DEVELOPMENT OF

LOW EXTERNAL INPUT SUSTAINABLE FARMING SYSTEMS

SUBMITTED TO

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

OTTAWA, CANADA

JANUARY 1993

BAIF DEVELOPMENT RESEARCH FOUNDATION

KAMDHENU, SENAPATI BAPAT ROAD, PUNE 411 016.

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DEVELOPMENT OF

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1.0 INTRODUCTION :

Man's increasing impact on the environment is resulting in a world-wide tendency towards the degradation and erosion of soils. Although many of the factors causing this are non-agricultural, nevertheless failure to practice an environmentally sound agriculture does result in unacceptably high rates of soil erosion and degradation.

A new strategy of efficiency and regeneration could help meet the needs of subsistence farmers, and begin to address the environmental and economic problems linked to more intensive cropping practices as well. Such a strategy would stress the efficient use of fertilisers, chemicals, water and mechanised equipments. As a supplement to efficiency, farmers would blend biological technologies and traditional farm practices to increase the contribution that the land's natural fertility makes to food production. The issue is economic survival. Only by husbanding their scarce resources, regenerating their land, and raising their yields can these farmers improve their economic prospects.

Biological Husbandry is a system of agriculture that seeks to maintain and improve productivity of land as far as possible by encouraging and enhancing natural biological processes, minimising the use of chemical fertilisers and pesticides. It is based on traditional methods and has been developed to incorporate much that is new in agricultural research and technology. Rejecting the use of resource-extravagant and energy- demanding chemicals, it stresses the need for further understanding and development of natural processes which help the farmer--processes that can be managed or manipulated in non- destructive ways to help him further. Biological Husbandry has particular application in poor countries, where unimproved traditional methods are no longer sufficient but where the insensitive introduction of orthodox, energy-consuming methods of farming leads rapidly to economic and agricultural disaster.

Biological agriculture is a system of farming based on the principle that agriculture is, first and foremost,a biological science. Biological husbandry includes biological systems of agriculture,horticulture, forestry, gardening etc.

The aims of biological agriculture are to develop:

1. A sustainable agriculture, i.e. a system which maintains and improves soil fertility so as to guarantee adequate food production in the foreseeable future.

2. A self-sufficient or, more realistically, a self-sustaining agriculture, i.e. a system which relies as much as possible on resources from within its own area.

3. An agriculture which takes as its guide the working of biological processes in natural ecosystems.

The basic principles of biological agriculture can be listed as:

1. The health of soil, plant, animal and man are linked by a common nutritional cycle.

2. The health of the whole cycle will be diminished by a loss of soil fertility or by any imbalance introduced into the soil by improper husbandry practices.

3. All living materials and waste products must be returned to the soil for the maintenance and improvement of its fertility.

4. This return is necessary for the purification of waste materials, which would otherwise cause pollution, and for the recycling of essential elements.

5. The soil should retain an ordered structure, with decomposing material on the surface and humus-enriched soil below. This implies a minimum of soil disturbance.

6. As in natural ecosystems, plants and animals should coexist, each as mixed communities; crop rotations and mixed stocking constitute a practical expression of this principle.

7. As far as possible the soil should always be covered by living and decaying material.

8. The resources of an area are usually adequate for sustained growth in that area.

Biological agriculture concentrates on building up the biological fertility of the soil so that the crops take the nutrients they need from the steady turnover within the soil. Nutrients produced in this way are released in harmony with the needs of the plants, and are not presented to the plants in excessive amounts at any time. Biological soil fertility is directly related to the development and maintenance of a high level of organic matter. When applied to the soil in the right manner, organic matter has a wide range of effects- physical, chemical and biological- which not only develop the soil structure and fertility but also can help to control pests and diseases within the soil and on the plants.

Biological agriculture attempts at all times to work on a cyclical basis, which is the only way a sustainable and self- sufficient agriculture can be maintained.

Although the importance of biological agricultural system is being recognised by farmers all over the world there seems to be a dearth of farmer level studies on this topic. There is thus need for systematic enquiry into the methods used in biological husbandry, to evolve a sustainable farming system for a given region.

BAIF's development strategy has aimed at establishment of meaningful relationship between the rural poor and the available natural resources viz. land ,water, livestock and vegetation leading to enriched environment and improved quality of life. The BAIF has been successful in providing the techno-management services for comprehensive development programmes at the doorstep of the rural poor and in strengthening the capabilities of the participants for grass-root level management.

Land and water are the two basic resources needed to sustain long term agricultural production. Food demand will increase as the populations increase and their consumption patterns change. It is thus necessary to ensure food security by increasing the food production while conserving the natural resources. These two can be mutually supportive as they

1) lead to good husbandry and sustainable management;

2) reduce rural-urban migration; and

3) alleviate poverty and thus help slow population growth.

BAIF has already recognised the importance of these two vital resources viz. land and water for sustainable agricultural development and has successfully implemented programmes by introduction of appropriate technologies to attain self sufficiency in five to six years. It would now be necessary to implement such programmes in other regions covering important crops.

2.0 OBJECTIVES :

1. To investigate the utility of environmentally sound LEISA technologies for sustainable production of crops under field conditions.

2. To develop suitable water application systems for efficient water use.

3. To identify plant materials, based on indigenous knowledge, for effective control of selected plant pests, and study the utilisation methods.

4. To promote farmer enterprises in local production of necessary inputs to support LEISA techniques in crop production.

3.0 RESEARCH STUDIES :

1. STUDIES WITH BIOLOGICAL N FIXATION:

Rationale :

Agricultural policies emphasizing increased production without regard to the environment have greatly contributed to the deterioration of the resource base all over the world. Chemical fertilisers and pesticides have played a major role in increasing agricultural production however continued overuse of these has been responsible for damaging the land and water resources. Excessive use of chemicals to control insects, pests, weeds, fungi has threatened the health of humans and lives of other species. The effects of such chemicals do not remain localised to the area where they are used but travel through the food chain.

Sustaining higher levels of food production for the growing population and their changing consumption patterns would be possible only if the resource base is secure. More efficient use of organic nutrients can be attempted to improve the yields. It would thus be necessary to encourage use of organic plant nutrients to complement chemicals.

One of the alternatives to chemical fertilisers is the use of biofertilisers. The use of micro-organisms to fix atmospheric nitrogen is known for a long time. Of

the various symbiotic micro-organism capable of nitrogen fixation two have received considerable attention namely legume-Rhizobia and Azolla-anabena. While the use of these microbes to improve productivity has been shown by various on station trials their use has not been well adopted by farmers. The proposed project will be undertaken to test the efficacy of the above mentioned microbes for improvement in the crop yield under field conditions and identify the constraints in the adoption of the technology.

Methodology :

All the studies will be undertaken as 'On farm' trials. For the legumes the crops would be gram, groundnut. For each of the crop at least 70 farmers (different socio economic groups) would be involved for undertaking the trial where in conventional practices of the farmers would be compared with application of appropriate Rhizobium culture for yields. It is assumed that 0.1 ha of land would be available with each farmer for each treatment. The study would be repeated in 3 successive years

The methodology for the azolla-anabena study would be more or less same with rice cultivating farmers.

The parameters to be recorded would be :

i) grain yield and quality
ii) biomass yield
iii) Nodulation
iv) Growth characters
v) Keeping quality of produce.

In addition during the trials the participating farmers would be involved in a survey to assess their perceptions.

For large scale extension of the technology it is proposed to involve additional 100 families for use of the technologies which would be used as demonstration centres.

2. STUDIES ON THE USE OF COMPOST:

Rationale :

Chemical agriculture has resulted in the degradation of land all over the world. It is further stressed that sustaining crop production through this system is becoming more and more difficult. It would thus be necessary to recycle the nutrients absorbed by plants from the soil by adopting use of organic matter. One of the traditional ways of supplying the nutrients is through aerobic degradation or composting.

Farmers in India have been traditionally using farm Yard Manure for supply of organic matter to the soil. Although scientific composting is not undertake at farm level the traditional pit system is used for composting by many farmers. The project would thus aim at regular production of compost and test its use in organic farming system for local crops.

Methodology :

Since a lot of information through station work is available on this topic it is proposed to undertake this work directly on the farm.

The first set of these trials would involve training of farmers for scientific preparation of composts using locally available wastes and their use for improving the soil nutrient status for crop production. The crops under study would be mainly rice, sorghum, millets, mango and sapota. The assumed area under each treatment will be 0.1 ha. for field crops and 0.25 ha for fruit crops with each participating family.

The effects of inclusion of organic wastes in addition to the normal agronomic practices of the region would be studied over a period of 3 years. The observations will be recorded on the produce yield and quality (composition depending on the crop) , soil status in terms of N,P,K, water absorption capacity and physical characters. The change in the soil status will be monitored during the course of the project implementation so as to generate data on long term effects of following the system.

The second set of trials would investigate the effect of these composts on vegetative propagation of plants. The beneficial effects of composts in development of rooting have been observed but not methodically recorded at farm level. This study would try to couple field observations with laboratory analysis of materials for possible auxins/other nutrients. These studies will be limited to a period of three years to take into consideration the climatic variations between years. The planned treatments include...

i) negative control.
ii) auxin treated.
iii) compost from different wastes.
iv) auxin + compost from different wastes.
v) vermicompost.
vi) vermicompost + auxin.

The effect of these will be studied on survival and rooting of cuttings of regionally important plants. The other observations to be recorded will include measurement of plant height and post-transplantation survival.

Both these trials will be undertaken for three successive years with 70 farmers in the first year and this number will be increased to 90 in the third year. In addition biointensive garden would be promoted specifically for the women of the farm families.

3. STUDIES IN VERMICOMPOSTING TECHNOLOGY:

Rationale :

Excessive use of chemical fertilizers for boosting food production to meet growing requirements of population has caused degradation of environment world over. The effect is more pronounced in densely populated developing countries. Thus there is increasing need for shifting existing cultivation techniques in agriculture to one which are ecologically sound and low input requiring. Earthworms and their role in improving soil characteristics are well known. Earthworm rearing has been successfully undertaken in many places in different countries but is only recently being introduced in India and vermicompost is commercially in demand for use by the farmers. The systematic studies on use of this manure are however very few in the developing countries.

Methodology :

The crops selected for the study are both seasonal and perennials. These will consist of :

i) Seasonal : Sorghum,pearl millet and sunflower.

ii) Perennials : Mulberry, custard apple, guava and mango.

The purpose of selecting sorghum and pearl millet is that these are the major cereal crops grown in this area while sunflower is an important oil seed crop which brings cash revenue to the farmers.

The area under mulberry plantation is increasing every year because of the Government's policy to promote silkworm rearing activity in the rural areas for gainful self employment. Custard apple guava and mango are important horticultural crops conventionally grown by the farmers of this region.

The crops under study will be subjected to four main treatments, the details of which are given below.

Treatment 1 : Application of mixture of vermicompost & Farm yard manure with mulch.

Treatment 2 : Application of vermicompost (VC) & effluent slurry from biogas plant with mulch.

Treatment 3 : Application of farm yard manure (FYM) and chemical fertilizers.

Treatment 4 : Application of farm yard manure alone.

In another experiment varying doses of vermicompost, will be studied in one cereal crop (sorghum) and one horticultural crop (guava) to work out the standard dose of application of vermicompost.

In each treatment there will be three replicates and each replicate will have plot size of 10 R.

The doses of farm yard manure and chemical fertilizers for field crops and plantation crops will be based on existing recommended practices. In case of the dose of vermicompost 20% of the FYM component will be replaced with VC on the basis of total solids contents.

The observations regarding soil and crop characteristics will be taken during course of the study.

1. Soil characteristics :-

   Chemical analysis N,P,K, Electrical conductivity (EC), pH, organic carbon content water holding capacity and soil texture. The samples will be collected at periodic interval.

2. Crop characteristics :-

i) Field crops :- plant height, days to flowering,grain yield,grain quality and straw yield will be recorded.

In case of sunflower crop oil content in the seeds will be studied.

ii) Plantation crops :- Total yield, size of fruits, sugar content and keeping quality of the produce.

In case of mulberry quality of leaves and their chemical composition will be studied.

At the end of each harvest economic assessment of each treatment will be undertaken for comparative evaluation.

Field Testing :

The technology of vermicompost production has been standardised, however it has not yet reached the farmers. In this project it is proposed to train the farmers from project area to take up vermicompost production activity at their farm. One hundred farmers from the villages will be selected for " On farm VC production." Every year twenty farmers will be trained by giving intensive practical training in VC production and its application to the crops grown by them. The VC production facility will be established at the farmer's door.

It is also proposed to study the effect of the vermicompost application on the crop productivity , soil characteristics and produce quality through on farm trials. For these the farmers involved in the production of the vermicompost would preferably be selected. In each case the minimum area under the crop selected will be Ø.1 ha and conventional practices of the farmers will be compared with the vermicompost application. The soil characteristics will include :

i) C:N ratio,
ii) electrical conductivity,
iii) physical properties.

The crops to be included for the on farm studies will include field crops (sorghum, millets, pulses) as well as fruit crops (mango, guava).

4. STUDIES ON INDIGENOUS METHODS OF BOTANICAL PEST CONTROL :

Synthetic chemical pesticides besides being costly are harmful to man, livestock and environment. Indigenous knowledge on plants possessing pest control principles, in countries like India offers exciting alternatives to these chemical pesticides.

It is therefore, necessary to make proper assessment of the indigenous knowledge on such botanical pesticides, develop low cost technologies for their cultivation and application and popularise their effective application by the farmers.

Some of the plants meriting attention for evaluation of their pest control effectiveness include Neem(Azadirachta indica), Karanj (Pongesmia glabra), Castor (Ricinus cummunis), Mahua (Madhuca indica) and Gingelly (Sesamum indicum). These plants are known to have pest control principles such as insect repellent, antifeedant, insecticidal and/or growth inhibition properties. These are attributable to chemicals such as Azadirachtin, Nimdin etc.

Neem, Mahua, Karanj are tree based oilseeds, while castor and gingelly are cultivated crops. Except for gingelly, all other oilseeds are considered non-edible and the cakes are also not used as animal feed. Mahua is widely found in the deciduous forests of Central and South India, Neem in the forests of deccan plateau and Karanja in Western India. Castor and Gingelly are widely cultivated as commercial crops. The

insecticidal, bactericidal and toxic properties of the oils and cakes are attributed to the presence of mowrin in Mahua, nimbidin in Neem and Karanjin in Karanj.

The pest control effectiveness of these botanicals, however, needs to be validated under specific agroclimatic conditions. This will help select promising materials for on-farm trials and large scale field testing.

Methodology :

a. **Assessment of indigenous knowledge and evaluation of plants having pest control properties :**

The following studies will be undertaken :-

i) Indigenous knowledge on plants having pest control properties will be assessed. For this necessary survey of literature as well as information available with the farmers, field functionaries and agriculture research institutions will be made.

ii) Neem (Azadirachta indica), Karanj (Pongamia glabra) Castor (Ricinus cummunis), mahua (Madhuca indica) and gingelly (Sesamum indicum) and any other plants identified during the field studies will be evaluated for their pest control effectiveness against selected pests infesting locally important crops.

iii) Techniques for preparing plant materials and their extracts in water or organic solvents will be standardized.

iv) Pests of major economic importance in case of ground nut, maize, grain legumes and cotton plants and their products will be collected from field, identified and characterized entomologically and reared under controlled conditions for experimentation.

v) Pest control effectiveness of plant materials or extracts obtained from different parts of the plants under investigation collected at different seasons and age of plant will be assessed individually on different pests. The concentration and rate of action of each material on selected pest will be determined by measuring in vitro reduction in the number of pests before and after treatment with the material extract under study.

b. Standardisation of Field Application of Botanical Pesticides

The biopesticidal properties of plants are found spread over different maphological parts. The plant issues in fresh or dried form will be used at different levels as acqueus or organic solvent extract for studies of insect repellent properties. The work would be aimed at developing easy to use package of practices for use as biopesticide against important pests of crops grown in the project area.

c. Field Trial and Farmers' Awareness Programmes

With a view to encourage farmers to use biopesticides, the field trials of biopesticide would be conducted on farmers fields and with their active participation. Even in cases where it is conducted on experiment stations, some farmers would be invited to participate in its implementation so that dynamic awareness programmes can be generated.

5. STUDIES ON LOW COST GRAVITY-FED DRIP IRRIGATION SYSTEMS:

Rationale :

Localized irrigation comes under the umbrella of systems which cause wetting of only part of the soil in the field, but the term refers in particular to systems which cause wetting of only that part of the soil at the base of the plant i.e. plant root zone.

The essential characteristics of these systems are slow and low volume application of water and fertilizers is localized in the plant root zone through distribution devices such as orifices, nozzles, microtubes, porus pipes, porus distribution units such as small cylinders of terra cotta etc. whether organised under or above the soil surface.

Advantages of localized irrigation are :

1. Water Saving
2. Control over water and nutrients
3. Easier control of pests and weeds
4. Possible use of saline water
5. Better use of poor soils
6. Easier management and reduction in labour
7. Utilization of lower discharges (sprigs, shallow wells)

The main disadvantage of the existing drip irrigation system is the high cost involved in buying, installing and maintaining the system . The second problem is the susceptibility of the small water passageways of distributors to clogging. Causes of blockages include sand, silt, organic matter, algae, bacterial slims,

colloidal or dissolve gross and precipitation of calcium carbonate at high temperature. In saline soils or with saline water localized irrigation has its potential salinity problems. Moreover with trickle irrigation, roots may concentrate in the wetted zone. Root growth therefore needs to be studied and properly managed.

By improving the existing localized irrigation/drip irrigation systems most of these disadvantages can be taken care of. The high initial cost can be reduced by gravity fed drip irrigation system and using locally available material like terra cotta with plastic polytubes. The porus distributors which will be having large distribution area can take care of problem of clogging.

The study will help in developing a system which can be integrated into an integrated farming system. In other words, it will help in bringing the waste-land under cultivation and conserving the natural resources.

The research work will be undertaken to develop low cost efficient water application systems for small farms and these irrigation systems will be incorporated into the integrated farming system.

Methodology :

In the first year of the project, trials of gravity fed irrigation systems, using porus terra-cotta units will be carried out at station level and these will be compared with the conventional drip irrigation system. The comparison of these system in cost, water saving and vegetative growth will be studied. The field trials will be taken based on the experience obtained in on station trials in the 2nd and 3rd years of the project. The studies will also include standardization of the quantity of water to be supplied at suitable interval for different types of soils and field conditions. In case of gravity fed drip systems, the variable discharge drippers will be used so as to apply

uniform quantity of water. The porus terra-cotta distribution units work on the principle of osmosis. These units will be buried in ground from which water will be sucked by the surrounding dry soil. Once it reaches to field capacity the intake of water into soil will be automatically stopped. As soon as the soil dries up, it will suck the water from porus distributors.

Results of all these trials will lead to give the optimum system which will be low cost, water saving and easy to maintain.

6. STUDIES ON FEASIBILITY OF MICRO-ENTERPRISE DEVELOPMENT FOR RECYCLING FARM WASTES :

The third activity envisaged in the project consists of developing farmer or community enterprises for production of the composts using locally available wastes. Existing practices of composting would be studied and documented. This would lead to identification of target group likely to be interested in proposed on farm studies. This work will be undertaken from the second and third years of the project. It is proposed to involved at least 30 farmers during this period. similar activity is also proposed for vermicompost production. Since no farmer in the operational area is currently doing this, farmers for enterprise development would be selected from those trained to undertake vermiculture. Other selection criteria will be same as above. The willing farmers with whom the availability of required quantities of wastes is not a constraint or a group of farmers will be encouraged to participate in this programme. These farmers will be selected from those trained under the earlier mentioned work and will be provided technical assistance in this venture and for marketing of the produce.

4.0 PROGRAMME DESIGN METHODOLOGY :

The research work is divided into four categories :

i) On station research would be mainly undertaken to supply the information not adequately reported in the literature e.g. use of vermicompost in the production of field crops.

ii) On farm trials and demonstrations for evaluation of existing technologies in existing farming systems.

iii) Technology testing and transfer (TT) which mainly consists of training, the target groups in appropriate technologies.

iv) The last aspect of the work consists of development of farmer/community production facilities for the inputs which would not only generate employment but also ensure the local availability of the critical inputs.

A table indicating, in general terms, the work proposed in each of the above is given below.

SR. NO.	ACTIVITY	STATION RES.	OF FARM TRIALS AND DEMONSTRATION	TECHNOLOGY TRANSFER	ENTERPRISE DEVELOPMENT
1.	BIOFERTILISER	-	*	*	*
2.	COMPOST	-	*	*	*
3.	VERMICOMPOST	*	*	*	*
4.	PEST CONTROL	*	*	*	-
5.	WATER MANAGEMENT	*	*	*	-

\- NO
* YES

As would be noted from the table all the activities cover the important aspects of On Farm Trials (OFT) and Technology Transfer (TT). As far as possible the selected farmers would be persuaded to use as many of these as possible on their farm to study combined effects.

For the OFTs the common approach will be to compare the existing farmer practices with the suggested treatment. It is planned to use a part of the sown area for experimental treatment thus allowing comparison with the existing farming practice within the farm. In these studies, observations will be recorded on the yields, soil fertility status, produce quality, and farmer perceptions. Due to the long term effects of most of the planned studies and also the predominantly rainfed agriculture in the area of operation it is aimed to undertake the studies for a period of five successive years.

The selection of farmers for the OFTs would be based on the availability of required inputs in terms of land, wherever necessary other material and willingness to join the programme on medium term basis. As far as possible attempts will be made to include various socio-economic classes of farmers in the OFTs.

While the main emphasis would be on the testing of these technologies work would also be taken up to develop package of practices for the cultivation of the locally important crops and also to study the alternative uses of the product for improved sustainability of the systems.

In all the studies proposed under different LEISA technologies at field level or on station an input-output analysis in economic terms will be carried out. In this analysis the costs of direct inputs/output would be according to the prevailing market prices in each area.

Comparison with existing systems would then ensure a more critical analysis of the proposed technologies. This would further enable identification of areas wherein more work may be needed to overcome a particular problem.

5.Ø PROJECT AREA :

The project work will be undertaken in the villages surrounding the existing BAIF programme near Urulikanchan and Akole (Maharashtra) and Vansda (Gujarat).

The area around Urulikanchan falls in the rain shadow region while those near Akole and Vansda are in the high rainfall zone. The principle crops in Vansda and Akole region include rice,beans,mango while those in Urulikanchan area are millets,sorghum,groundnut. Similarly the former two regions have a predominantly tribal population while Urulikanchan area is non tribal.

In the phase I programme study was conducted on the farming systems adopted by the farmers in two areas namely Uruli-Kanchan and Vansda. The information gathered during these studies led to identification of specific intervention needs for locally important crops and the present studies have been planned on the basis of the data generated out of phase I (refer Annexure - 1).

6.Ø EXPECTED OUTCOME :

The project would generate farm level data on the production characteristics and soil profile in different agro-climatic regions resulting from the proposed techniques. In addition the economics of production using different technologies and recommendations made for promotion of interventions suitable for various regions.

The work undertaken would encourage recycling of organic wastes generated in an area and promote farmer enterprises for production and supply of treated wastes useful for supporting plant life in the region. Local availability of such manures would lessen the dependence of the farmers on the expensive fertilisers and chemicals.

The generation of farm level data would increase the confidence of the extension workers and farmers for adoption of useful techniques. The data generated would also be used to identify the constraints in the adoption of the technologies and suggest suitable ways to overcome them. The work would also identify the target group(s) of farmers who would be more amenable to adopt the techniques.

Finally the results from various studies undertaken under the project would enable development of LEISA suitable for a region.

7.0 UTILISATION OF RESEARCH RESULTS :

BAIF is engaged in rural development work in different parts of the country. The results of the work undertaken in this project would be of use for the BAIF in the planning and implementation of development activities in the relevant area. The project work can also lead to identification of research topics which would be of direct use for the development work undertaken.

Dissemination of the results of the work envisaged in the project through BIRC would also lead to establish rapport with other organisations in the country working in this field and promote exchange of information/ideas for wider application.

8.0 LINKAGES :

Considerable interest in LEISA techniques has been generated all over the world during the last few years. A large number of groups in developed and developing countries have been

actively working on this important topic and BAIF has developed some contacts with Institutes like ODI in UK, ILEIA in Netherlands besides the IDRC.

The project is directly related with some other proposed projects like the Biofertiliser project which would provide the inputs that are necessary for demonstrations and trials. Similarly the mushroom project can contribute organic wastes for soil amendment. The other three projects which will have linkage with this project include those concerned with training (Rural Polytechnology Institute), Information and communications.

The project would address directly the activities specifically intended for participating women by organising biointensive gardens for cultivation of vegetables etc. which would be useful for better nutrition of the family and also as a source of income for women. A pictorial presentation of such linkages is appended. **(Annexure 4 A).** The inter project linkages for the Phase II Programme are enclosed in **Annexure 4 B.**

Experiences of various institutes working in LEISA are not as well documented as the Agricultural Scientific publications. It is therefore important to establish and strengthen contacts for exchange of information on topics of mutual interest. Besides the established contacts with the institutes mentioned earlier it would be useful to develop additional linkages with organisations like PAN, Belgium and other similar groups in Canada as well as India.

9.0 PROJECT PERIOD :

The effects of organic supply of nutrients are slower than the chemical fertilisers but are longer lasting. It would thus be necessary to test the technology over a period of 5 years to judge the sustainability of the system. The time frame for different activities to be undertaken is included in **Annexure 2.**

10.0 EVALUATION PLAN :

A mid term and final plan for the evaluation of the proposed project is given in **Annexure 3.**

11.0 BUDGET :

The overall project budget is given in **Annexure - 5** with budget notes in **Annexure 6.**

Details of BAIF contribution are given in **Annexure 7.**

ANNEXURE 1

LINKAGES BETWEEN PHASE I AND PHASE II

Activity	Phase I Achievements	Phase II Work Plan
Farming system	1. Study of the farming systems adopted by tribal and rural farmers. 2. Identification of specific intervention needs viz. cultivation practices, manure and fertilizers, aftercare, nursery raising, paddy varieties etc. for sustainable farming systems.	1. To investigate the utility of composting vermi-composting bio-fertilizers, and cover crops for sustainable production of crops at low cost. 2. Assessment of different plant parts for pest repellent activity. 3. To develop efficient water application systems. 4. To promote farmers enterprises in local production of necessary low cost inputs.

ANNEXURE 2

ACTIVITY PHASING

SR.NO.	PARTICULARS	YEARS 1	2	3	4	5
1.	Biofertilisers	———				
2.	Pest control	———	———	———	———	———
3.	Vermicompost	———	———	———	———	———
4.	Compost Studies	———	———	———	———	———
5.	Enterprise Development		———			
6.	Training	———				

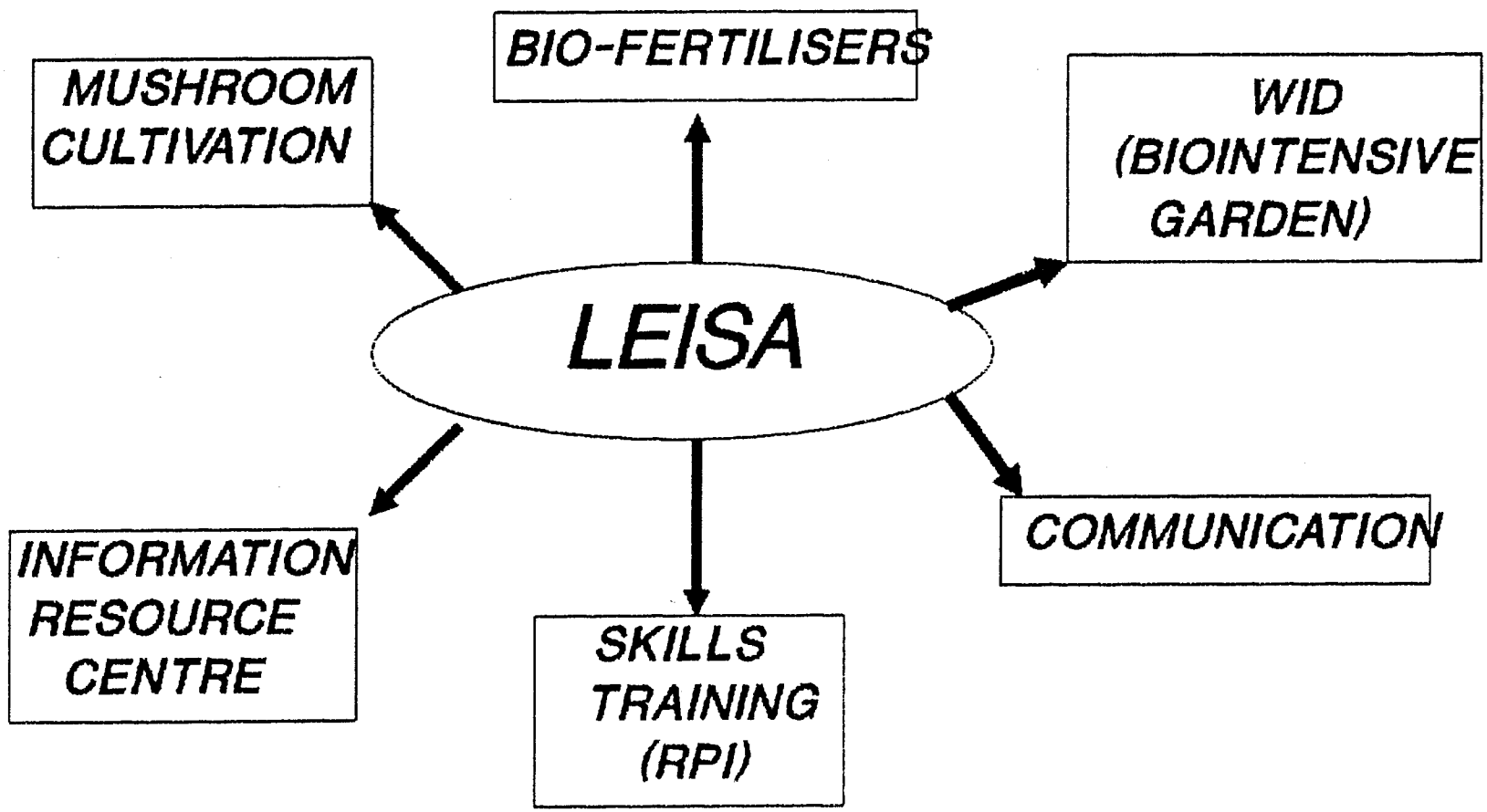
ANNEXURE 3

EVALUATION PLAN

ACTIVITY		EVALUATION PARAMETERS	
		MID TERM	FINAL EVALUATION/ IMPACT ASSESSMENT
1.	Development studies	* Preliminary results on studies	* Development of package in respect of different activities.
2.	Enterprise Development	* Commencement of compost and vermi-compost production at farmer level	* Number of enterprises operating
3.	Economic Analysis	---	* Cost-effectiveness of LEISA technologies.
4.	Training	* No.of participants trained * Training material Development	* Number of trained farmers practicing the technology.

ANNEXURE 4

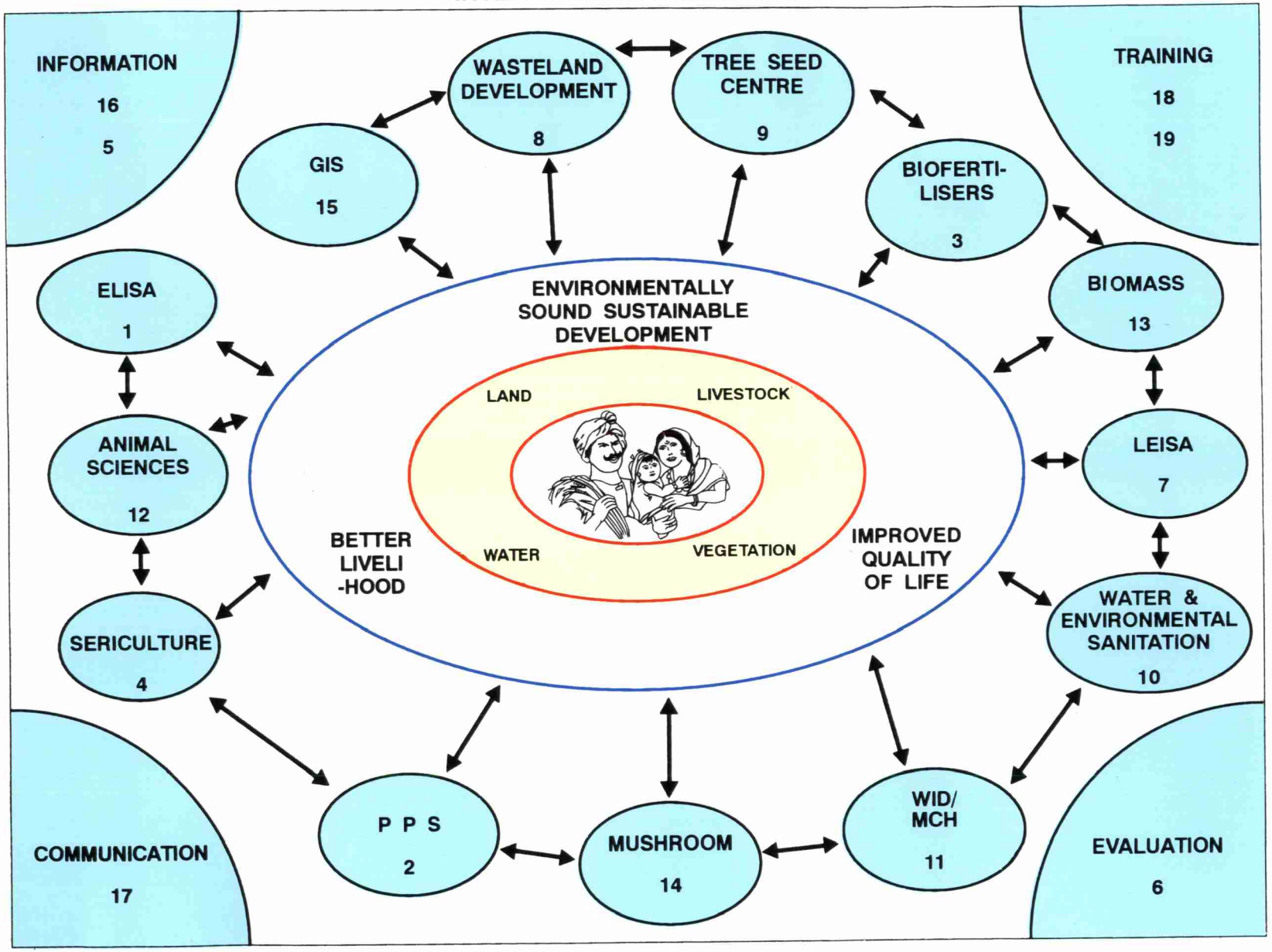
INTER PROJECT LINKAGES



HOLISTIC PROGRAMME APPROACH

ANNEXURE 4 B

INTER PROJECT LINKAGES



ANNEXURE 5

BUDGET SUMMARY

PROJECT NO. : 1
PROJECT TITLE : DEVELOPMENT OF LOW EXTERNAL INPUT SUSTAINABLE FARMING SYSTEM

(Rs. in '000

Sr. No.	A/C Head	<-----YEAR-----> 1	2	3	4	5	TOTAL
BAIF Administered :							
1.	Salaries	797	877	966	1062	1169	4871 0
2.	Research Expenses	384	770	811	562	261	2788 0
3.	Consultancy						0 0
4.	Reports & Documentation	10	10	10	10	10	50 0
5.	Training	70	80	90			240 0
6.	Travel	146	146	146	146	147	731
7.	Books & Periodicals	11	11	11	11	11	55
8.	Capital Equipment	62	350	162	10	10	594 0
9.	Infrastructure						0
10.	Administrative O. H.	148	223	221	180	161	933
	SUBTOTAL (A) :	1628	2467	2417	1981	1769	10262
							0
IDRC Administered							0
1.	Training & Travel			200		200	400
	SUBTOTAL (B) :	0	0	200	0	200	400
	TOTAL CONTRIBUTION :	1628	2467	2617	1981	1969	10662

ANNEXURE 6

BUDGET NOTES
(AMOUNT IN RS.)

1. SALARIES

The following manpower is required for the implementation of this project work

SR. NO.	DESCRIPTION	NO. OF STAFF	AMOUNT
1.	Project Coordinator (70% of Rs.135000)	1	94500
2.	Research Officers (Agronomy Soil Science Biochemistry and Engineering)	4	307200
3.	Extension Officers (2 at each location)	6	230400
4.	Research & Administrative Assistants (70% of Rs. 230400)	4	120960
5.	Allocated Expenses of Programme Monitoring Cell		44000
	TOTAL		797060

Note : An increment of about 10% is expected over every preceeding year.

2. RESEARCH EXPENSES

ITEM NO.	YEAR 1	2	3	4	5	TOTAL
1. Compost	60000	60000	80000			200000
2. Biofertilisers	56000	64000	72000			192000
3. Vermicomposting	63000	72000	81000			216000
4. Botanical Pest Control		4200	4800	5400	--	14400
5. Water Application System	100000	210000	240000	270000		820000
6. Enterprise Development		10000	20000			30000
7. Analytical Costs	75000	75000	75000	50000	30000	305000
8. Lab Scale Analysis		44600	7000	6000		57600
9. Data Collection	15000	15000	15000	15000	15000	75000
10. Data Compilation & Analysis	10000	10000	10000	10000	10000	50000
11. Organic Water Recycling		80000	80000	80000	80000	320000
12. Extension biofertilizers		10000	10000	10000	10000	40000
13. Extension Vermicomposting		100000	100000	100000	100000	400000
14. Extension Pest Control		10000	10000	10000	10000	40000
15. Allocated Expenses of Programme Monitoring Cell	5000	5000	6000	6000	6000	28000
TOTAL	**384000**	**769800**	**810800**	**562400**	**261000**	**2788000**

I) On Farm Trials :

In these studies it is proposed to include 70 80 and 90 farmers in each of the first three years.

1) Supply of compost 5 MT/farmer per year and other material @ Rs.1500 per year. The total cost of this is Rs. 360000 of these 200000 will be borne under the project and the rest by farmers.

2) For the OFT on the cost of inputs like appropriate culture etc. is to be provided Rs.500 per participant. The total provision for this is Rs. 120000 for the project period.

3) The cost of digging two pits for vermicomposting of 5'x5'x3' size works out to be Rs. 75/- therefore for two pits each farmer will be paid Rs.150. Each farmer will be provided one breeder box of earthworms (aproximate cost Rs.500/-). In addition each participant in the on farm trials will receive Rs. 250/- towards sundry costs and also as part compensation. The total cost for each farmer thus will be Rs. 900/- The requirement of funds is estimated at Rs. 216000 for the 3 year period. (63000 + 72000 + 81000)

4) In the botanical pest control studies starting from the second year of the project Rs. 60 per participant have been proposed with a total provision of Rs. 14400. (4200 + 4800 + 5400). This amount will be used for collection of designed plant material, preparation of suitable extract and application on crop.

5) For the development work for some of the newly introduced system Rs.100000/- have been allocated for supplies etc. in the first year. For the onfarm trials in water application systems to be initiated in the 2nd year Rs. 720000 have been provided. Thus the total Budget for this activity is Rs. 820000.

II) Enterprise Development :

1) As indicated in the work plan farmer production centres for compost and vermicompost are to be developed. The activity would be taken up with 10 and 20 farmers in the second and third year of the project. The necessary facilitues for these enterprises would be provided through project funds @Rs. 1000 per participant with total requirement of RS. 30000.

III) Analytical costs :

1) The work plan includes analysis of the soils for various characters during the course of the studies proposed under 4.14.3. It is further planned to test the produce for quality in comparison with the traditionally grown crop. The estimated number of these samples is about 250 per year. The analysis costs are estimated to be Rs.300 per sample. The total provision for this purpose is Rs. 75000 in each of the first 3 years while for the last two years Rs. 80000 have been allocated. The total amount requested under this head is thus Rs. 305000.

2) For the laboratory scale work needed to support biopesticide work in field as well as for the Lab scale evaluation of the products rs. 28000 have been provided (15000 + 7000 + 6000).· For supplies (Glassware, Chemicals, etc.). In addition Rs. 30000 have been provided for oritical equipment like pest unit etc. in the first year. The total amount is thus Rs. 58000 for project period.

3) Data collection and recording will be done by the local field functionaries. The cost of data collection for all the studies works out to be Rs. 75000/-

4) The cost for data compilation and analysis is estimated to be Rs. 10000 per year and provision for Rs. 50000 has been made for the project period.

IV) Extension Work

1) Organic waste recycling.Assistance for for farmers willing to practise this method of farming is proposed to be given @ Rs. 800/farmer (Rs. 400 each for the Bio-Intensive Garden and the field crops.)for 100 farmers per year starting from the second year and Rs. 320000 have been allocated for this purpose.

2) For the extension activity in biofertilisers provision of Rs. 40000 has been made to cover the cost of inputs @Rs. 100 per participant for the four years starting from the second year.

3) For the vermicompost work the activity is proposed to be tried with 100 farmers per year from the second year. Total provision of Rs. 200000 is made to cover the cost of inputs @ Rs.500 per participant.

4) For the pest control extension activity additional amount of Rs. 10000 for each of the last four years is allocated to cover the cost of supplies to the participants. The total provision is Rs. 40000.

5) Allocated Expenses of Programme Monitoring Cell

3. REPORTS AND DOCUMENTATION

A provision of Rs.10000 per year is made for the cost of supplies needed for preparation of periodic reports of the project. The total provision is Rs. 50000 for 5 years.

4. TRAINING

1) The cost of training the participants/field staff is to be charged to the project. This would include traveland other costs like food of the participants. The required amount is Rs. 140000 for the project period @ Rs.500 per person.

2) An additional amount of Rs. 100000 is provided for production material like charts booklets video cassettes.

5. TRAVEL

1) The Field Assistants would be required to undertake local travel for the implementation of the field work. They would be paid Rs.200/month for this purpose. The annual costs are Rs.36000.

2) The Extension Officers will be supervising the field trials and would be paid Rs. 600/month approximately towards the travel. The yearly expenses for this are estimated to be Rs.42000.

3) The Research Officers are expected to visit each area twice per season at an estimated cost of Rs.1000 per visit. The yearly costs are Rs.48000.

4) The Coordinator will visit each area at least two times in each season. The amount allocated to cover the expenses for this travel is Rs. 18000 per year.

The total of the above costs is Rs. 144000 per year.

5) Allocated Expenses for Programme Monitoring Cell are Rs. 11000

6. BOOKS AND PERIODICALS

The amount requested under this is for the books and periodicals to be procured on this subject. This would also cover the cost of literature searches that may be required on the topic. Rs.11000 have been allocated per year.

7. CAPITAL EQUIPMENT

An amount of Rs. 180000 is provided for procuring six motorcycles for the extension offficers for field work @ Rs.30000 each. Also it is proposed to procure a Computer at the Central Office for data analysis. An amount of Rs. 60000 is provided for the same.

An amount of Rs. 26000 has been provided to procure minor equipment like balances scales for recording of the observations and supply to the farmers. It is proposed to procure three laptop computers at field level for data recording. An amount of Rs. 300000 is provided for the same. Allocated expenses of Programme Monitoring Cell are Rs.28000.

IDRC ADMINISTRERED

TRAINING AND TRAVEL : To undertake study tours and training programme in the areas of sustainable Agriculture, Vermiculture and Faring Systems Research, an amount of Rs.200000 has been provided in the 3rd and 5th years.

ANNEXURE 7

BAIF CONTRIBUTION

CAPITAL EXPENDITURE

1.	Land and other facilities	750000
2.	Infra structure for vermicompost production	100000

RECURRING EXPENDITURE

1.	Cost of cultivation of crops.	125000

Salaries :

BAIF will contribute 30% of the salaries of the following staff.

1.	Project Coordinator (30% of the salary Rs. 135000)	Rs. 40000
2.	Research and Administrative Assistants (30% of Rs. 172000)	Rs. 51840
		Rs. 92340