, Jorhat)	Loamy soil ; annual rainfall about 150 cm or assured irrigation	4 years	Oil-50kg/ annum	Rs. 2,500/ annum	Rs. 6.000 (@ Rs. 160/kg of oil)	—

1	2	3	4	5	6	7	8	9
83.	Peppermint *Mentha piperita* L (CIMAP, Lucknow) (RRL, Jorhat)	Medium deep soil; pH 6-7.5 with adequate irrigation; tropical & subtropical climate/temperate climate	3 years	Oil-5kg/annum	Rs. 3,000/ annum	Rs. 7,000 (@ Rs. 200/kg of oil).	20 t	
				PLANT DRUGS				
84.	Palatable isapggl, granules for laxative (CDRI, Lucknow)	Isapgol (*Plantago ovata* seed husk)	Available (small)	Rs. 50,000 to Rs. 1,00,000/ 100 kg per day and upwards.	Etectricity marginal	5-10	—	—
85.	Pyrethrum for insecticide (RRL, Jammu)	Pyrethrum flowers	In use (small)	Rs. 5,00,000/ 50 t flowers per annum	Wood/Coal 100 t/annum	15	2	—

1	2	3	4	5	6	7	8	9
86.	Attars, perfumed water and oil from flowers (NBRI, Lucknow)							
	i) Rose oil/ water (from Damask rose)	Fresh flowers of Damask rose (*Rose demascena*)	Available (cottage)	Rs. 30,000/50kg flowers distillation percharge (one ha. of plantation yields about 3,000 kg flowers)	Fuel wood 60q for distilling 3,000kg flowers	6	—	—
	ii) Jasmine concrete & absolute	Fresh flowers of Jasmine (*Jasminum grandiflorum Linn.*) Petroleum ether 40-60°C or Normal hexane 65-70°C	Available (small)	Rs. 2.00,000/ 24,000kg flowers in 4 months in the year	Electricity 5 kwh	5	—	—

1	2	3	4	5	6	7	8	9
87.	Blue oil from Matricaria *Chamomilla Linn*, (NBRI, Lucknow)	Dried flowers	In production (cottage)	Rs. 5,000 for growers on a hectare of land plus Rs. 2,500 for distillation plant	Fuel wood 2.25q for 1,500kg flowers	10	Several	Cultivation-10 Processing-1
88.	Citronella oil (RRL, Jorhat)	Citronella grass	In use (cottage)	Rs. 20,000/ 200kg per batch	Wood/Coal 30kg/batch	2-3/ha	Consultancy given to 45 parties	
89.	Citronella oil (2-3 dihydrogeranoil) RRL, Jammu)	Eucalyptus citrodora oil	In production (small)	Rs. 2,00,000/ 10kg of finished product per day	Electricity marginal	10	4	2
90.	Citrus oil, terpeneless (CFTRI, Mysore)	Citrus oil (lemon/lime oil/ orange oil)	Available (cottage)	Rs. 40,000/2 columns deterpentation of 4-8kg of citrus oil per day.	Electricity marginal	2-3	—	—

1	2	3	4	5	6	7	8	9
91.	Essential oil (RRL, Bhubaneshwar)	Lemon grass citronella, Palmarosa grass Cinnamon leaves.	In production (cottage)	Rs. 7,000/100kg per day	Wood/Coal 30kg/day	2		
92.	Menthol (RRL, Jammu)	Mint oil from mentha leaves	In production (small)	Rs. 4,00,000/3t of menthol per annum	Electricity 5hp	6	39	7
93.	Rose oil (CIMAP, Lucknow)	Rose flowers	Pilot plant (small)	120kg of flowers per batch, cost being estimated	—	—	—	—

Sl. No.	Process (Laboratory)	Traditional Process	Improved process at Rural Level
94.	Carcass-Processing (CLRI, Madras)		
	i) Carcass collection and transport to processing centre.	Carcasses are dragged, or transported by a hard-cart, to the village outskirts for flaying. A drawback is that hides in many cases get damaged because of dragging as well as because of delays in flaying. When animals die of natural causes and in plances where carts cannot ply, the carcasses have to be removed manually.	A carcass-collection cart with a hoist is recommended. Improvement in design with standard components like wheels, beams, pulleys and rollers for easy transportation of carcasses. For urban use, a jeep with trailor is suggested.
	ii) Flaying and curing	Done by an ordinary knife, this in an improper method. The drawbacks are that hides get cuts, and more flesh is left in some parts, such flesh putrefying and damaging the hides. The hides are not cured immediately and are mostly dried in the sun. Sometimes, the salt applied is inadequate, or contaminated, or used salt is re-utilised.	i) Two types of flaying knives should be used; (i) round-edged, and (ii) sharp and pointed. A flaying platform may be provided. ii) To remove blood and dirt, use of 30% Na Cl by weight of hides, or a mixture of salt and preservatives, is recommended. The mixture should be applied in 3 parts on the flesh side of hides. There should be washing pits and a good supply of water.

1	2	3	4
			iii) A weighing machine should also be provided.
	iii) Carcass disintegration, per-processing /composting.	Flayed carcass is left as such to vultures and dogs and the bones are collected afterwards.	i) Carcass parts should be separated into fallow, bones and flesh for animal food, manure, horns and hoofs. ii) Where there is no arrangement for carcass cooking the meat and bone shoul be buried and the bones recovered later for being sold to bone mills. iii) Pre-processing of bone flesh for bon flesh mill plant. iv) Composting of waste for manure. v) Recovery of tallow by scrapping and melting in pan. vi) Preservation of tallow before supply to processing units. vii) Recovery of guts for rackets ; hair for brushes ; hide trimmings, ear, and tails for glue-making and horns/bones for curios.

1	2	3	4
95.	Tanning (CLRI,Madras)		
	i) *Jawasee/ awk/*lime process (unhairing)	i) Fallen flint hides in mixed lot are used with no proper seaking. Old *Jawasee/awk* bath are used for years and these emanate a very strong foul smell, with the resultant stigma and social problems. It takes 20-90 days for unhairing. Similarly, jawasee treatment is done in two haths, and without being washed it is taken to old *(Malni) oza* bath.	i) The hides are soaked well in a preservative. A fresh jawasee bath is prepared and hides are treated for 5-6 days. The treated hides are unhaired, fleshed, washed and lightly pickled and taken for tanning. The processing period is considerably shortened and the foul smell is eliminated.
		ii) Lime process : Hides are partially soaked and immersed in an old-lime liquor with fresh lime for 15-20 days, unhaired, fleshed and washed.	ii) Lime process—The hides are well soaked : Liming is done in two stages, spanning a period of 6-8 days. These are unhaird, fleshed, washed, delimed by using (NH4) 2S4 and lightly pickled with salt and sulphuric acid. The drudgery of the beam-house operation is thus eliminated. Use of water is minimised by using chemicals for deliming.

1	2	3	4
	ii) Tanning	Tanning is done by the pit-or bag-tanning method, by using aval or babul bark or any other locally available bark. The drawbacks are that the quantity of bark used is often insufficient, and the leathers are unevenly tanned. As a result, the final products are disfigured with dark patchy colours, while some are hard leathers, with a foul smell.	Tanning is done by the following method using locally available barks : i) E. I. tanning ii) Improved bag-tanning iii) Wet-blue chrome iv) Rural chrome process for sole/lace v) 'Novotone' finishing.
	iii) Post tanning	Salt dissolved in old tan liquor is sprinkled on the flesh side of pit or bag-tanned leather and dried as such on ground. These are then processed, dried, beaten and stored. The leathers are creasy and uneven in colour, emit a foul smell, and are mostly used for rural footwear, *Charas* (water-lifting leather bag) and *mashk* (water containerfor sprinkling), buckets, and agricultural accessories.	The tanned hides are treated with myrab and oil, using locally available oil, epsom salt, and jaggery. These are hooked for semi-drying, following by setting by slickers, and are dried. The finished leathers are of uniform light colour, smooth, soft and plain, and are free from foul smell. Thus, this leather can be used for shoes and other footwear and leather products to meet the demand from rural and urban markets.

1	2	3	4
96.	Leather products (CLRI, Madras) Footwears and leather goods manufacturing	*Desi juti* (native shoe), irrigation leather (*charas*), leather bucket, agricultural accessories. etc., are made to meet the local village demand. For this, old traditional tools are used.	With the improved technology, shoes, chappals sandals, school bags, shoulder bags for upper-class men and women, pouches, waist belts, sport goods like football and volleyball, industrial leather goods, etc. could be produced to meet the demand of rural as well as urban markets. Use of improved tools and improved designs are recommended.
97.	Leather-processing management (CLRI, Madras)	Hardly any concept about management except where there is some organised structure. Because of constraints in the availability of sufficient quantities of carcasses within easily transportable reach, processing becomes uneconomical and unproductive, Rural artisans are also exploited by the urban-based industries and their agents.	Improved management considerations : 1) After the death of the animal, its immediate removal from rural homes, farms and other places in the village is absolutely necessary. Hence, appropriate transportation from the place of death to the disposal ground is a must. The expenses in this regard have to be incurred by the owner of carcass, the flayer, the tanner or any agency. Expenditure cannot be avoided even if the carcass is to be buried, and hence need not be brought into the economics of utilisation.

1	2	3	4
			2) The development of growth centres with common facility/service centres by location depends on : a) Size of procurement of dead animals. b) availability of hereditary flayer/leather artisans. c) Promotional objectives and policies and the current consumption pattern of leather goods for local consumption and for catering to urban demand. d) scope of subsidiary occupation to the rural poor. 3) Given necessary training, supply of required materials, services, facilities and supervision and R & D support, it is possible to establish a technology appropriate to rural areas. 4) By-product utilisation should also be organised simultaneously.

1	2	3	4
			5) Product on and fabrication depend on local demands, nearness to market, ancillary contacts, etc. a) Introduction of improved tools and equipment ; b) Utilisation of locally available resources and technologies ; and c) Introduction of improved andnewer designs in combination with traditional crafts/ skills would be necessary to help the villager to earn a higher income, which in turn would improve the socio-economic conditions of the rural leather artisans.

OTHER TECHNOLOGIES

Sl. No.	Technology/technique (Laboratory)	Main feed/stock raw material	Status/scale of technology	Cost/capacity of plant	Energy source/ requirement	Employment potential	Utilisation status (number of parties)	
							Released to	*In production*
98.	Cabinet drier (solar for fruits /vegetables) (RRL, Jammu)	Glass pans, black paint, vegetables, fruits.	In use (cottage)	Rs. 1,600/80kg per batch (size 2.5x2.5 metre ground area)	Solar	Self employment	Several	Several
99.	Cashew nut decorticator (CNERU, Durgapur)	Cashew nut in mild roasted form	Design available (cottage)	Rs. 350 for one shelling unit, excluding mounting and seating arrangement	Manual	do	—	—
100.	Clay flooring and roofing tiles (Mangalore type) (CRRI, Roorkee)	Alluvial clay of suitable composition.	In production (small)	Rs. 1,50,000/ 75000 tiles per year (8 hours/ day shift)	Wood/Coal 450 t/annum crank press screw press operated manually	Skilled-2 unskilled -18	5	5
101.	Cupola, mini (NML, Jamshedpur)	Pig iron, pig ironscrap and coke	Released (cottage)	Rs. 18,000/25 kg per hour molten metal	Electricity 10-15 kw/day	5	3	—

1	2	3	4	5	6	7	8	9
102.	Ferro-cement Unit, grain storage bins, water tanks, septic tanks, biogas digestor and holders, etc. (SERC, Roorkee) (RRL, Jorhat)	Cement, sand water proofing chemicals wire meshes. M.S. barspwires.	In production (small)	Rs. 1,20,000/ 200 units per month.	Electricity 3-5 kw/unit	Skilled-6 Unskilled -14 (masons and carpenters)	15	6
103.	Flowers and foliage, dehydration of (NBRI, Lucknow)	Fresh flowers, foliage, etc.	In use (cottage)	Rs. 10,000/ 50,000 flowers per annum	Electricity 25 kwh	Self employment	10	1
104.	Hand tools, harvesting and tilling (MML, Jamshedpur)	High/medium carbon steel plates, 6mm approximately	Available (small)	Rs. 1,00,000/ 3-5 t per annum	Electricity 10-51 hp	do	—	—
105.	Juto gunny bags pest-proofing of, (CFTRI, Mysore)	Chemicals.	In use (cottage)	Rs. 16,000/ treatment of 3000 bags per day	Manual	do	2	2

1	2	3	4	5	6	7	8	9
106.	Leaf cup-plate making machine (CFTRI, Mysore)	Dry leaves of banana, areca sheets, etc.	In production (cottage)	Rs. 3,500/ 3,000 cups per day	Electricity 300 kw/day or Kerosene oil	do	90	3
107.	Mineralised salt lick for cattle (CSMCRI, Bhavnagar)	Salt and minerals	In production (small)	Rs. 1,02,000/ 200 salt licks of 2kg each per day.	Electricity 5.2 kw/day Water 500 kl/ day	5	39	15
108.	Musk melon sees, dehulling of (CFTRI, Mysore)	Seeds of musk melon	Released (tiny)	Rs. 30,000-40, 000/100kg of seeds per hour	Electricity 8hp	5	—	—
109.	Speciality paper (RRL, Hyderabad) (RRL, Jorhat)	Cotton rags and cotton linters.	In production (small)	Rs. 6,50,000/ 270kg per day	Electricity 500 kw/day Water 150 kl/ day	108	4	1
110.	Slate, paper (RRL, Jorhat)	Paper board, wood, resin	In production (cottage)	Rs. 15,000/200 slates per day	Electricity 0'02 kw/day	5	58	9

1	2	3	4	5	6	7	8	9
111.	Slate; plastic (RRL, Jorhat)	Plastic sheets, chemicals.	In production (small)	Rs. 50,000/200 slates per day	Electricity 20 kw/day	5	18	3
112.	Sodium silicat from rice husk ash (I.S.S.) (CGCRI, Calcutta)	Rice husk ash, soda ash.	In production (small)	Rs. 25,000/0.5t sodium silicate per day	Electricity 16 kw/day Fuel (Coal) 120 kg/day	4 per shift	8	1
113.	Water filter candles for domestic use (RRL, Jorhat)	China clay and non plastic material	In production (cottage) (small)	i) Rs. 20,000/ 50 candles per day	coal marginal	4	17	2
				ii) Rs. 6.46.000 /1000 candles per day	Coal 300 q/ annum	25		