Mr Rushing

QUARTERLY REPORT

For the period: April through June 1983:

IRRI/USAID Contract Nos. 492-CA-1-1707, 497-0244 and RMI

Agriculture Extension and Research

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EXECUTIVE SUMMARY

1. Walter C. Tappan will assume the IRRI Liaison Scientist position being vacated by J, Ritchie Cowan upon his retirement in September 1983.

2. Indonesia must develop a comprehensive research program for all of its food crops. But this must not in any way jeopardize the momentum status and state of development of their rice and rice based farming systems research.

3. Plans must be made to carefully integrate all of the staff as the current generation of scientists and leaders reach retirement and new personnel take over key leadership positions.

4. Every effort must be made to continue to strengthen the excellent collaboration that has been well established between AARD and IRRI.

5. The GEU Monthly Meetings have proven to be an invaluable asset. It is essential that they be conducted on a regular basis without fail.

6. A former long-time IRRI staff member in Indonesia Dr. H.M. Beachell spent 5 weeks on a consultancy with particular reference to hybrid rice research and BPH challenge.

7. The BPH which wrought serious havoc in the last decade still is lurking in the background as an ever present future challenge. Even though the new biotype identified in the province of North Sumatra is in an endemic status at the present time; it must be carefully watched. Its suppression must be pursued with continued vigilence.

8. The Consequences of Mechanization Project has served as an excellent 'forum' for developing future research and educational programs in farm machinery improvement.

9. Water Management is a key to future success. There must be more than just empirical knowledge to support this important 'field'. Hence, forthwith a modest comprehensive research effort is imperative.

10. As food production demands increase, quality (nutritional values) must not be sacrificed when endeavoring to meet quantity goals.

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11. Future and continuous training (professional improvement) is essential. It is important to make sure that it is relevant and practical.

12. All personnel should be regularly encouraged by recognizing the dignity of their profession. They need to be reminded that it is an important task which they are doing for the welfare of mankind.

13. As intensity of food production expands, there is a danger that vital watersheds might be destroyed. Current feasibility studies are most timely. Administrative officials and politicians should be encouraged to carefully assess the 'decision making' guidelines being given them by these professionals.

14. As the farming systems program matures, livestock in certain areas and perhaps in most areas can become an extremely important component. The advice and counsel of animal scientists must be sought. They play an important role in a farming systems program.

15. The cropping systems program during the past decade has identified the palawija crop 'soybeans' as an extremely important component. More stress needs to be given to

the improvement of this crop. It provides an excellent source of protein to complement and supplement that produced by rice.

16. Major personnel changes within the Directorate General of Food Crops will have a significant bearing on future working relationship with IRRI particularly the Agricultural Engineering consulting aspect.

17. The Director General of Food Crops conducted a review on June 1 of many expatriate programs underway in his Directorate General. The highlights of this review are reflected in this report.

18. Some changes were made relative to the nature of the Luwu Project during the quarter.

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Agriculture Extension and Research

As the preface to this my last quarterly report is being written I am prompted to reflect on what has happened over the last six years and contemplate the challenges of the future. As we look at the accomplishments since 1977; there are many. Indonesia has made real and positive strides in improving its capability to produce its staple food, rice. It is on the threshold of moving into a sustainable production program for other important food crops such as palawija, vegetables and fruits. A comprehensive development and commitment of its agriculture potential is an absolute necessity if it is to meet the food needs of future populations. To do so it must have scientists and educators knowledgable in agriculture science and technology and able to skilfully develop programs which will meet the needs of Indonesia. IRRI has played a significant role as it has transcended the spectrum from a cooperative, technical assistance role to that of largely a collaborative partner.

IRRI's usefulness in the future will largely depend on the capability of its leaders to evolve types of programs which will complement, supplement and collaborate with those of their Indonesian colleagues to maximize the production of high quality foods. Once the food has been produced it is important that it is appropriately

and expeditiously distributed in such a manner that everyone has an adequate supply of high quality food stuff at all times. Thus, the role of the marketing systems is extremely important. It is useless for the farmers to be encouraged to increase their production if no system is available for marketing it in a manner that provides them a reasonable return on their investment and the consumer with a quality product at a reasonable and fair price. Before any expanded agricultural program can be successful, there must be an adequate supply of good quality seed available at the right time in the right place and the right quantity. In some cases it will be vegetative cuttings for propagation rather than seed. Nevertheless, these planting stocks are basic to any expanded and intensified program if sustainability and stability is the goal.

There have been significant successes achieved in the last six years. There are many challenges ahead as have been briefly enumerated above. None of these are insurmountable. However, if they are to be solved in an orderly fasion, then those responsible for their solution must accept the responsibility of organizing such programs and encouraging such development as would provide answers to these challenges. A carefully orchestrated role of liaison and collaboration between the Government of Indonesia (specifically the Department of Agriculture) and an international institution like IRRI makes for a 'winning team'.

In 1977 we were just at the end of a major scourge caused by a serious epidemic of BPH. However, we did not know that! The GEU (Genetic Evaluation and Utilization) had just been organized by the CRIA rice scientists. At one of the regular monthly meetings a significant statement appeared in the minutes of January 1978 re a point of view expressed by the GEU Coordinator, Dr.B.H. Siwi and I quote " The spirit of cooperation expressed by the scientists from different disciplines that work together is the GEU". This exemplified the prevailing enthusiasm of this interdisciplinary group. Subsequent accomplishments speak well of this significant team work effort.

The Cropping Systems program had had some five years of intensive activity and were on the threshold of emerging from some of their initial experimental sites and establishing studies in different environments to determine what additional information they needed relative to the development of methodologies to efficiently syncronize what the farmer has to do every day.

Work was beginning on examining critically the Consequences of Mechanization. It was evident that mechanization as such was here to stay. The prime question was how could we best assist the farmers to use it wisely and well. This was examined in two ways, one by exploring the relative role of machines designed specifically for the small farmer in contrast to the labor intensive environment. It dealt primarily with rice production. These studies have now been brought to a conclusion with some very useful guidelines for decision makers as they would deal with this particular need of Indonesia's future agricultural demands.

As scientists learn from their studies it is important that this information be put in a form that it can be shared with other scientists; with educators responsible for working with the farmers to aid them in solving production problems and for decision makers. A proposal had been put forth in 1977 to offer some assistance in the dissemination of research results. Now six years later there is a 'well oiled" GEU program. Cropping Systems has graduated into a Farming Systems Program to better meet the need of the farmer. A modest but effective research dissemination program is in operation in CRIFC. Thus, there are many pluses. Rice production has reached a higher level than it has ever reached in previous history. Imports of rice were 300,000 tons of milled rice in 1982 down from the highest importation in 1980 of almost 3 million tons of milled rice.

A very serious drought was experienced in 1982. This has had some impact on food crop production capabilities in 1983. However, at the writing of this report in general production seems to be at a fairly high level. It is anticipated that there should be at least a million metric tons more of milled rice produced in 1983 than there was in 1982. A new biotype of the brown planthopper was identified in the province of North Sumatra. It did cause some location specific devastating results to production in late 1982 and early 1983. However, quick action on the part of research scientists and production departments of the Department of Agriculture resulted in bringing a potentially disastrous situation under control to the point where BPH is now more or less endemic. This does not mean that constant surveillance of the situation can be abandoned.

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There is adequate technology available to double rice production within the next 10 years providing adequate and appropraite incentives are given the farmers to do so. After that there is an infinite potential for rice production in environments less suitable than those that are currently being used. However, economics will dictate that utilization of many of these areas may be undesirable unless it is necessary to put a higher price tag on food production and cost to the consumer. Therefore in the meantime it is most essential that all other food resources be exploited to the maximum. This means that palawija crops must be used wisely in the best and most appropriate types of farming systems along with vegetables and fruits. Markets will need to be developed for expanded production. Preservation of certain of these crops will be a necessity. It will require a new approach on sanitation and hygiene in order to provide quality products for subsequent consumption. All of these things are possible but there will need to be expanded scientific personnel and educational programs to accomplish these goals. Wise use of land and water resources will be absolutely essential. It will be important as agriculture intensifies to pay special attention to problems of erosion and well thought out uses of areas which now are important watersheds. All of these challenges are being currently given consideration but it will take much more well developed scientific manpower to achieve the goals which must be attained.

During the balance of the 1980s and into the 1990s the world food production challenge will be one of an ever increasing proportion of the world's population moving into a stage of high growth rate of

food demand. To accelerate the needed agriculture development, greater intensity of collaboration on all fronts and in some cases technical assistance will be needed. It is important to have a well thought out synchronized working relationship between national and international agriculture research systems (such as the CGIAR) is essential. Our goal must be that adequate food is not just a right of all people but an accepted fact. To accomplish this, national governments must give primary concern to a sound dynamic agricultural program. An agriculture based strategy for economic development will stimulate and serve as a catalyst to many other sectors of the economy.

It is not sufficient to just have an adequate bulk supply. It must be of good quality and appropriate nutritional value. The nutritional value set forth in Appendix I reflects that the average Indonesian consumes per capita per day approximately 2400 calories. This is the bare minimum. This must be increased. It is interesting to note that of this 2400 calories per capita per day, approximately half of it comes from rice. Fifty three calories per day comes from soybean. Rice produces a high percentage of the protein consumed. Soybean produces as much protein consumed in the country as that of animal protein. Hence, it is important in planning for the future that all food resources be appropriately and adequately developed in order to compensate for anticipated lack of economically feasible expansion of such basic food crop as rice. The cropping systems research over the last decade has shown that varieties carrying those "gene pools" which will guarantee maximum

high quality nutrition may be grown under conditions which will further enhance this characteristic. In some instances and may be in all cases marketing procedures should be based on nutritional quality basis. Farmers should have an incentive to benefit by carefully producing and properly processing his or her crop for the market in such a way that the consumer receives maximum nutritional benefit.

Countries like Indonesia and Malaysia are at a very critical stage in their development. Those who were "charter members" of many of the key research and educational activities as independence was won are now on the threshold of retirement. A new generation will be taking over in the not too distant future. The dedication and sincerity of those who were responsible for launching these important agricultural organizations and institutions must be perpetuated. The younger generation will need encouragement, wise counsel and guidance. But it must be recognized that they will undoubtedly do things differently even though they will be attempting to achieve the same goal that is adequate high quality food for all. The successes which have been observed and experienced in Indonesia within the framework of CRIFC and AARD during the last 6 ot 7 years have been spectacular. It is easy to measure these successes on a volume basis for example by the increase in production of rice or some other commodity. Perhaps in the long run the most dramatic change which has taken place is the fact that a research organization was built, welded together and staffed with well trained scientists to carry on the work in the future. Sometimes this significant dimension is overlooked.

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We too frequently think of research and/or organization to promote production merely as a measure of the amount of research findings and/or educational effort expended. Whereas the human dimension is probably the most important if it has been developed in such a way that it will be continuous and enduring. We must not loose the pace and momentum which has been generated within the past decade. There were those in the Western World in the decades of the '60s who predicted dire distress due to inability to produce adequate food needs by mid 1970s. For the most part these prognostications fortunately were proven wrong. But we must not rest on our laurels.

By some who are most knowledgable and have spent a life time working in International Agricultural it is felt that it takes at least 20 to 25 years to identify and train a sufficient number of scientists in various disciplines involved in crop production.This seems like an exceedingly long time. Now in the case of some parts of the world, it is felt that it could take as much as 50 years. Once the organization has been properly and adequately put in place, it is extremely important to make certain that it remains viable over a long period of time. Therein lies the danger as we move from one generation to another particularly if policiticians and other decision makers do not understand the long range nature of this 'business of agriculture'.

It is so easy to become overly impressed with major successes such as the near selfsufficiency in rice which was reached in 1981. But lurking around the corner can be hazard such as drought which in Indonesia has reoccurred in 1962, 1972 and 1982. Also, there can be pest situations developed which under normal circumstances are

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endemic but for certain environmental reasons and/or genetic may suddenly become epidemic. Hence, a careful articulately, wise and continuous surveillance of potential pest explosions is absolutely essential.

There must be clear and open channels of communication between researchers and action or production program people and universities. The universities need to know what the challenges are so that they can educate accordingly. The production expediters and researchers must be constantly aware of what universities are doing which may be of benefit to them in solving their problems. There will always be an important place for the 'short term' training in technology. To some degree many International Research Institutions are a natural to do some of this kind of training. It is impossible for them (IRI's) to do such for all who would have need of it. However, in collaboration with national programs they (IRI's) can assist national agencies in their role for such a training.

Care must be taken that international and national research agencies and/or institutions do not become so esoteric that they have no empathy for the needs of the farmers. There will be a need for more specific and sophiticated training in very narrow disciplines. But there must be a sufficient number of generalists who can put all the pieces together and 'make a plant grow'. Otherwise we can have 'ivy towered' research institutions doing scientific endeavors of high quality and highly respected by scientific peers with little direct value in meeting the needs of the consumer. There needs to be a continium. Developing countries must be most careful

that this continium is maintained. If not, then their "practical usefulness" will gradually fade into oblivium as far as meeting the every day food needs of the expanding world population.

Those responsible for leadership must encourage pride in accomplishment. But at the same time retain a humble attitude because of the vast array and matrix of things unknown to all of us. When pride and humility are merged it results in dignity! A "DIGNIFIED PEOPLE" can hold their own in any segment of science. Dignity is resilient. This attitude and characteristic must be kept in mind as programs are developed and goals are set to make sure that there is a well ballanced use of 'good common sense' and a practical dimension to this total effort of food production. Those responsible for mapping programs of training for future scientists must bear this in mind. Decision makers and personnel managers should be counselled to encourage the training of potentially able young people prior to them being permanently established within the framework of an institutional and/or governmental organization. Too frequently these capable young people are discriminated against because they do not have a full time appointment at an appropriate time when there is an opportunity for them to receive additional technological training and/or advanced training. This 'man made' constraint must be overcome.

The future is bright and challenging. There is a role for private enterprises in many aspects of agriculture development in the developing world. These opportunities must be carefully explored and exploited. One good example is the identifying of outstanding

farmers and encourage them to be seed growers par excellence. Those having an interest on handling, processing and marketing quality seed should be encouraged to get into private seed business.

In the meantime it is important to recognize some of the current activities which have taken place during the past quarter that will contribute both in a tangible and intangible way to meeting some of the goals as set forth above. It must always be kept foremost in our thinking and planning that the most important product which we have to market is an 'idea and/or concept'in meeting the every day needs' of those to whom we are accountable. In many if not most cases the need will be location specific. It will be impossible to find a formula which will apply in all situations. Thus we must be flexible.

Farming Systems

The consultant has been very active with a number of projects during the quarter. These many activities are reflected in the three monthly reports for April, May and June respectively.(Appendices I-1, I-2 and I-3.)

The watershed is an important topographic component of any agricultural area. It can provide the base for water retention and distribution. If it is not properly managed, it can be the source of inadequate supplies of water due to rapid runoff. This automatically leads to flooding, serious erosin and subsequent loss of food crop production potential. As population pressure increases there is always

a danger that the usefulness of certain topographic areas for watershed purposes will be destroyed. A comprehensive study was made of several different watershed regions in Java during the month of April. A technical report relative to farming systems research development in upper river watershed assessment are prepared. It appears as Appendix II.

When water is impounded behind a dam in a reservoir a complex set of canals for distributing it to farmers is necessary. Much engineering is required and the delivery system must be maintained and repaired from time to time. Sometimes it is difficult to synchronize these engineering maintenance requirements with the time when the water is needed by the farmers. Once water gets to the tertiary or subsequent level of delivery, its appropriate usefulness by the farmers is regulated to a large degree by the manner in which it is made available to him. Hence, there is an entire subject matter or discipline known as 'water management' that becomes extremely important to the farmers who need it (water) for the production of their crops. A modest but important collaborative project on "On Farm Water Management Research" has been developed between AARD and IRRI. It will be based at the Sukamandi Balai. Details relative to this project proposal and data to be collected are reflected in Appendix III.

Livestock can play a significant role in Farming Systems. To explore how cropping and livestock systems might be better integrated into farming systems, IRRI sponsored a workshop in this regard in late April. Several scientists from Indonesia participated in this workshop.

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As a follow up to this workshop the Indonesian Farming Systems Research and Development program completed a project proposal for research in Batumarta, South Sumatra to further research this important dimension of farming systems. The Head of IRRI's Global Farming Systems Research Service participated in a field trip in this regard. See Appendix IV.

Over the last decade the Cropping Systems Research has identified soybeans, a palawija crop, as being one of the most important components. Where it is adapted it fits into the cropping patterns and yields more calories per hectare than other palawija crops. Therefore it is important to explore carefully the potential of this crop both as a monoculture and as a component of a farming systems program. To this end there will be an international symposium "The International Symposium on Soybean in Tropical and Subtropical Cropping Systems" to be held in Tsukuba, Japan, from September 26 to October 1, 1983. A manuscript entitled "Increasing Soybean Production Through Improved Cropping Systems and Management in the Tropics" has been prepared by Djuber Pasaribu and J.L. McIntosh, to be presented at this meeting. The Director of INTSOY (International Soybean), Dr. H.E. Kauffman, spent two days during the quarter visiting with interested scientists in AARD. This was a very useful exchange to determine how INTSOY might be more helpful to the soybean research program now underway and being anticipated in the future. This was an important dialogue relative to fostering and enhancing the farming systems research program.

Agricultural Engineering

There were major adminstrative changes made in the GOI Agency to which this program is attached. Mr. Suhaedi was appointed Director General of the Directorate General of Food Crops, a post previously held by Mr. Wardojo who is now junior Minister for Food Crops. Mr. Jafri, former Director of Bina Produksi to which the IRRI agricultural engineering program is assigned was reassigned as Secretary to the Directorate General of Food Crops. The vacancy created by his reassignment was filled by Mr. Sihombing who now becomes the Director of Bina Produksi in which the Sub-directorate of Agricultural Engineering is a part.

On June 1 Director General Suhaedi convened a meeting of expatriate scientists who are participating in the many cooperative and collaborative programs within the Directorate General of Food Crops. A report was made for the IRRI Agricultural Engineering activity. A detailed report in this connection previously submitted to Mr. Suhaedi are found in Appendix V. This was a very useful program since it provided a comprehensive picture of the many and varied activities being carried on by a number of expatriate scientists supported by many different donors.

On June 2 a special ceremony was held by the Director of Bina Produksi to recognize the innovativeness of staff members who have designed and developed many useful, practical and inexpensive tools which can be of immense assistance to the Indonesian farmer.

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The IRRI Consulting Agriculture Engineer had a very busy two months (April and May) of this quarter. During the month of June he was on annual leave. His activities are reflected in considerable detail in Appendix VI. Attached is a special statement prepared at the request of the Governor of West Sumatra entitled "Promotion of Locally Manufactured Hand Tractors in West Sumatra". A special request was made to visit Bali with a Bank of Indonesia consultant. Appendix VI-1 reflects the nature of the needs expressed by those with whom they visited on this field trip. There was also a request to provide assistance to other Eastern Indonesian provinces. It will be impossible to take on additional activities of this nature unless there is a major adjustment made through increase of staff and budget. However, it is encouraging that by virtue of successes had todate in the provinces in which this program has been active have prompted others to seek this kind of educational assistance.

Work continues on the Luwu Project with a skeleton staff in the field. During the quarter, Colonel Heru, Project Manager requested that consideration be given to extending this project through the end of the current calendar year. An appropriate additional budget adjustment to permit such an extension has been submitted. As of this date there has been no response to this proposal.

The regular six months report October 1982 through March 31, 1983 on the Luwu Project was submitted. (See Appendix VII).

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G.E.U.

In the first 1983 quarterly report it was reported that Dr. H.M. Beachell was in Indonesia on a special consultancy from February 1 through early March. His consultancy report appears as Appendix VIII. Appendix IX is a trip report by S.Virman:

Also in the first quarterly report of 1983 the appearance of a new biotype of BPH in North Sumatra was discussed. It was indicated that 17 tons of PB56 was airlifted from IRRI (Philippines) to Medan. This seed was established in early March in seedbeds and transplanted in early April. By early May there were reports of some grassy stunt in the planting of PB56. When it (PB56) was developed it showed high resistance to grassy stunt. In the meantime IRRI's rice virologist, Dr. Hibino, has found evidence that there are 2 strains of grassy stunt. It is possible that one of these strains may be present in North Sumatra which was not present where the experimental stocks of PB56 were evaluated. On the other hand, it would appear that there is a strong possibility of 'seed contamination' either in the seedbed and/or in the fields to which the PB56 was transplanted of volunteer seedlings which were susceptible to grassy stunt. It did show up in some fields in early May. However, by harvest time in late June the crop looked very good. This is a case where continued vigillance must be kept relative to the possibility of a new strain of grassy stunt being present. In the meantime the BPH bas become almost non existent and is definitely now endemic in nature. As a result of discussions

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during the 1983 Collaborative Meetings in early March IRRI scientists put together a group of experimental lines for further testing in the BPH infested area of North Sumatra. This material was sent forward during the quarter and was established in early June.

Dr. Bambang Suprihatno in charge of the CRIFC Hybrid Rice research program departed on June 12 for IRRI. He will spend a six month Post Doctorate working exclusively on Hybrid Rice with colleagues at IRRI. While there he will also make a number of crosses for the Indonesian program. Bambang Sutaryo also travelled with Dr. Bambang and will spend four months on special training on Hybrid Rice technology.

During the quarter 3 rice varieties were officially released by the Minister of Agriculture. They are: PB56, Sadang and Sentani.

Training

One phase of training program is professional improvement effected through participation in conferences, symposia, workshops, etc. The annual IRRC (International Rice Research Conference) held each April at IRRI was scheduled this year for April 18-22. The following Indonesian scientists participated in the program.

Dr. B.H.Siwi
Dr. Z. Harahap
Dr. H. Anwarhan
Dr. Bambang Suprihatno
Dr. A.M. Fagi
Dr.M. Sudjadi
Mr. Soetjipto Partohardjono
Ir. Ruhendi

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Soetjipto Partohardjono and Inu G. Ismail participated in the Poster Session. Their paper was entitled "Management of Red Yellow Podzolic Soils for Sustain Crop Production in Indonesia".

Type of Training	Number of Trainees	Dates Dispatched	Dates Returned	Location
INSFFER	1		April 30	IRRI
G.E.U.	2		May 22	IRRI
Upland	3	May 22		IRRI

Visitors:

Dr. Albert Hagan, USAID
Dr. Peter Carriage, CSIRO
Dr. Douglas Perry, IADS
Mr. Alan Strout, MIT/WB
Ms. Greta Watson, AARP/BARII
Dr. A. Syarifuddin, SARIF
Dr. A.B. Wanders, ATA
Dr. Soewardjo, P3MP
Dr. S. Virmani, IRRI
Dr. C. Bockhop, IRRI
Dr. L. Crowder, Rockefellow Foundation
Dr. P. Dart, ICRISAT
Mr. H. Murphy, IRRI
Dr. & Mrs. K. Brown, BARIF
Ms. Annie Frio, IRRI
Mr. Bart Duff, IRRI
Dr. C.P. Mamaril, IRRI
Ms. R. Wilson, IRRI
Dr. V.R. Carangal, IRRI
Mr. Ruben Villareal, IRRI
Ms. Lisa Kulp
Mr. Leo Gonzales, IRRI
Dr. H.E. Kauffman, INTSOY
Mr. Tamisin, IRRI

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COOPERATIVE CRIA - IRRI PROGRAM
THE INTERNATIONAL RICE RESEARCH INSTITUTE

CABLE ADDRESS:
IRRIAID BOGOR

MAIL ADDRESS
COOPERATIVE CRIA - IRRI PROGRAM
IRRI - P.O. Box No. 107
BOGOR, INDONESIA

May 5, 1983

To : Dr. J. Ritchie Cowan
IRRI Liaison Scientist

From : J.L. McIntosh
Farming Systems Liaison Scientist

Subject : Monthly Report - April 1983

I. Principle Activities and Accomplishments

A. Upper River Watershed Assessment.

A team of about 15 scientists, representing different disciplines, plus relevant GOI and USAID officials spent the last week in March and the month of April involved in this exercise. The first week consisted mostly of planning and organizational sessions. The second and third weeks involved visits to the Citanduy, Solo and Brantas River watershed projects and to the Yogyakarta Rural Development Project. The fourth and fifth weeks involved discussions among the team members and further discussions with GOI officials. Dr. Surjatna and I were responsible for the Cropping Systems Assessment within the Context of Farming Systems Research and Development. I was able to spend 15 days working with the team and preparing summary and technical reports. Copies of the reports are enclosed.

B. Preparation for and attendance (one week) at the IRRI sponsored Crop/Livestock Farming Systems meeting at Los Banos. Drs. Siwi, A.P. Siregar and Ir. Soetjipto represented AARD at the meeting. The Asian Farming Systems Working Group will serve as a coordinating body for selected Farming Systems Research Sites. Indonesian scientists wish to participate and have suggested thatBaturaja be a collaborating unit.

The discussions at the meetings were very useful. Several scientists who have had experiences in Livestock Farming Systems from Asia as well as North America gave

presentations and discussed approaches that will be useful to the group. The main focus of collaboration will be on animal feeds.

Other items of interest were:

1. Forage crops after rice — Trials at IRRI were started two years ago to evaluate the growth, longivity and seed producing characteristics of forage species grown during the dry season after rice harvest. These crops were planted soon after rice harvest in January and have been growing on residual moisture since that time. Most of the species studied were legumes. Of these pigeon pea, calopogonum centrosema and pueraria have done very well. These are all commonly grown in Indonesia. The next step will be to identify the most palatable cultivars from these species. It is significant that sweet potatoes which were inadvertantly left in the field have also grown well and are still growing.

2. Force feeding of beef cattle — During a field trip to Batangas, we were able to see the management operations for Batangas beef industry. The key factor appears to be the use of rice bran and ground grain in a slurry and literally poured into the animals mouth. To a limited extent this kind of operation would have a place in Indonesia.

II. Miscellaneous Activitie

1. Editing of reports for IRRC and other conferences.

2. Consultations

III. Constraints to Work

1. Lack of a coordinated Farming Systems Research and Development effort within AARD.

IV. Plans

1. Visit Maros and Banjarmasin to assist in FSR&D Program development.

2. Help develop and carry out collaborative research plans.

WATERSHED ASSESSMENT REPORT
FARMING SYSTEMS EVALUATION AND DEVELOPMENT

Introduction

Farming systems are usually comprised of many different agricultural enterprises that are inter related. Some of these enterprises are discussed in detail by other members of the assessment team. This report however will assess the farming systems in the upper river watershed project areas from a holistic point of view but keeping in mind the major objectives of soil conservation and the need to increase crop production. In each case, however, it is understood that farmer acceptability (socio-economic) and biological stability and sustainability of the farming system must be a part of any assessment. Cost to the general public must be another consideration.

Cropping systems and later farming systems research in Indonesia and other countries in Southeast Asia over the past ten years has developed methodology for evaluating existing farming systems and designing, testing and implementing new technology that is appropriate for specific target areas. Much of the technology has been disseminated through government agencies and implemented to some extent. In this report the field activities that were observed in the upper river watershed projects will be assessed with respect to standard development methodologies.

Background

Agriculture has extended into the upper river watershed areas where unsuitable soil, land formation and topography hinder stable crop production. Consequently, there is a considerable drop in soil fertility and crop yields. Furthermore, the area of land available to each farmer has decreased due to subdivision (among family members) and abandonment as a result of erosion. Farm income is therefore very low, and the great majority of people living in the most eroded areas are subsistence farmers.

The farmers understand that erosion reduces yields but also know that the use of fertilizer counterbalances the yield losses. However, on steep slopes where upland farming is practiced, eventually a complete loss of arable soil will occur unless soil conservation measures are taken. Down stream river channels and irrigation canals will be filled with sediment. The farmers have neither the skill nor the financial resources needed to implement control measures which require considerable amounts of labor and time.

The solution to this problem requires erosion and flood control through good watershed management practices. This must be accompanied by an improvement in the productivity of the depleted soil to increase farm production and income. Alternative farm enterprises must be developed that require less soil disturbance particularly for the steeper areas. Finally the population and land and water resources must attain a dynamic equilibrium.

Objectives

The main objectives of upper river watershed developments are:

1. Soil and water conservation
2. Increase production in a way that is technically sound and economically viable.

Review of Projects

The development activities being carried out in each of the upper river watershed projects do not substantially differ. The objectives are similar. There are some differences in approach and starting points among the projects. A detailed review is not relevant primarily because projects are short termed and supplementary to the government system. The Indonesian systems for research and extension and production programs are well developed. Technical assistance through these channels is likely to be most productive. Existing institutional constraints to upper river watershed research and development are legitimate concerns of this assessment and will be considered in detail by our colleagues.

Each project that we visited, including the P3RPDAS activities, really constitute farming systems research and development but with special emphasis on the implementation phase. Figure 1 illustrates the research phases that are usually considered necessary to carry out farming systems research and development in a selected target area,

such as any one of the five project areas visited. It is important to note that equal emphasis is placed on socio economic and on biological research. For pioneer research in upper river watersheds such as in the Solo River and Citanduy target areas, there was little existing technology that could be obtained from other locations with similar conditions. Consequently, there was very little "Technology Transfer in" and much initial work was done on soil conservation and motivational strategies. With experience gained from research and development in these two target areas and cropping systems research carried out in other places in Indonesia considerable technology has been developed that can now be directly transferred to new target areas. Consequently, new projects are able to concentrate on implementation and extension. Figure 2 illustrates this situation by showing considerable "Technology Transfer in". These figures are like a road map that shows where you are now, where you have been and where you should go. Since most of the activities observed in the field constitute the implementation phase (Phase V), it is understandble that very little biological and economic research could be seen. This suggests that in the opinions of the project planners, ample technology was available to proceed with the implementation phase directly or with some supplementary field trials. In general this conclusion was right. The field work in terracing, cropping systems, forage production, animal husbandry and perennial crops has progressed. But there is also evidence that trickle down support from the existing research institutions (AARD and Universities) is inadequate to deal with problems and constraints in the field. Rather than slow down the implementation activities that are underway, it would be better to accelerate on site research from the research institutes to fill the technology gap.

Assessment of Constraints

It needs to be emphasized that the upper river watershed projects as well as the institutionalized P3RPDAS activities have moved forward in carrying out their assigned tasks. The sequence of activities, such as, terracing (soil stabilization), cropping pattern testing, forage production, animal husbandry, tree crops, fisheries (check dams) are basically correct. There are however managerial, institutional and technical problems that have constrained progress. This assessment deals primarily with constraints that involve methodology and technical matters. The major constraints identified include the following:

1. Implementation activities are moving faster than available technology and personnel can adequately support for:

    a. adapted plant materials
    b. steep slope technology
    c. economic evaluation
    d. extension methodologies and strategies
    e. animal technology
    f. on site decision making

2. Insufficient coordination among existing projects and supporting institutions.

3. Timely availability of seeds and other planting materials.

4. Field staff are inadequately trained for on farm research and development activities.

5. Inadequate flow of appropriate technical information to the field.

Recommendations

1. Based on existing methodology for farming systems research and development, it is important that project personnel understand the sequence of research and development phases and that they carry out their activities accordingly.

   Figures 1 and 2.

2. Research and development activities must be truly interdisciplinary and integrated with other appropriate government agencies — this includes everything from site selection to implementation.

   Figures 3 and 4.

3. It is imperative that some form of national coordination be established to insure institutional support and prevent excessive duplication of effort.

   Figure 5.

4. Technology coming from existing research institutions may not be directly supportive for the special needs of these projects. On the other hand, on site farming systems research may be constrained by insufficiently trained personnel and lack of control of land for field research. To provide continued back up support, it is necessary to fine tune existing technology and provide a place for more relevant training. A kind of Field Laboratory is needed. These facilities would be located in areas representative of the

major watersheds in selected agro climatic environments.

Figure 6.

5. It is imperative that a workable scheme for seed and plant material production and delivery be implemented as soon as possible.

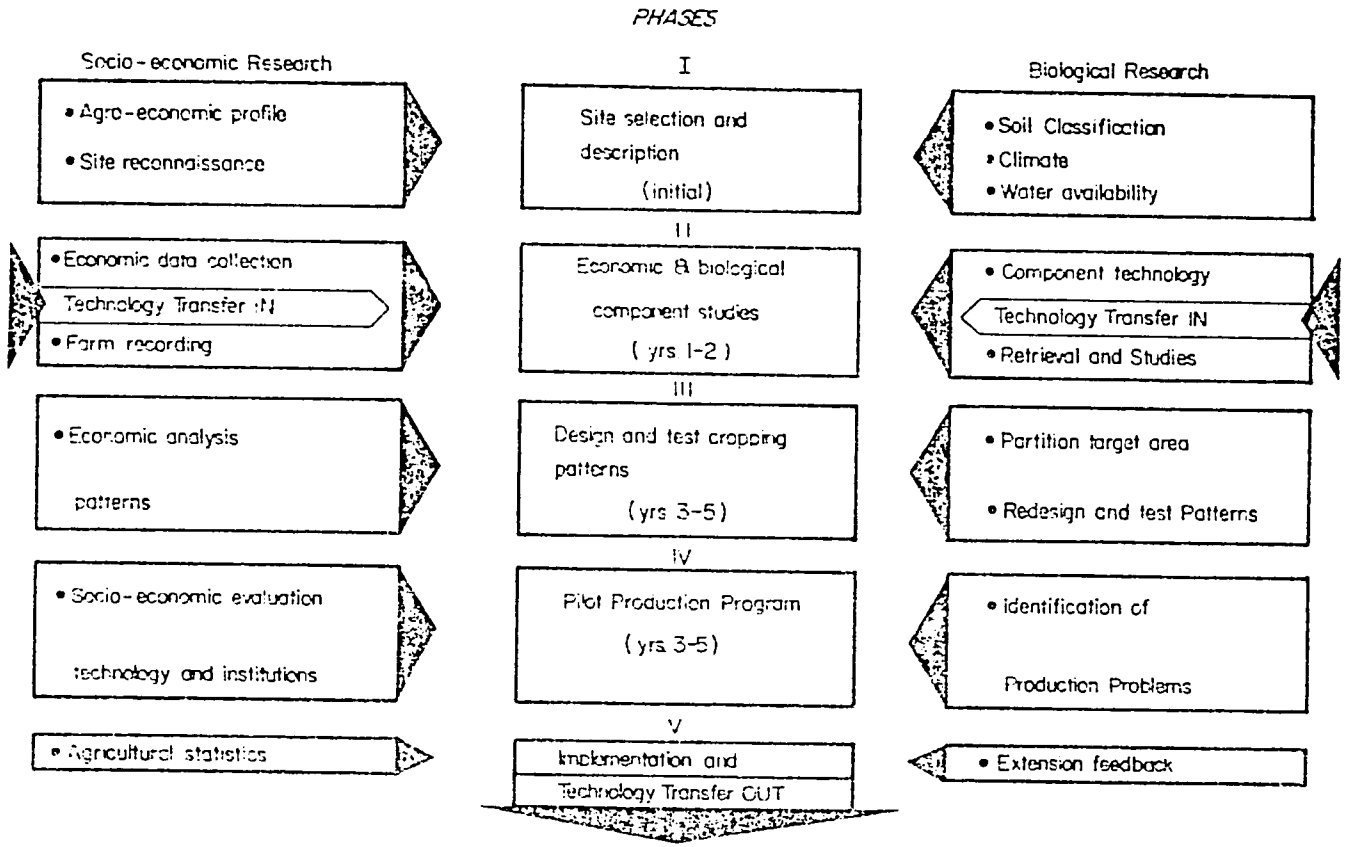


Fig. 1. Parallel biological and socio-economic activities required for the five distinct research and implementation phases of a Farming systems program with little inflow of technology.

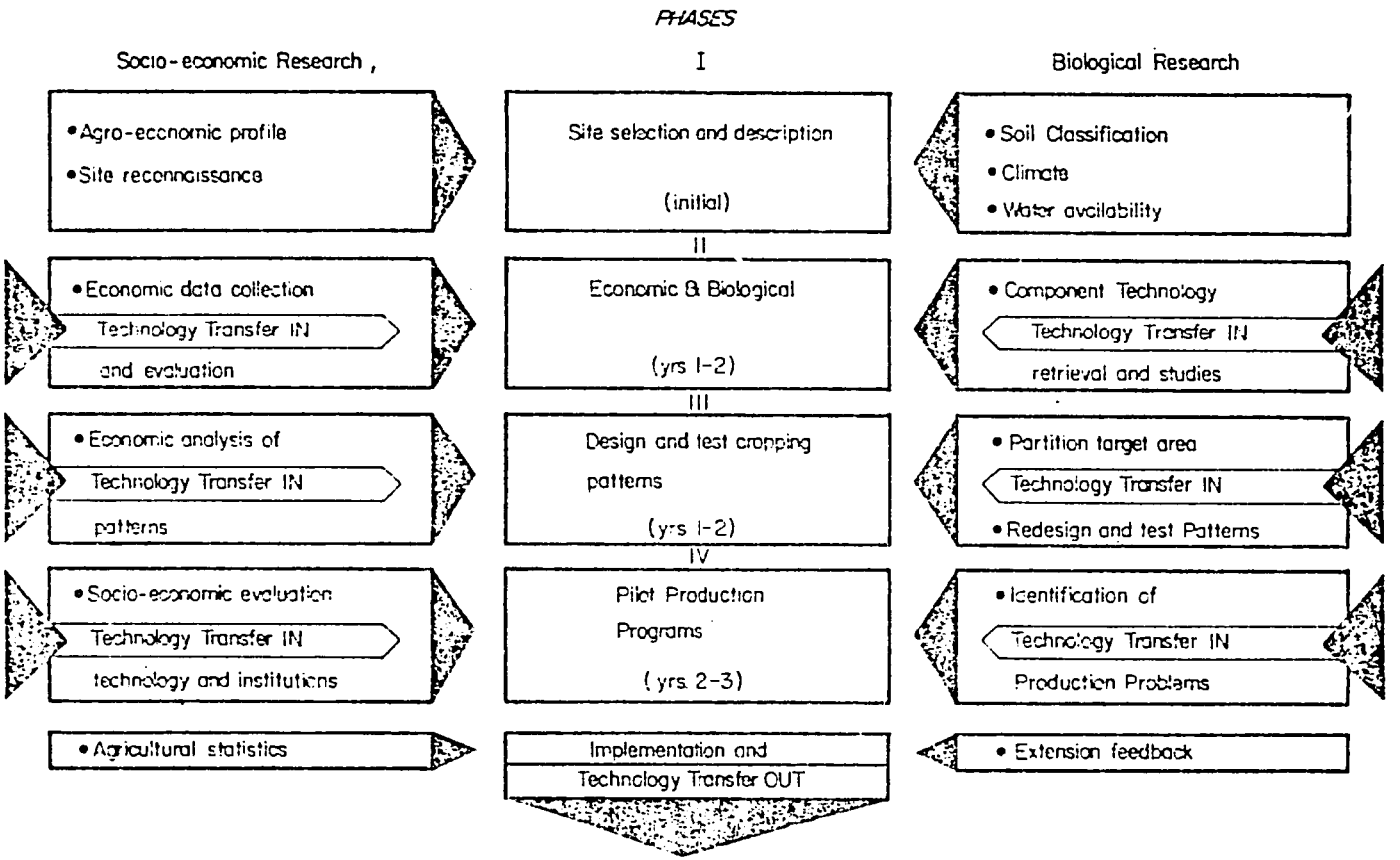
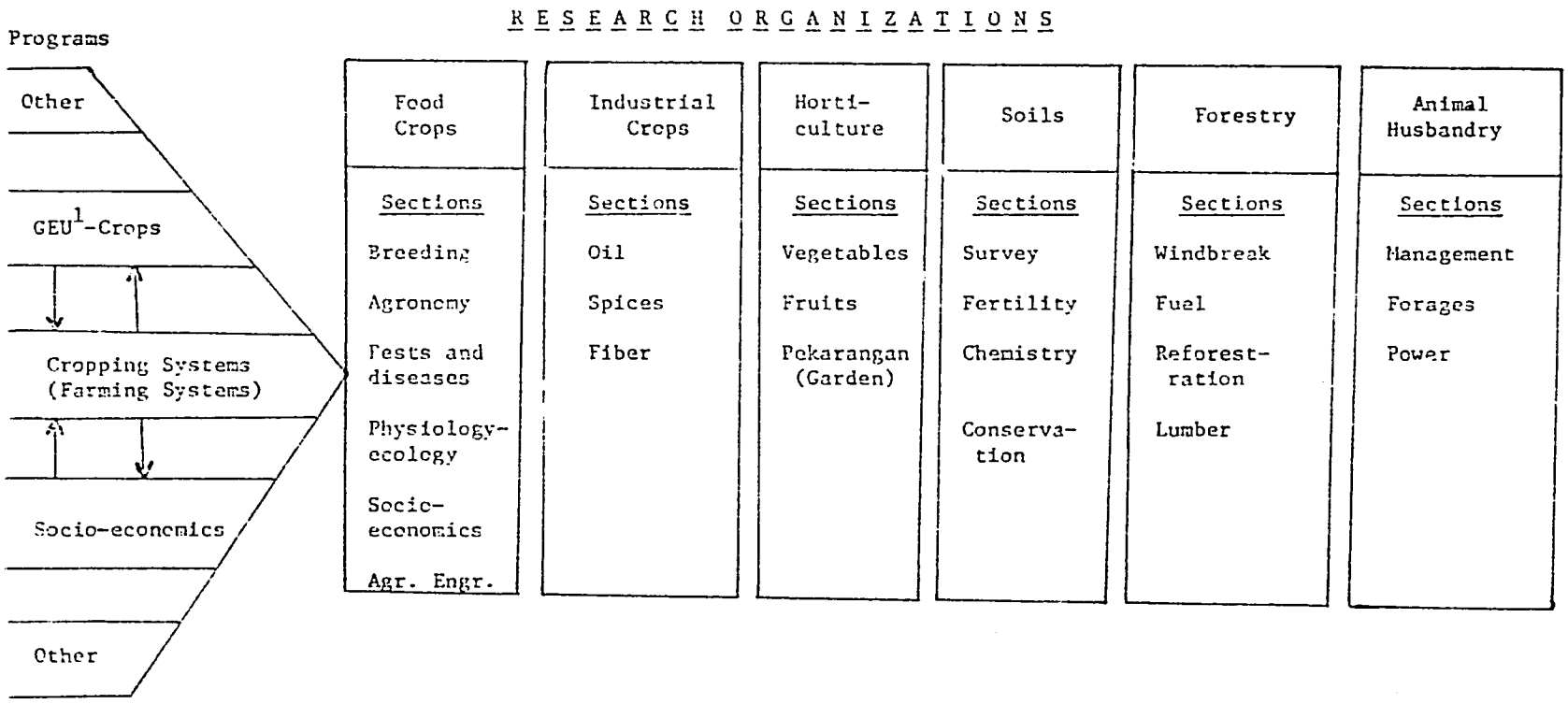


Fig. 2. Time frame for research and implementation phases of a Farming systems program with significant inflow of technology from research in areas with similar site descriptions. This technology transfer may reduce the research time in a target area by two or more years.

Framework for integrated Farming Systems Ressearch



[1]GEU - Genetic Evaluation and Utilization refers to systematic varietal improvement studies for food crops such as: rice, corn, legumes, etc.

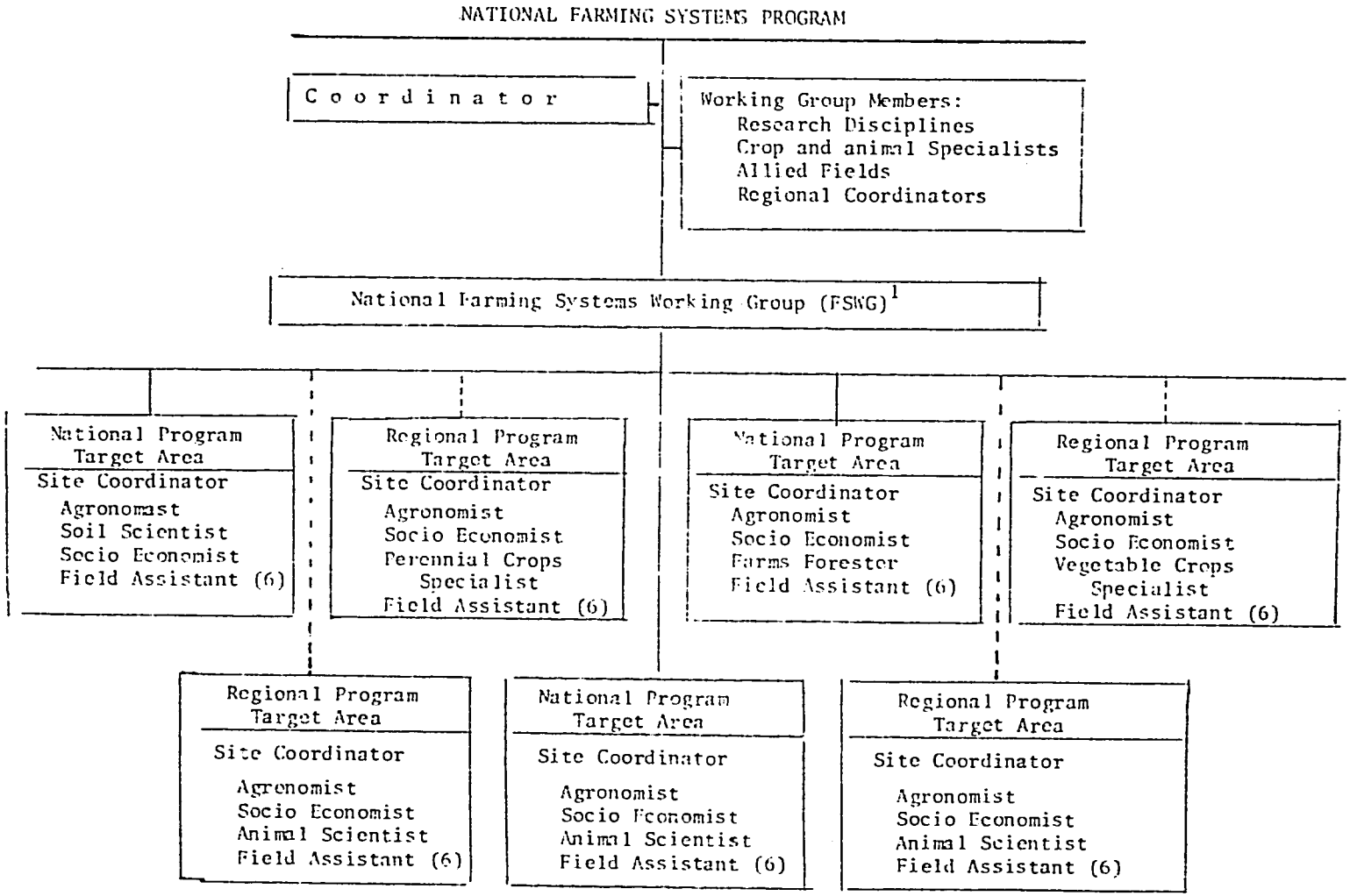
Fig. 3 This diagram illustrates how research in a Farming systems program (FSP) interacts with other systems, programs and traditional commodity and discipline-oriented research activities.

Research-extension interface over different phases of a Farming systems program

Target Area Selection	RESEARCH AND IMPLEMENTATION PHASES					Technology transfer
	I Site description	II Econ & Biol.Pot'l	III Design & Test	IV Pilot Prod. Prog.	V Implementation	
FSWG[1]	FSWG	FSWG	FSWG	FSWG	FSWG	FSWG
Extension Local Gov't. Nat'l Gov't.	Extension Local Gov't.	Extension Farmer Local Gov't. Bureau Stat.	Extension Farmer Local Gov't.	Extension Farmer Dir. Prod. Local Gov't.	Extension Farmer Nat'l Prod Prog Local Gov't.	Extension Other Nat'l Gov't. Agen

[1]FSWG - abbreviation for Farming systems working group which is the multi-disciplinary research group that coordinates and carries out the research plans of Farming systems programs in a target area.

Fig. 4 . This is a schematic representation of the research-extension workload distribution and interaction with farmers and other government agencies in different phases of Farming systems research and implementation.



[1]Regional Programs would be the administrative responsibility of the Regional Research Institute, but hopefully in collaboration with the National Program. There would likely be more than one site within a target area, and different technical expertise may be needed for different areas.

Figure 5. Possible organizational chart and staffing requirements for a Farming Systems Program.

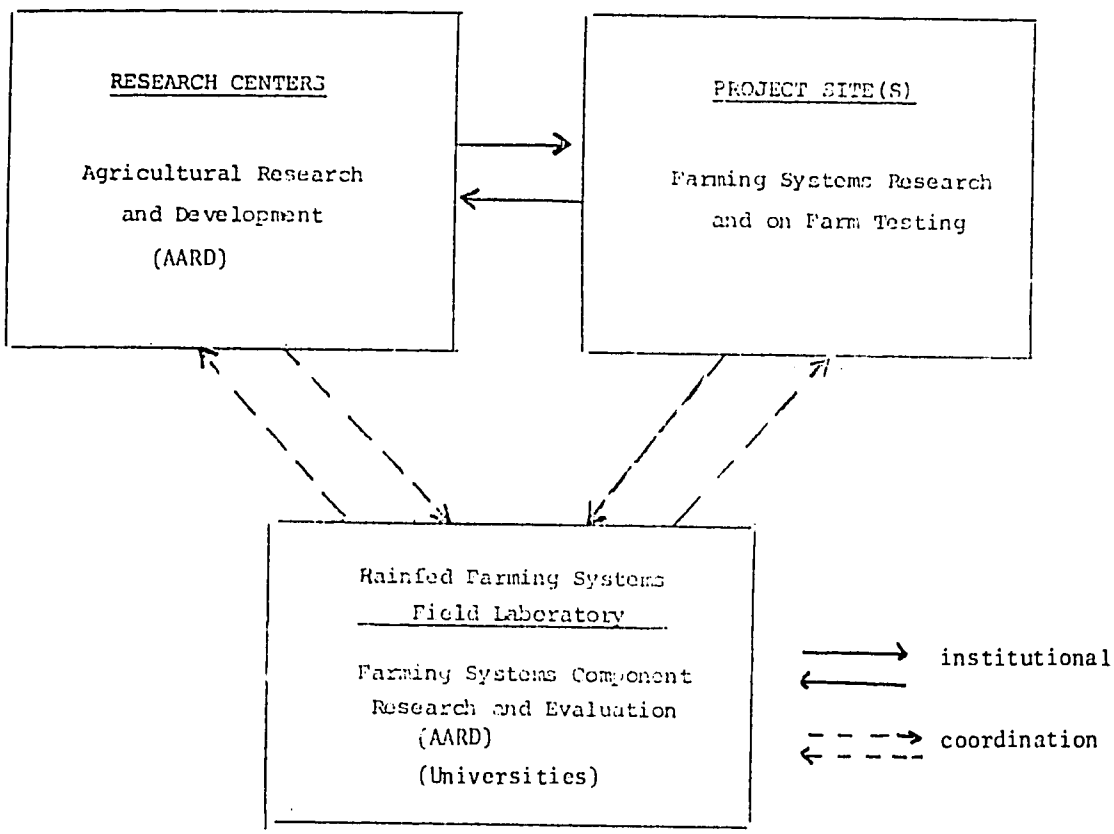


Fig 6

Development, evaluation, testing and flow of technology for Rainfed Farming Systems Research.

COOPERATIVE CRIFC - IRRI PROGRAM
THE INTERNATIONAL RICE RESEARCH INSTITUTE

CABLE ADDRESS :
IRRIAID BOGOR

MAIL ADDRESS
COOPERATIVE CRIFC - IRRI PROGRAM
IRRI - P.O. BOX NO. 107
BOGOR, INDONESIA

June 6, 1983

To : Dr. J. Ritchie Cowan
IRRI Liaison Scientist

From : J.L. McIntosh
Farming Systems Liaison Scientist

Subject : Monthly Report - May 1983

I. Principle Activities and Accomplishments

A. Finished Upper River Watershed Assessment and participated in discussions of report.

B. Assist in preparation of a Crop/Livestock Systems Research project proposal.

As a follow-up of the Workshop held at IRRI Los Banos in April, the Indonesian Farming Systems Research and Development program has almost completed a project proposal for research in Batumarta, South Sumatra and Crop/Livestock Systems research. A Working Group of AARD scientists, including the following has carried out this task.

Dr. B.H. Siwi	- Administrative Coordinator
Dr. Suryatna Effendi	- Batumarta Farming Systems Research Project Leader
Dr. A.P. Siregar	- Animal Scientist
Dr. Sultoni Arifin	- Agro-economics
Dr. Soewardjo	- Soil Conservation
Ir. Soetjipto Ph.	- Agronomy
Mr. Inu G. Ismail	- Cropping Systems
Dr. V.R. Carangal	- Asian Farming Systems Working Group

It is expected that this project will be a follow-up of the IRRI meeting and complementary to the Farming Systems Research to be carried out in Batumarta with Trans III funding. The Trans III research will be mostly directed toward new land opening and development while the crop/livestock research will be in the older settlements of Trans I where farming systems have been developed — including animal production.

C. Edit scientific papers for:

1. Soybean Breeding
2. Azolla

D. Travel

1. BARIF, South Kalimantan to evaluate candidates for IRRI Training Courses and to discuss Cropping Systems Research.

2. Sembawa and Batumarta, South Sumatra to participate in planning activities for Farming Systems Research and Development.

II. Miscellaneous Activities

1. Seminars attended

a. Lamtoro Research in NTT - PDP Project
b. Home Gardens Research - AVRDC/UNICEF
c. Imperata Management - Mike Dove, RF

2. Consultations

a. Dr. V.R. Carangal, IRRI
b. Dr. C.P. Mamaril, IRRI
c. Dr. Albert Hagan, USAID Consultant on Home Gardens evaluation
d. Dr. Peter Carriage, CSIRO Consultant on Animal Production
e. Dr. Doug Perry, IADS, Padang

III. Constraints to Work — The development of a Working Group of scientists from different disciplines who wish to work together is developing well.

IV. Plans

1. Continue work on project development for crop/livestock.
2. Prepare paper on soybeans in Tropical and Sub-tropical Agriculture.
3. Help review last season research and develop plans for new crop season.

COOPERATIVE CRIFC - IRRI PROGRAM
THE INTERNATIONAL RICE RESEARCH INSTITUTE

CABLE ADDRESS :
IRRIAID BOGOR

MAIL ADDRESS
COOPERATIVE CRIFC - IRRI PROGRAM
IRRI - P.O. BOX NO. 107
BOGOR, INDONESIA

July 2, 1983

To : Dr. J. Ritchie Cowan
IRRI Liaison Scientist

From : J.L. McIntosh J.L. McIntosh
Farming Systems Liaison Scientist

Subject : Monthly Report, June 1983

I. Principal Activities and Accomplishments

1. Prepared paper and participated in the Sixth Cropping Systems (Farming Systems) Workshop, June 20-21, 1983.

   This was an excellent meeting in which research in the different land areas over the past 10 years was summarized and management guidelines developed. One of the most significant reports was presented by Pak Sukmana of BIMAS who very clearly outlined BIMAS strategy for implementation of cropping systems research technology in the different land areas of Indonesia. This has been a major objective of the research - that is, to develop the technology to the point where it could be implemented by extension on a wide scale.

2. Prepared with Mr.Juber a paper for the Soybean Symposium to be held in Tsukuba, Japan, September 26 - October 1, 1983. Copy of this paper attached.

3. Interact with Indonesian colleagues through discussions, editing of reports and preparation of project proposals. The crop/livestock project proposal has been prepared and the first draft submitted for administrative review.

II. Miscellaneous Activities

1. Continued Dr. Carangal's consultancy and returned from trip to Palembang (Sembawa) and Batu Raja (3 days).

   It is proposed that the Trans III Farming Systems Research on land clearing and management be carried out in the newly opened areas, while the crop/livestock research will be carried out in the older areas where more permanent conditions exist in Baturaja.

2. Consultations (other than research colleagues).

a. Alan Strout	MIT/WB
b. USAID	Rural Development Agriculture
c Greta Watson	AARP/BARIF
d. Dr. Syarifuddin	SARIF
e. Research dissemination	CRIFC
f. A.B. Wanders	ATA - Dutch.
c. Dr. Soewardjo	P3MT

3. Court Proceedings for Adoption of Jonathan Michael McIntosh.

4. Sukamandi - one day

III. Constraints

Development of projects and research progressing well. Older cropping systems staff need advanced degree opportunities.

IV. Plans

1. Help develop Terms of Reference for Consultancies for P3MT projects.

2. Work with Farming Systems staff on implementation and evaluation of projects.

3. Attend final session of Consequences of Mechanization Workshop.

JLM:fh

Technical Report
Farming Systems Research and Development
Upper River Watershed Assessment

Introduction

Integrated upper river watershed management and resource systems (especially on Java) should be developed with the understanding that problems that exist are really "people problems" that are exacerbated by physical and technical constraints. Consequently, the well being of people must be the central consideration for watershed management and resource development programs. Any program to be successful should emphasize the improvement of the economic and social condition of the people as well as land treatment practices and improvement of agricultural production and stability.

Conservation practices are connected to agricultural production in two important respects. First, they are physically bound because ground cover and soil management in agriculture or forestry (or in combination) affect both the degree of soil erosion and the maintenance of installed conservation works. Secondly, they are economically bound because the primary justification for conservation of agricultural or forested lands is that these lands, either now or in the future, will be more productive than they would have been without the conservation effort.

In essence upper river watershed development is really an integration of the human element with a system of land management through viable Farming Systems to increase production and economic well being as well as protection of the natural resource.

Farming systems are usually comprised of many different agricultural enterprises that are inter related. This report however will assess the farming systems in the upper river watershed project areas from a holistic point of view while keeping in mind the major objectives of soil conservation and the need to increase crop production. In each case, however, it is understood that farmer acceptability (socio-economic) and biological stability and sustainability of the farming systems must be a part of any assessment. Cost to the general public must be another consideration.

Cropping systems and later farming systems research in Indonesia and other countries in Southeast Asia over the past ten years has developed methodology for evaluating existing farming systems and designing, testing and implementing new technology that is appropriate for specific target areas. Much of the technology has been disseminated through government agencies and implemented to some extent. In this report the field activities that were observed in the upper river watershed projects will be assessed with respect to standard development methodologies.

The soil and water conservation program in the upper river watershed should focus on developing technology for erosion control in these critical areas and provide support mechanisms to help upland farmers adopt the control measures and improved farming practices so they might increase their productivity and income. Concurrently, adoption of these techniques will induce farmers, individually and collectively, to maintain and improve their terraces and waterways. Moreover, the impact

should be the greatest for the poorest farmers. In their efforts to survive on marginally productive land, these farmers are slowly but surely destroying the land and their source of livelihood.

Background

The soil erosion problems in the upper river watersheds are quite evident. So is the high sediment load of all the main tributaries. The natural ecosystems of the watersheds have been disrupted by deforestation, uncontrolled agricultural development, and many other unwise practices.

Agriculture has extended into the upper river watershed areas where unsuitable soil, land formations and topography hinder stable crop production. Consequently, over time this has brought about a considerable loss in soil fertility and a drop in crop yield. Furthermore, the area of land available to each farmer has decreased due to subdivision (among family members) and abandonment as a result of erosion. Farm income is therefore very low, and the great majority of people living in the most eroded areas are subsistence farmers.

The farmers understand that erosion reduces yields but also know that the use of fertilizer may counterbalance yield losses. However, on steep slopes where upland farming is practiced, eventually a complete loss of arable soil will occur unless soil conservation measures are

taken. Downstream river channels and irrigation canals will be filled with sediment. The farmers themselves have neither the skill nor the financial resources needed to implement control measures which require considerable amounts of labor and time. It seems most likely that any significant development program for these areas will require substantial financial and technical support.

The technical solutions to these problems require erosion and flood control through good watershed management practices. This must be accompanied by an improvement in the productivity of the depleted soil to increase farm production and income. Alternative farm enterprises must be developed that require less soil disturbance particularly for the steeper areas.

Another point which must be stressed is that although terracing will halt erosion, it will not in itself increase the productivity of the land. Similarly, fertilizers will increase production but by themselves will not control erosion. Both are necessary and complementary inputs to improved soil and water conservation and increased crop production.

Finally, the population and judicious land and water use must attain a dynamic equilibrium.

Farming Systems Concepts

Figure 1 diagrams the scheme used for farming systems research and development in Indonesia. This approach is being used in a similar fashion in many other countries in South and Southeast Asia. The approach represents an attempt by agricultural research scientists to develop, through a process of understanding and redesigning farm systems in specific target areas, technology that will be more directly relevant to small farmers. This approach is not critical of existing agricultural research that has more discipline and commodity orientation but is intended to identify and remove constraints to farmer adoption of new technology in a more responsive and direct manner. The feedback to the existing research and extension agencies from farming systems research can be especially valuable. It helps create an awareness of farmers' problems and stimulates scientists to design research projects that are problem oriented.

Unfortunately farming systems research may imply more than can be actually accomplished. There are practical consideration that must be taken into account and rational judgments made. For example, many scientists are not farmer oriented. They may prefer indepth studies of a particular commodity or subject within a discipline. There are funding, managerial and logistical problems. Finally there are so many

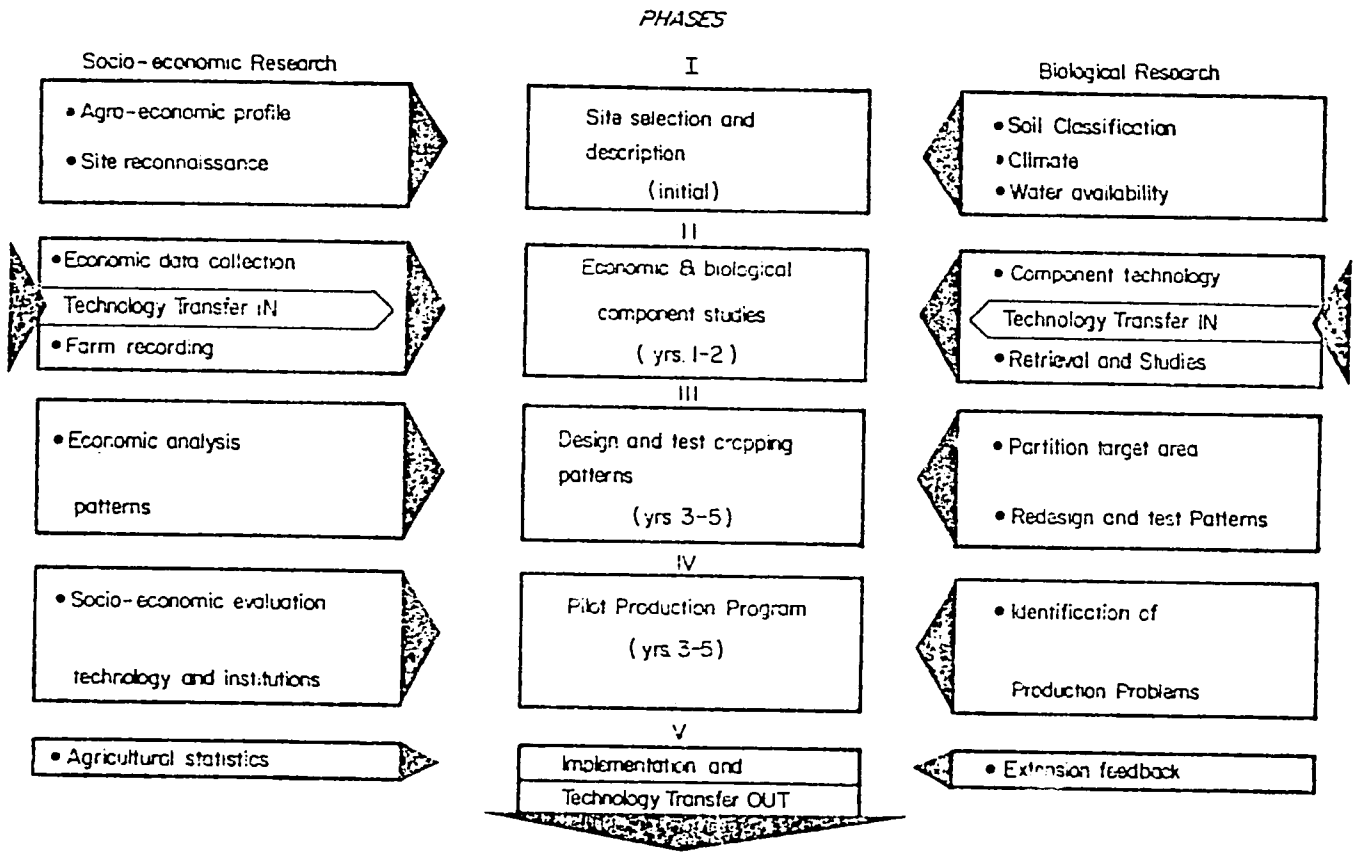


Fig. 1. Parallel biological and socio-economic activities required for the five distinct research and implementation phases of a Farming systems program with little inflow of technology.

different kinds of farm systems in so many differ agro-climatical environments that it is impossible to work on all with the number of scientific staff that may be interested in this approach. Consequently, major policy decisions are needed to decide where and when on site farming systems research may take place. These decisions may be based on rational scientific reasoning but usually a more pragmatic approach is taken. A combination of funding and technical considerations usually prevail.

Consequently, at any one time in Indonesia only a limited number of target areas and research sites can be tackled. But through adequate site descriptions (socio economic and biological) transfer of technology from one place to another place with similar site description can occur quite successfully (Figure 2). This is basically the process that has taken place in the upper river watershed projects. There has been a considerable inflow of technology from other projects. This has been supplemented by a limited amount of onsite research – for example, in the early stages of the Panawangan pilot project in the Citanduy river watershed. But implementation of technology that has been transferred always uncovers the constraints to adoption and the need for more research. This should not be considered a problem but progress toward problem identification. A viable research organization will respond to these identified problems. Implementation also uncovers institutional constraints. Interdisciplinary research that is integrated with other government agencies is necessary but may not always happen smoothly (Figures 3 and 4). But again this may be viewed as progress

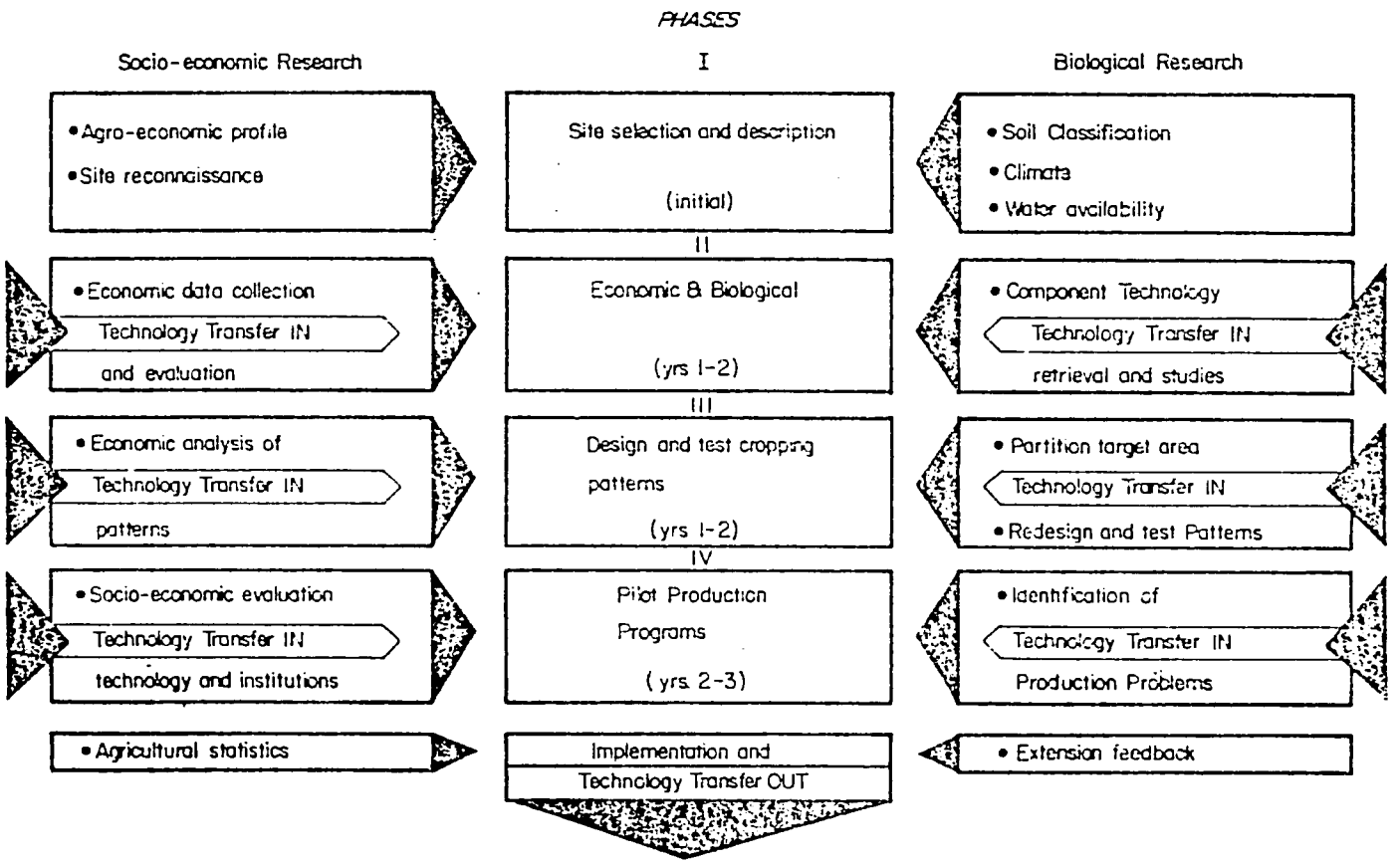
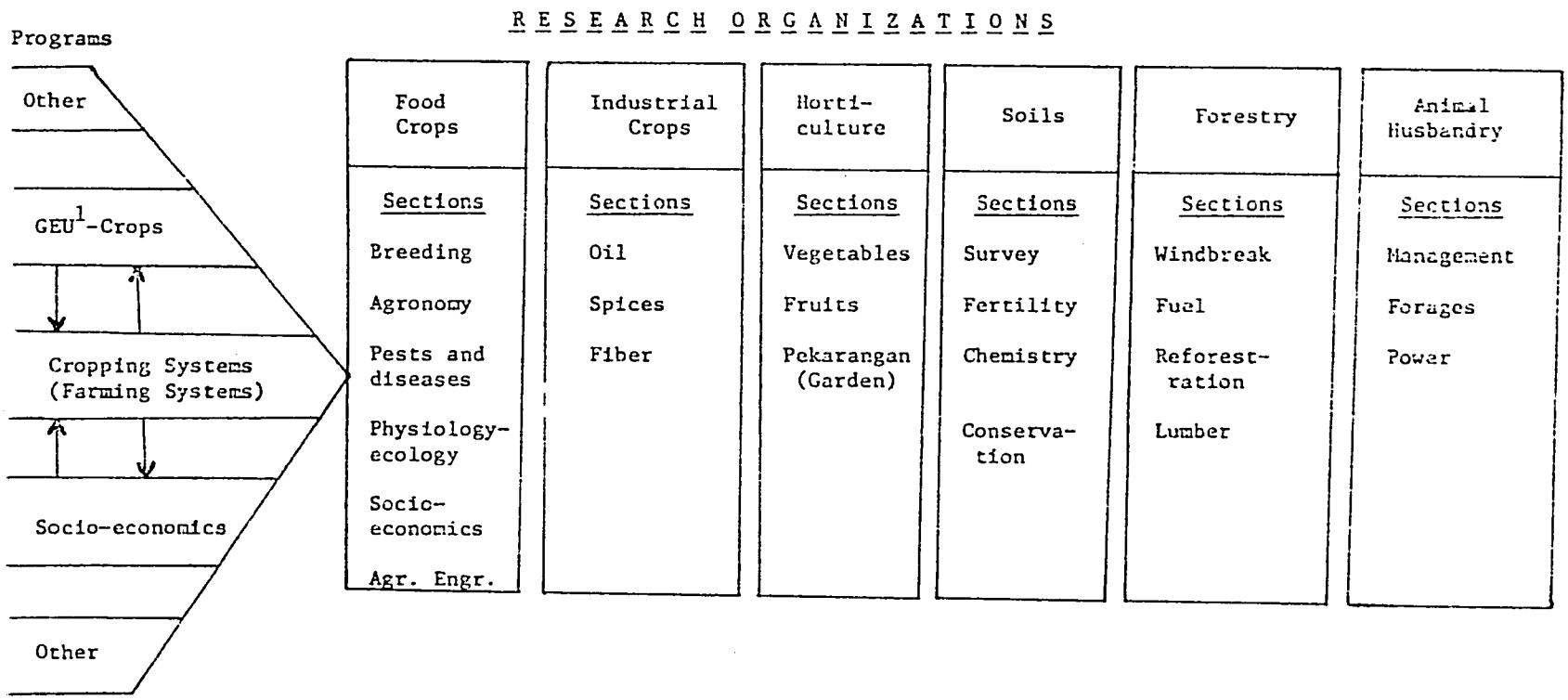


Fig. 2. Time frame for research and implementation phases of a farming systems program with significant inflow of technology from research in areas with similar site descriptions. This technology transfer may reduce the research time in a target area by two or more years.

Framework for integrated Farming Systems Ressearch



[1]GEU - Genetic Evaluation and Utilization refers to systematic varietal improvement studies for food crops such as: rice, corn, legumes, etc.

Fig. 3 This diagram illustrates how research in a Farming systems program (FSP) interacts with other systems, programs and traditional commodity and discipline-oriented research activities.

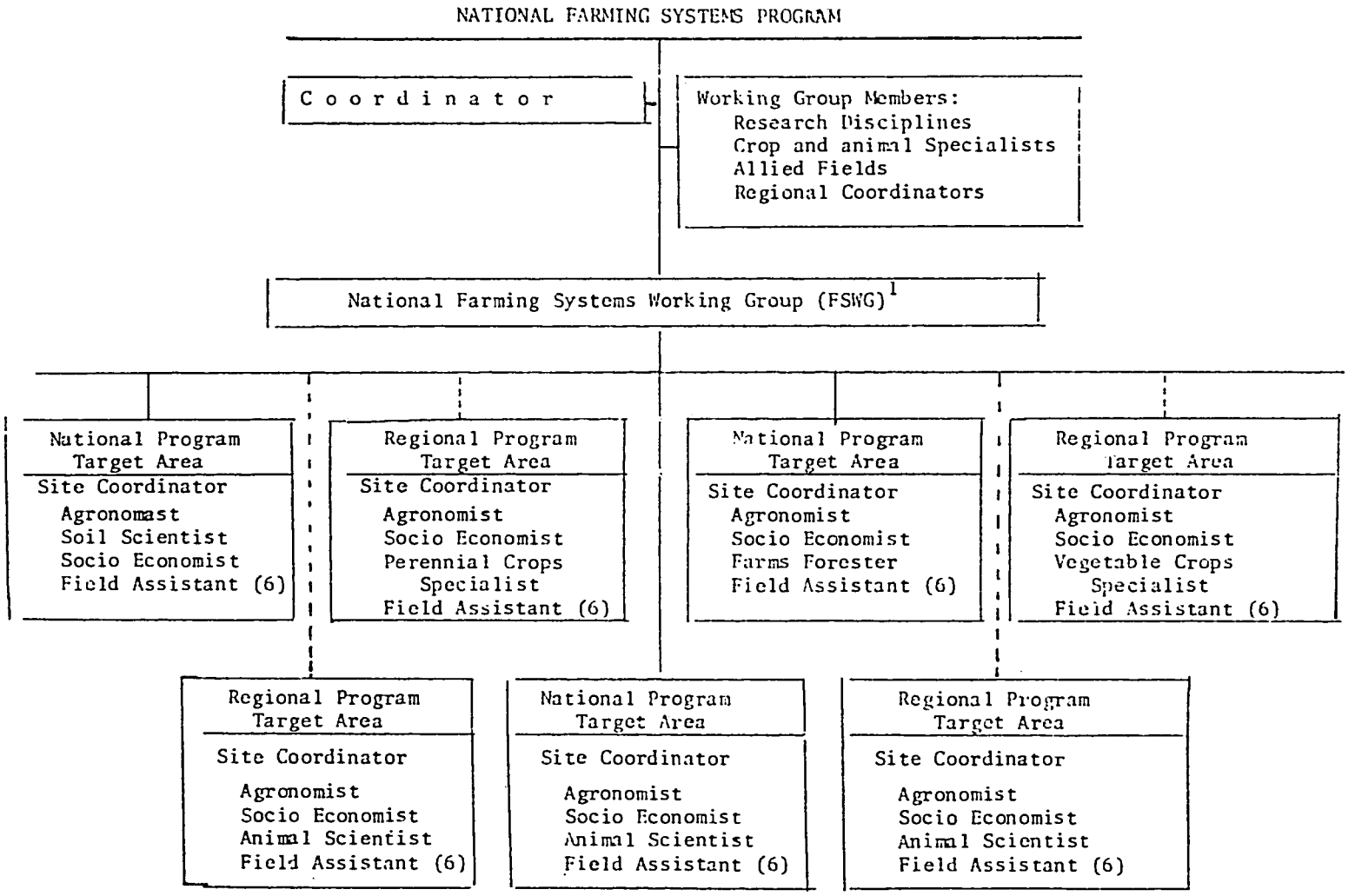
Research-extension interface over different phases of a Farming systems program

Target Area Selection	RESEARCH AND IMPLEMENTATION PHASES					Technology transfer
	I Site description	II Econ & Biol.Pot'l	III Design & Test	IV Pilot Prod. Prog.	V Implementation	
FSWG[1]	FSWG	FSWG	FSWG	FSWG	FSWG	FSWG
Extension Local Gov't. Nat'l Gov't.	Extension Local Gov't.	Extension Farmer Local Gov't. Bureau Stat.	Extension Farmer Local Gov't.	Extension Farmer Dir. Prod. Local Gov't.	Extension Farmer Nat'l Prod Prog Local Gov't.	Extension Other Nat'l. Gov't. Agen.

[1]FSWG - abbreviation for Farming systems working group which is the multi-disciplinary research group that coordinates and carries out the research plans of Farming systems programs in a target area.

Fig. 4 . This is a schematic representation of the research-extension workload distribution and interaction with farmers and other government agencies in different phases of Farming systems research and implementation.

if positive steps are taken to resolve the identified problems. But solutions to these technical and institutional problems will not solve themselves. Coordination is needed. It is our feeling that two kinds of coordination are needed — administrative and technical. Administrative coordination can solve the institutional problems and provide the environment in which the scientists can carry out their responsibilities. But at the national level there must also exist technical coordination to insure that appropriate technologies are transferred and that duplication of effort is minimized. The technical coordinator may need support through a Working Group of appropriate colleagues and authority through some control of funding (Figure 5). Specific research issues that arise may require indepth study on site or within the selected target area. It is our feeling that field laboratories are needed to provide the environment for technology to supplement on site farming systems research activities and bring together scientists from different researh centers, universities and institutes (Figure 6). This may be the most suitable approach to faster interdisciplinary research that cuts across the different crop commodities and kinds of farm enterprises. These should not be considered permanent research facilities but simply locations for study of specific problems or research issues that have been identified in specific target areas. One or two of the three centers visited in the Yogyakarta project would be ideal for field laboratories. Land and building exist that could be quickly used. It is important that longer termed research on adapted varieties, soil conservation and combinations of different farm systems need more indepth study over time. Ultimately these facilities would be returned to the local government for extension centers or other uses.



[1]Regional Programs would be the administrative responsibility of the Regional Research Institute, but hopefully in collaboration with the National Program. There would likely be more than one site within a target area, and different technical expertise may be needed for different areas.

Figure 5. Possible organizational chart and staffing requirements for a Farming Systems Program.

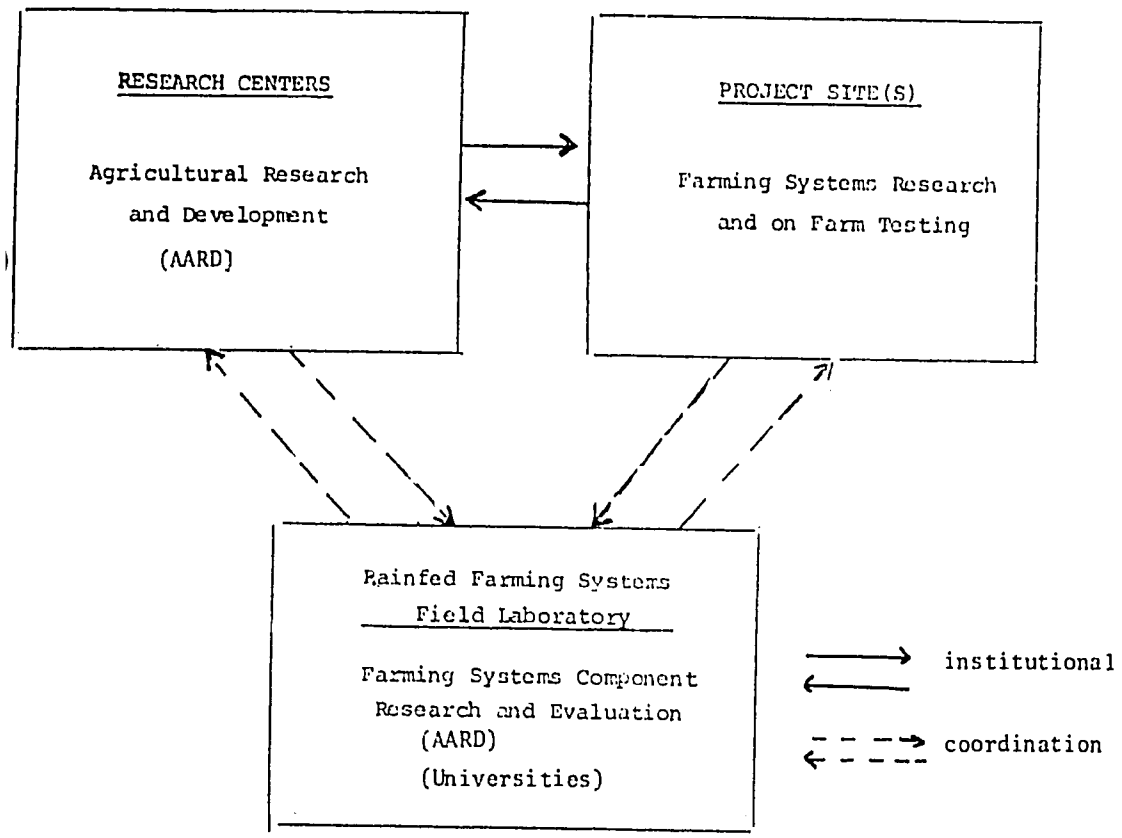


Fig 6

Development, evaluation, testing and flow of technology for Rainfed Farming Systems Research.

Upper River Watershed Projects

A major policy decision has been made to tackle problems associated with the upper river watershed areas on Java. In order to move quickly special funds and projects have been put into effect. This implies that the existing government agencies needed additional support to solve the problems within the watersheds with respect to:

1. Soil and water conservation
2. Increase production in a way that is technically sound and economically viable.

There have been obvious results from this policy. The numbers of staff and activities of the P3RPDAS are indicators of action. Terracing, reforestration, check dams and more intensive food crops production through the various special projects are also indicators of results. Because of the focus on action (implementation) many times the positive results are obscured or diminished by problems with inadequately trained personnel, insufficient technology, logistics and institutional support. All of these aspects will be covered by the various team members. Specifically for the Farming Systems Assessment, we feel that the decision to implement existing technology was timely and stimulative to existing research and extension agencies in Indonesia. However, we also feel that existing agencies and universities should begin to play their legitimate role in research and in implementation. This is particularly true for research and extension in agriculture. It is imperative that people have access to food or food production. Populations of 1000 people per square

kilometer living in mountainous and remote places must be largely self sufficient in food. Consequently, food crops production for basic food self sufficiency will always be a major component of any farming system. The Agency for Agricultural Research and Development (AARD) and the various Directorate Generals within the Ministry of Agriculture must play a major role in technology development and transfer to farmers. Except for the National Forest Lands and for lands excluded from food production because of steepness, farming systems research activities from AARD and appropriate universities will likely generate the technology base while the Agricultural Services of the Ministry of Agriculture will execute the extension. The institutions exist to do this. The soil conservation and farm forestry technologies may be supported by the newly formed Ministry of Forestry. The activities of these two Ministries can be complementary and stimulative to each other. All of this falls within the line agencies and requires no special projects. However, there must be flexibility within each Ministry to provide for coordination, hopefully through programs that have special funds to facilitate interdisciplinary research and implementation.

Soil Conservation

Farming systems strategies can be developed for all land areas. This can be done in a way that is consistent with the major objectives of the upper river watershed. Specific guidelines simplify the tactics used but may not facilitate accomplishments. For example, slopes steeper than 50 percent may be successfully used for food crops

production while slopes less than 50 percent may be better used for perennial crops or pasture. Extension agents need to be experienced to help farmers make these kinds of decision. Hopefully the government regulations can accomodate this kind of flexibility. Of course, soil conservation is understood to be a basic prerequisite.

It should be understood that Indonesian farmers are familiar with level bench terraces. The terraces of rice paddies in the mountains of Java testify to this. The same kind of commitment to terracing can be made to dryland agriculture if the benefits are as obvious. Many farmers are convinced and even after they transmigrate from Java to Sumatra and other places with much less favorable soil proceed to stabilize their soil through bench terraces. There usually remains a problem of how to drop the water from one level to the next. This needs more study. But basically for the deep volcanic soils on Java, the bench terrace remains a viable model.

The next question considers the alternative to bench terraces. It is said that there are alternatives that require less labor and are more effective. This needs to be demonstrated if possible under field conditions. Usually the alternatives use slope cropping and alley cropping strategies. For gentle and longer slopes where the fields may be larger these appear to be viable options. The latter can be especially useful on shallow soils with relatively high pH's in drier climatès such as found in Eastern Indonesia. Between the extremes of Panawangan and Flores, there must be viable options. The criteria for differentiating strategies may be developed in field laboratory studies.

Specific Sites

General Descriptions and Strategies

For ease of presentation rainfall distribution and cropping patterns for three of the four site areas visited are summarized in Figures 7, 8 and 9. The descriptions that follow for all four watersheds are given to show differences among the locations and need for additional research and testing. These descriptions are based on the limited data available. The incompleteness of the existing data indicate the need for systematic and coordinated research and development.

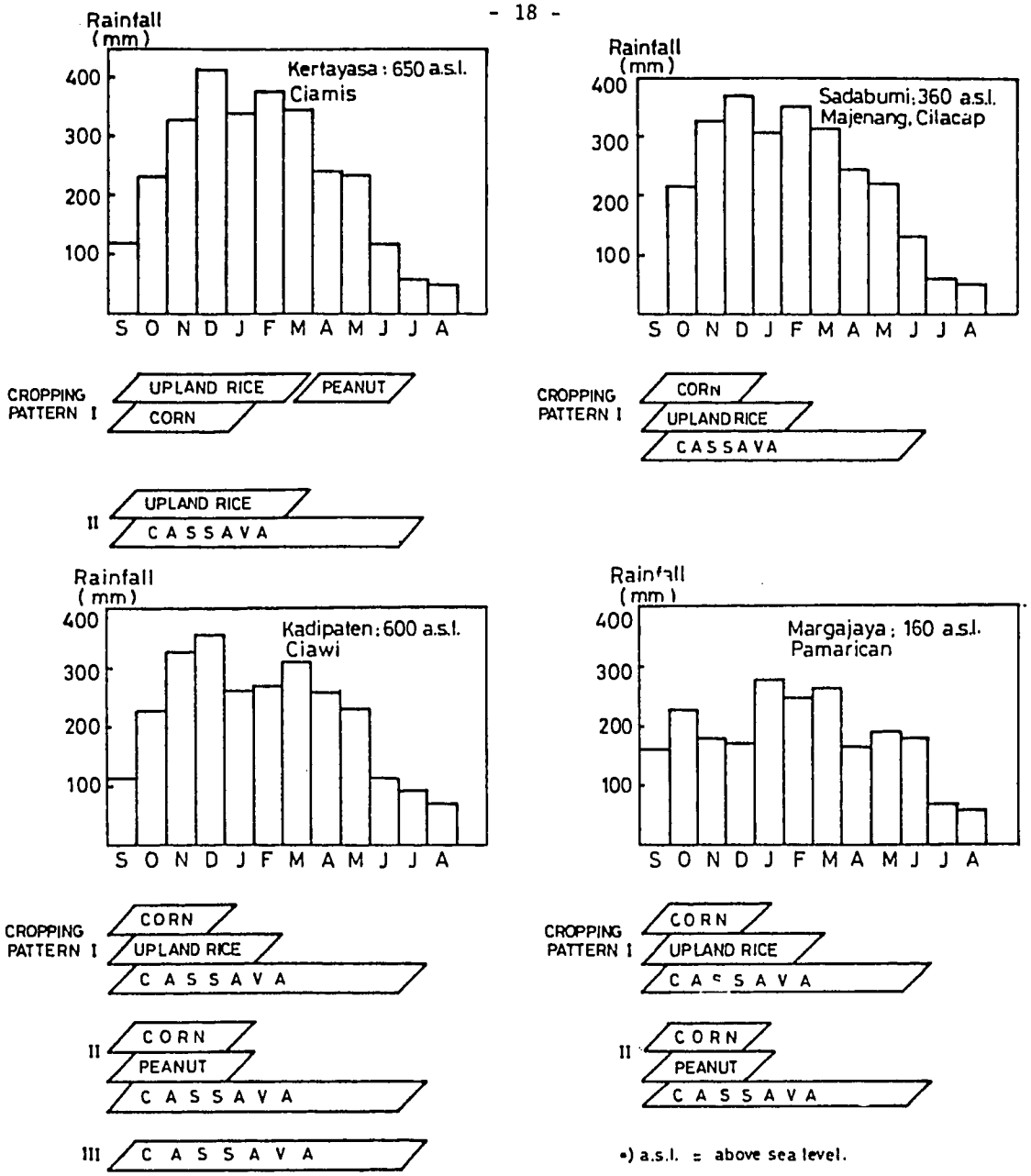


Fig. 7 : Monthly rainfall distribution and existing cropping patterns in fourlocation in Citanduy Sub watershed (upper watershed).

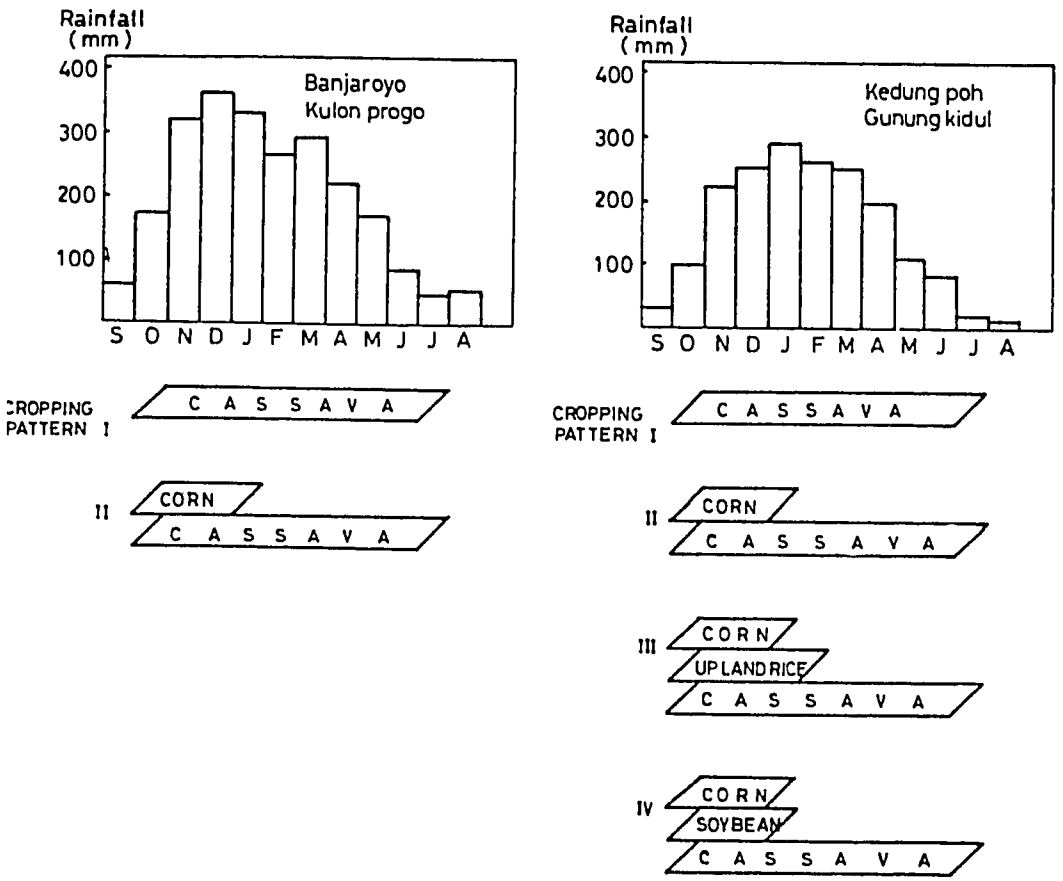


Fig. 8 : Rainfall distribution and existing cropping patterns in Kulon progo and Gunung kidul area of Yogyakarta.

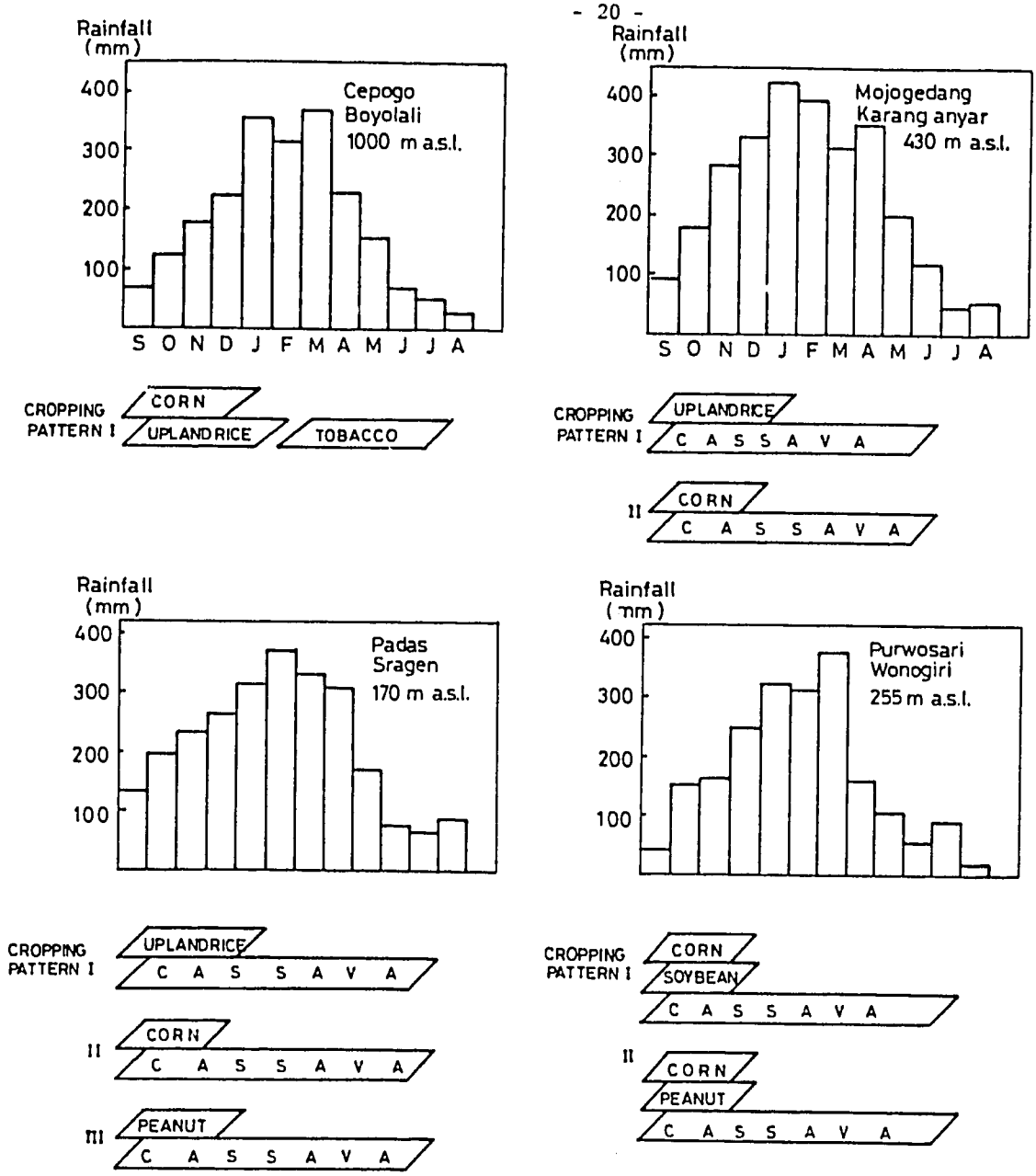


Fig. 9: Rainfall distribution and existing cropping patterns in upland watershed Solo : Cepogo, Mojogedang, Padas and Purwosari.

Citanduy Upper River Watershed. The Citanduy River basin is mostly in West Java. The upper river portion has a humid climate with at least eight continuous months with more than 200 mm of rainfall. Usually only the months of July and August have less than 100 mm of rainfall. The soil in the upper watershed is of volcanic origin and immature in development. In general the soils are deep and relatively fertile but respond dramatically to phosphate and nitrogen fertilizers

1. Cropping patterns. Figure 7 shows the rainfall distribution and farmers' cropping patterns as observed in the field and reported in various publications. A composite cropping pattern that is common for much of the area consists of the following crops in the sequence of C + ULR / Cv. In areas where the soil has been seriously eroded the sequence consists of C + PNT / Cv. In this case cassava is the main crop. In extreme cases sometimes only cassava is grown. Generally some fertilizers are used for rice but not for the other crop.

2. Varieties of food crops. Local Bulu varieties are most commonly used for upland rice. These high quality (good taste) varieties have some resistance to blast disease but are relatively late maturing. They have little or no brown planthopper resistance. Metro is a commonly grown corn variety. Varieties of peanuts, mungbean and cassava, that are commonly grown, have usually originated from improved varieties. In most instances, the legumes are degenerated and virus infected.

3. Perennial crops. Perennial crops, especially cloves, are the most important source of cash income in Panawangan and farmers plan to plant more. In Majenang, however, a combination of coffee, jengkol, clove and coconut are usually grown in the home garden. There is a need for identification and selection of more shade tolerant secondary crops that have market potential and for home consumption. Fruit trees species especially appear to offer potential for increased production. Already in Kadipaten citrus, avocado and guava are widely grown in addition to clove.

4. Livestock. The main livestock raised by village residents are chickens (for home consumption), goats and sheep.

5. Crop yields. Table 1 shows yields from cropping patterns tested in Panawangan in the 1981-82 crop season. These are representative of crop yields under farmer and improved management in other places in the watershed. These data show potential for increased yields and income.

If soil and water conservation measures are to be developed further, there are some specific research and production issues that must be addressed.

- Develop or identify forage crops and food crops that can be grown under partial perennial crops canopy.
- Further develop forage production and animal systems strategies in combination with perennial crops.
- Develop systems for record keeping and farming systems evaluation.

Table 1. Cropping patterns tested in the Citanduy Upper River Watershed. 1981-82.

Cropping Patterns	Varieties	Location				
		Kadi-paten	Pana-wangan	Guna-sari	Marga-jaya	Karang Pucung
		---------- Yield (ton/ha)----------				
Introduced C.P.						
A. Corn +	Arjuna	1.64	1.91	1.93	1.51	1.83
Upland rice -	C-22	1.03	.60	1.00	2.70	1.26
Peanut /	Gajah	.28	.52	.36	.51	.34
Cassava	Local	10.25	9.36	9.00	11.00	0.25
B. Corn +	Arjuna	1.64	1.86	1.82	1.51	1.09
Upland rice -	C-22	1.05	.72	1.00	2.75	1.26
Corn	Arjuna	1.72	1.97	1.10	1.92	1.50
Peanut	Gajah	.34	.60	.36	.81	.45
C. Corn +	Arjuna	1.68	1.93	1.86	1.60	1.09
Peanut -	Gajah	.48	.41	.32	.72	.66
Corn +	Arjuna	1.60	1.81	1.83	1.51	1.25
Soybean	Galunggung	.98	.70	.95	.91	.67
Farmers' C.P.						
D. Corn +	Local	0.75	.69	-	-	-
Upland rice /	Local	1.85	.97	-	-	-
Cassava	Local	4.98	6.40	-	-	-

Source: Annual Reports, Citanduy/AARD Research Project.

From field experiences and research it is felt that the cropping pattern ULR + C / Cv / SB or PNT, planted at the beginning of the rainy season can give yields that are at least twice those of existing patterns provided that 200 kg/ha of urea and 150 kg/ha of TSP are used. We would expect yields of 1.8 - 2 ton/ha of rice, 1.5 ton/ha of corn grain and 10 ton/ha of wet cassava roots. The expected yields of soybean or peanut would be around 1 ton/ha.

Yogyakarta Project Area. Agricultural based community development is the central focus of the Bangun Desa Project in Yogyakarta. The development activities are concentrated in:

1. Desa Hargotirto, Kecamatan Kokap, Kabupaten Kulon Progo.
2. Desa Banjar Oyo, Kecamatan Kali Bawang, Kabupaten Kulon Progo.
3. Desa Kedung Poh in Kecamatan Nglipar, Kabupaten Gunung Kidul.

Almost all farm activities in Desa Hargotirto, Kulon Progo, are devoted to upland agriculture. The area has an altitude between 500 to 1500 meters above sea level. The topography ranges from almost level to steep land. The soil is of volcanic origin and productive if not seriously eroded. The depth of soil varies but in many places is too shallow for constructing bench terraces. Most of the home gardens are planted to coconut as well as fruit trees with cassava interplanted as a main food crop. Sweet potato and corn are usually grown as monoculture on terraced lands. The yields of cassava are still very low — ranging from 2 to 4 ton/ha of wet roots when planted as monoculture, but only 0.9 to 1.2 ton/ha if intercropped with corn. Corn may yield only 0.2 ton/ha of dry grain.

In Banjar Oyo, Kali Bawang, Kulon Progo, the topography ranges from level to hilly. The total amount of rainfall exceeds 2484 mm per year as shown in Figure 8. Rainfall exceeds 200 for at least 6 months per year. There are four dry months with less than 100 mm rainfall. Two types of cropping patterns are dominate in these areas:

- Solid cassava — planted as monoculture and
- Cassava intercropped with corn.

Corn and cassava are usually planted at the same time at the beginning of the rainy season in October or November. Corn is usually harvested in January while cassava is harvested as needed for home consumption. The production of cassava is still very low, only 2 - 3 ton/ha of wet root. Corn yields are low also, with only 0.2 - 0.3 ton/ha of dry grain. Very little fertilizer has been used for these crops, usually not more than 50 kg of urea as well as TSP/ha.

Desa Kedung Poh has an average elevation of about 500 m above sea level and slopes ranging from 15 - 40%. The soil is very shallow. The rainy season lasts about six months from November to April, while the dry season lasts from May to August. The total amount of rainfall is around 1849 mm per year. The monthly distribution of rainfall is shown in Figure 8. There are four main cropping patterns used by farmers. These are:

- Cassava planted alone;
- Cassava intercropped with corn;
- Upland rice + corn intercropped with cassava;
- Corn + soybean intercropped with cassava.

1. Land Use. The land in the Yogyakarta project area is hilly and eroded. But there remain pockets of soil that are productive and which sustain high populations. The soils are in great need of stabilization through intensive soil conservation and reforestration efforts. Table 2 shows the distribution of land use in the project areas. It is interesting to note the large area of land in home gardens compared to the amount in upland fields. Since the Yogya area tends to be subject to extremely dry and long dry season the farmers have compensated by making better use of perennial crops as a means of livelihood and for food.

2. Cropping Patterns. Upland rice + corn / cassava is a dominant cropping pattern used by farmers as well as the project. Improved varieties, planted in the early wet season can at least double the yield of the existing pattern. Better arrangement of the crops in rows permits the planting of either soybean or peanut between the cassava rows after rice harvest.

3. Varieties. Improved varieties of upland rice (C-22, Cipunegara, and IR-36) corn (Bromo, Arjuna and Genjah Kertas) as well as Cassava (Adhira I and Gading) have been introduced. These varieties grow well in these locations. Blast disease attacks IR-36 if it is grown under upland conditions. Unfortunately other varieties that are specifically adapted to upland are not resistant to brown plant hoppers and cannot be grown (Table 3).

Cassava planted in intercrop combination with corn and rice yielded 8 ton/ha of wet root, while corn in the combination yielded 2 - 2.5 ton/ha of dry grain.

Table 2. Land categories based on agricultural use in 3 locations in Gunung Kidul and Kulon Progo.

Location	Area of lowland rice	Area of Home gardens	Area of Upland fields	Total Land area	Average land area per farm family
	ha				
Banjar Oyo	112	651	739	1,502	0.93
Hargotirto	27	1,200	133	1,360	0.97
Kedung Poh	98	292	484	874	0.90

Source: Annual Reports, Bangun Desa Project.

Table 3. Yields of upland rice grown in intercropped combination with corn and cassava.

Location	Rice variety used			
	IR-36	C-22	Cipunegara	G-H-185
	---------- Yield (ton/ha)----------			
Kedung Poh	3.6	4.01	-	-
Banjar Oyo	3.2	-	4.4	-
Hargotirto	-	-	-	4.4

Source: Annual Report, Bangun Desa Project

Davros soybean grew well in the project area and yielded 1.2 ton/ha of dry grain while grown in combination with cassava. Gajah peanut produced 1.2 ton/ha of dry pods in the same combination.

4. Perennial Crops. In contrast to the Citanduy watershed drier conditions prevail in the Yogyakarta area, especially during the dry season. The availability of shrubs and tree leaves for animal feed during the dry months become very important. Also, the soils tend to be shallow and have less water holding capacities. Under these conditions trees play a major role not only for animal feed but also for human food and soil conservation. For the badly eroded areas, especially on steep lands, permanent tree and grass cover appears to offer the best solution for a combination of soil conservation and production of useful commodities.

5. Livestock. Table 4 shows the importance of livestock among these farm families. The farmers are making the best use of agricultural by-products and grasses for livestock feed. They are returning the stable manure to their farm land. The small ruminants appear to fill an especially important role in the farm economy.

6. Crop Yields. Research trials conducted on farmers' fields at three locations indicate that the introduced cropping pattern (ULR + C / Cv / legume) could increase the yield of food crops substantially as shown in Table 5.

Upland rice as well as corn and cassava in the Introduced Cropping Patterns A and C gave higher yields than the Farmers' Cropping Pattern. Cropping Pattern A is quite stable under upland condition. It is expected that yields and profitability can be further increased as more adapted varieties and management practices are developed.

Table 4. Livestock distribution in Banjar Oyo, Hargotirto and Kedung Poh.

Location	Cattle	Small ruminants	Chicken
	---------- number of animals ----------		
Banjar Oyo	848	3,372	10,812
Hargotirto	248	2,774	18,028
Kedung Poh	529	1,158	10,083

Source: Annual Reports, Bangun Desa Project.

Table 5 Average yields of upland rice, corn, cassava and legumes in cropping pattern studies at Kedung Poh, Banjar Oyo and Hargotirto, Yogyakarta. 1981-82.

Cropping Pattern	Yield (ton/ha)		
	Kedung Poh	Banjar Oyo	Hargotirto
Farmers Cropping Pattern			
Corn +	1.2	1.1	0.9
Upland rice /	2.0	no rice crop	no rice crop
Cassava -	6.0	5.2	5.1
Peanut	0.7	0.4	0.4
Cropping Pattern A			
Corn +	2.4	1.9	1.4
Upland rice /	3.4	4.3	2.6
Cassava -	8.5	9.0	7.5
Peanut	0.8	0.7	0.6
Cropping Pattern C			
Corn +	2.5	1.8	1.3
Peanut /	1.8	1.5	1.4
Cassava +	8.0	9.0	7.2
Soybean	0.8	0.4	0.4

Source: Annual Report, Bangun Desa Project

Upper Solo River Watershed. In the Upper Solo basin, erosion and flooding are widespread. Some 250,000 ha (24.4%) are seriously eroded, while on half of this land, erosion has reached such a critical stage that the land has been virtually abandoned for agriculture.

The basic problem in the upper Solo River watershed is the intense population pressure on the land (estimated 690 inhabitants/km^2). As a result agriculture has been extended into areas unsuitable for cultivation because of land formation and topography. Crop production and farm incomes are therefore, very low and the great majority of people living in these areas are subsistence farmers. In most areas, unless soil conservation practices are adapted complete loss of arable soil will inevitably take place.

1. Cropping Patterns. The existing cropping patterns in this upland watershed under farmers' conditions are shown in Figure 7. Most of the cropping patterns are basically similar to others we have observed in Citanduy and Yogyakarta. The patterns are intercrop combinations. In Boyolali, corn and cassava (and sometimes upland rice) are the main commodities. At higher elevations some vegetable crops are grown. Tobacco is also grown in these areas especially for cash income.

In Mojogedang and Padas the main cropping patterns consist of upland rice, corn and peanut intercropped between cassava rows. Here and there sesame is also grown but on a limited scale.

In Wonosari soybeans are also planted between cassava rows and sorghum is usually planted on the ridges of the terraces.

The results of research trials carried out in 7 locations are shown in Table 6. It seems that the use of organic matter as compost as well as stable manures are a must to increase the productivity of the soil. Data in Table 6 show that without applying stable manure, the yield of upland rice, corn, cassava and other crops are very low, even with the use of chemical fertilizers as recommended.

In Desa Lemah Ireng demonstration plots have been carried out. Land terracing as well as introduction of improved cropping patterns brought about considerable improvement in their farming systems. Yields and income, calculated in rupiah, are shown in Table 7. Yield and income of introduced cropping pattern are compared to the existing farmer's cropping pattern.

It appears that the cropping pattern of upland rice plus corn intercropped with cassava and followed by legumes (soybean, mungbean or peanut) gives a good performance in most agroclimatical conditions provided the amount of rainfall is well distributed and exceeds 1500 mm/year.

Upper Brantas River Watershed. The total area of the Brantas River Watershed is about 11,800 km^2 which may be broken down to 27.3 percent Irrigated land, 23.4 percent forest land, 20.9 percent upland (dryland), 16.0 percent home yard, 5.2 percent estates, and 7.2 percent divided among others.

Table 6. Yields of Cropping Patterns tested in 6 locations in the Upper Solo Watershed. 1981-82.

Locations	Upland rice	Crops grown in pattern			
		Corn	Peanut (dry pod)	Soybean	Cassava
		---------- Ton/ha ----------			
Mojogedang	1.2	1.8	1.2	0.35	9.8
Purwosari	-	1.2	1.25	-	7.2
Bulu	1.4	2.1	1.4	-	9.4
Gendah	-	1.4	0.72	-	5.6
Kr. Tengah	-	1.6	2.25	0.62	-
Padas	1.24	0.8	-	0.300	-

Source: Annual Report Solo River/AARD Project.

Table 7. Yields and economic data from cropping patterns tested in Lemah Ireng Demplot, Upper Solo River Watershed. 1981-82.

Cropping Patterns	Yield	Gross Returns	Cost of Production	Net Returns
	Ton/ha	----------Rp/ha----------		
Farmers C.P.				
Corn +	2	200,000		
Peanut /	1	300,000		
Cassava	13	260,000		
Introduced C.P.				
Upland rice +	3.5	350,000		
Corn +	1.8	180,000		
Stringbean -	250 bunches	12,500		
Peanut +	1.5	450,000		
Corn +	1.0	100,000		
Cassava	5.0	100,000		
		1,192,500	313,600	778,900

Source: Annual Report, Solo River/AARD Project.

Only small amounts of phosphate and nitrogen fertilizers are used by farmers. Stable manure when available is carefully utilized especially for high valued crops like tobacco.

2. Varieties of Food Crops. As in most upland crop areas local varieties are used. Generally introduction of new and viable seed can increase yields by 100 per cent. But these increases in yields must be accompanied by an increase in fertilizer use and management.

3. Perennial Crops. These areas tend to have long dry seasons and occasionally dry wet seasons. The soils tend to be shallow and infertile. Perennial fruit and forest tree crops appear to offer good possibilities for the special conditions in this watershed. They offer food, erosion control, animal feeds and fire wood They can supplement the food and animal crop production programs underway.

4. Livestock. Inadequate supplies of forages and water during the dry season hinder large ruminant production. The numbers of goats and sheep can be increased significantly in the project area. Combination of forage grasses and tree legumes offer a palatable and nutritious diet.

5. Crop Yields. The yields of upland rice, corn and cassava as well as peanut and soybean are very low. The yields of these crops can be increased at least two times if improve cultural practices are put into consideration.

The total area which is in need of rehabilitation consists of about 151,700 ha located in Malang, Blitar, Tulungagung, Trenggalek, Kediri, Nganjuk, Jombang, Mojokerto and Pasuruan. The population density of these subwatersheds is around 916 people per km^2.

The average annual rainfall is 2050 mm/year of which about 80 percent occurs during rainy season between the months of December to May. Consequently, only 20 percent occurs during the dry season period between June-November. The soils derived from limestone, are shallow and are especially subject to erosion during the rainy season.

1. Cropping Patterns. In the lower elevations (less than 600 m above sea level) farmers usually grow upland rice or corn intercropped with cassava. Some farmers grow peanut and soybean intercropped with corn at the beginning of the rainy season. Sugarcane is grown in the southern part of Malang and corn is usually intercropped with young sugarcane. At higher elevations, vegetable crops like garlic, leaf-onion potato, cabbages and sweet potato are grown. Corn may be intercropped with onions and carrot or sometimes with sweet potato.

2. Varieties of Food Crops. Local varieties are used almost exclusively for upland rice, cassava and legumes. Improved varieties of corn that are resistant to downy mildew are used except were early maturity is required.

3. Perennial Crops. These crops are especially important in this watershed especially to provide food stability for man and animal.

4. Livestock. Large ruminants as well as small ruminants are important.

5. Crop Yields. The demonstration plot of 20 hectares located in Desa Purworejo, Kecamatan Donomulyo, Malang gave a good impact to the neighbour areas. During the second and third years, the area bench terraced covered around 75 hectares. The farmers' cropping pattern before the demonstration plot was conducted consisted of corn intercropped with cassava. Rice was not grown simply because the farmers were not able to get good yields. Table 8 shows the cropping patterns and the yields for crops before and after the project started. Fertilizer had been applied on the dem-plot at the rate of 200 kg urea, 100 kg TSP and 4 ton of stable manure/ha. The farmers' plot usually received only about 4 tons of stable manure and 50 kg urea and 75 kg TSP/ha.

The yield performances from these plots are not yet up to potential. Yet the farmers are happy and indicate they will continue to follow the introduced cropping pattern.

Table 8. Average yields of corn, rice, peanut and cassava before and after establishment of the dem-plot.

Cropping pattern	Before Dem-plot Ton/ha	After Dem-plot Ton/ha
Upland rice +	no rice crop	1.72
Corn /	1.27	1.70
Cassava /	2.01	5.10
Peanut	no peanut	0.73

Source: Brantas River Project.

General Discussion

Rainfall. The rainfall data shown in Figures 7, 8 and 9 show differences in total and distribution of rainfall from collection stations near or in the target areas. It would be useful to have some data on rainfall intensities. It would also be useful to have data for a shorter time interval (daily or every five days) so that some rainfall probabilities could be developed particularly for the beginning and ending of the rainy season. This would be useful for planning purposes but probably not so useful to farmers. The events in any one year that the farmer (or researcher) observes taking place at the appropriate time of the year gives a better guide for time to plant (or not to plant) than long term weather data. Farmers through their collective wisdom can do this quite well.

Cropping Patterns. The cropping patterns that accompany the rainfall distribution data are considered to be reasonable approximations of existing farmers' cropping patterns in the areas visited. Contrary to commonly expressed opinion new cropping patterns are not usually imposed on farmers from some bureaucratic body in Bogor but are simply modifications (hopefully improvements) of existing patterns. Usually the options for crops are not as great as one would suspect. There are certain basic food crops that predominate – rice (upland and lowland), corn, cassava and legumes (mungbean, peanut, soybean and cowpea). Farmers prefer rice if they can perceive any reasonable likelihood of success. Corn is usually a crop that is intercropped into upland rice. Cassava is added to insure food production and more efficient use of turn-around time and the dry season. Legumes for the most part are grown after the rice but are also grown for seed for the main season (dry season) at the beginning of the rainy season. There are additions and

exceptions depending on farmers preference and experience. Farmers on Java are basically food crops oriented and will grow food crops where other commodities, perhaps, should be grown. If tree crops or other non food crops are grown exclusively, we are usually dealing with an absentee land owner or a relatively wealthy farmer.

Land Resources. The soils vary considerably among the sites visited. There is a need to better understand the soils, not from an intellectual but from a practical point of view. We need to delineate among areas that can only be preserved for perpetuity by forests and those that may be stabilized and used for other kinds of agricultural enterprises including food crop production. Depth and nature of the soil and steepness of slope are major determinants for selecting agricultural enterprises within a site area. These combined with rainfall characteristics are the major determining factors that must be assessed and quantified to varying degrees. Fortunately, we usually have the farmers' experiences to fall back upon. What he is doing provides a good example of what can be done. The arbitrary slope of 50 percent above which only perennial crops should be grown may be arbitrary but it represents a base around which more precision may be developed. Even in areas where the average slope exceeds 50 percent there are places (top of hill) where the land may be stable and suitable for food crops production. Our zeal should not prevent this eventually. Farmers must have food even though they may not have money with which it may be purchased at a particular time.

Detailed land use and soil maps are not really very useful for on site decision making even if they become available within the next

ten years. Like weather maps they may be used for broad scale description purposes. Airphotos and on site evaluations of soil texture (the feel method), structure and fertility are most important. These evaluations which can be made by any competent soil scientist coupled with on site evidence represent information that can be most useful to determining soil conservation strategies and farming systems. These evaluations can be usefully inscribed on aereal photos for on site use. Until more complete soil surveys are completed, systematic but simple procedures need to be developed to provide guidance.

Socio Economic. Biological scientists have been criticized, perhaps rightfully, of ignoring the need for simple economic evaluations of their technology. This results from the emphasis in colleges and universities and even research institutes on discipline and commodity research. In small farm situations this problem is exacerbated by farmers' decisions and practices which do not lend themselves to standard economic evaluations. Mixed farming systems that include animals are especially difficult to evaluate from a strict commercial point of view. Consequently, it is important to know why farmers do what they do. But there can be a tendency to over emphasize this and become enamored with these kinds of studies and not fully appreciate the need for the studies in the first place. For the most part simple agro-economic profiles of the site areas will tell us the kinds of information needed for farming systems design and evaluation.

These can be followed by more indepth studies on special issues that arise. Broad based and detailed socio economic studies in farming systems research need to be avoided simply because the mass

of data collected precludes rapid summary and write-up. Consequently, the report may be published after the on site biological research is finished. The indepth studies represent ideal thesis projects for university students and these should be encouraged.

In practice most of the production economics data have been collected by the biological scientists simply because most agricultural economists find this activity routine. But with mixed farming systems research and evaluation the job is much more complex and requires the services of experienced and technically sound economists. Since the decision making processes are not simply economic, the term socio-economist is used to describe what is needed. We must be able to understand better the farmer's decision making processes, especially if major changes are contemplated for existing farming systems.

Farming Systems Research and Development

Farming systems are location and farmer specific. This is a warning to all who may wish to make general recommendations for new farming systems technology or even describe existing systems. But it is encumbent upon governments to develop agricultural production, to improve the well-being of farmers and the general public and to conserve natural resources for future use. It is necessary to develop national programs that many times appear autocratic and "top down". The technology may nothelp many farmers and even groups of farmers. But generally these programs are evolutionary in their development and application. Specificity and applicability increase with experience and time and with feedback from farmers and program

officers in the field. Consequently, constructive criticism can be useful if it is given through appropriate channels.

The implementation programs for upper river watersheds are still in the developmental stages. Even the research base for technology is in the developmental phases and is subject to continued testing and reevaluation. The process is never complete even though the returns from further research becomes less and less. With these reservations in mind we would like to offer the following suggestions for farming systems research and development for upper river watershed areas as a first approximation. Where relevant we will use existing criteria for description.

Farming Systems Research Approach

Farming systems research in Indonesia is carried out by a coordinated group of scientists from various disciplines. It is interdisciplinary and integrated with other government agencies and activities (extension, local government, irrigation and national production programs). It is focused upon specific target areas and limited in scope to make more efficient use of research staff and funds. Indonesia has developed methodology and staff sufficiently strong to continue this research. But, special efforts are needed to stabilize the gains that have been made through longer term research projects, particularly in the upper river satershed areas. Although production of food crops sufficient for subsistance has been and will

continue to be the first step in the development of farming systems for small Indonesian farm operations, greater effort will be made to study and improve all production aspects of the operation from soil conservation to marketing.

Partitioning of the Target Area.[1] A watershed is not a homogenous area. For research and development purposes some delineation of relevant climatic and physical features must be made. The following is an example of factors to be considered that affect land management.

Humid areas (9 months > 200 mm and 3 months ± 100 mm)

> 50% slope

Deep soil (volcanic origin)

Shallow soil (rock and parent material exposed on terracing)

< 50% slope

Deep soil (volcanic origin)

Shallow soil (rock and parent material exposed on terracing)

Drought prone areas (6 months > 200 mm and 3 months ± 100 mm

> 50% slope

Deep soil (volcanic origin)

Shallow soil (rock and parent material exposed on terracing)

[1] From a national point of view we would look on the upper river watersheds collectively at a target area and each watershed as a site. But for those working only on watersheds each specific watershed may be considered a target area.

<50% slope

Deep soil (volcanic origin)

Shallow soil (rock and parent material exposed on terracing)

Dry areas (3-4 months >200 mm and 3 months ± 100 mm)

>50% slope

Deep soil (volcanic origin)

Shallow soil (rock and parent material exposed on terracing)

< 50% slope

Deep soil (volcanic origin)

Shallow soil (rock and parent material exposed on terracing)

Each of the above vary according to other easily delineated criteria which directly affect cropping patterns such as soil texture and pH and length of slope. For a socio-economic delineation, the most import criteria relate to:

- Land ownership
- Distance from market facilities
- Farm size
- Population pressure

Farming Systems Component Technology. Technology coming from existing research institutions may not be directly supportive for the special needs of farming systems development in upper river watershed areas. On the other hand, on site farming systems research may be constrained by insufficiently trained personnel and lack of control of land for field research. To provide continued back up support, it is necessary to fine tune existing technology and provide a place for more relevant training. A Field Laboratory is needed to facilitate these activities. These facilities would be located in areas representative of the major watersheds in selected agro climatic environments. Three such laboratories should be sufficient for Java conditions. There must be a careful balanced among availability of staff and funds and research need. The primary objective would be as follows:

- to provide a central location for more efficient collection, evaluation and transfer of appropriate component technology;
- to provide an opportunity to conduct long term experiments for food crops, perennial crops, animal husbandry, water control, fertilizer efficiency, crop residue management and stability and sustainability of different farming systems and land management;
- to provide an environment for conducting interdisciplinary farming systems research before technology is transferred to farmers;
- to provide a facility and staff for training of extension and research personnel.

On Site Farming Systems Research. There is a need to continue and intensify on farm research. The technology coming from existing research centers and institutes provides a technology base. But this base needs modification and application not only in the Field Laboratory but under farmers' conditions. The Agency for Agricultural Research and Development (AARD) through the Central Research Institute for Food Crops has developed methodology for doing this. Cropping and Farming Systems Research has been carried out under farmers' conditions in more than 20 locations on Sumatra, Java, Sulawesi and Nusa Tenggara Timur (see References).

Recommendations

1. Based on existing methodology for farming systems research and development. It is important that project personnel understand the sequence of research and development phases and that they carry out their activities accordingly. Figures 1 and 2.

2. Research and development activities must be truly interdisciplinary and integrated with other appropriate government agencies — this includes everything from site selection to implementation. Figures 3 and 4.

3. It is imperative that some form of national coordination be established to insure institutuonal support and prevent excessive duplication of effort. Figure 5.

4. Develop Farming Systems Field Laboratories for representative agro-climatic and socio-economic regions within the Upper River Watersheds in Java in which longer termed and more comprehensive interdisciplinary component technologies may be developed. These facilities would also serve as training centers for extension specialists and farming systems site researchers. Figure 6.

5. Expand and strengthen on site farming systems research. Figure 6.

References

The following references contain significant references to the Indonesian Farming Systems Research Methodology.

Shaner, W.W., P.F. Philipp and W.R. Schmehl. 1982. Farming Systems Research and Development: Guidelines for Developing Countries. Consortium for International Development. USAID (Contract No. AID/DSAN-C-0054). Westview Press, Boulder, Colorado. 414 p.

_____ 1982. Readings in Farming Systems Research and Development. Edited: W.W. Shaner, P.F. Philipp and W.R. Schemehl. Consortium for International Development. USAID (Contract No. AID/DSAN-C-0054) Westview Press, Boulder, Colorado. 175 p.

The following reference is a compilation of ten years of Cropping and Farming Systems Research in Indonesia. Much of this material has been published in various forms but is brought up to date and summarized in this draft.

McIntosh, J.L., Surjatna Effendi, R.H. Bernsten, A. Syarifuddin Karama, Inu G. Ismail, Imtiaz Basa, Asep Saefuddin and Socharsono. 1983. Indonesian Farming Systems Research and Development. Agency for Agricultural Research and Development, Central Research Institute for Food Crops, Bogor, Indonesia. Draft.

I. Project Digest and Technical Data

A. Title : On-farm Water Management Research

B. Coordinating Country : Indonesia

C. Location of Project : ASEAN On-farm Water Management Field Laboratory, Sukamandi, West Java, and collaborative research in other ASEAN Countries.

D. Objectives

Long term

1. To develop crop and water management techniques for more intensive cropping patterns and higher technical efficiencies of irrigation water use in developed large scale irrigation schemes (such as Jatiluhur) in Southeast Asia.

2. To provide data for use in improving on-farm water management in the small scale (Sederhana) irrigation systems in Southeast Asia.

3. To promote these activities through the development of an ASEAN On-farm Water Management Working Group.

Short term

1. To identify the problems of on-farm water management through on-farm surveys and research for large and small scale irrigation projects.

E. Scope of Work

1. Establish and staff through the project an ASEAN On-farm Water Management Field Laboratory.

2. Improve water use efficiency in large scale and technically developed irrigation schemes through on-farm water management research and implementation for Southeast Asia.

3. Improvement of crop production and economic well being of farmers in simple (Sederhana) irrigation systems in Southeast Asia.

4. Promote collaborative on-farm water management studies, training and research dissemination through development of an ASEAN On-farm Water Management Working Group.

F. Implementation time:

1. Minimum length of project is five years.

2. Time frame for implementation is as follows:

Activity	1983	1984	1985	1986	1987	1988
Field Laboratory	Staffing, Back-up Studies and Logistics					
Farm Surveys	Agro-Econ					Impact
On-farm Research		Site Selection				
Full irrigation			On-site Research		Pilot Prod Prog	
Simple irrigation			On-site Research		Pilot Prod Prog	
Collaborative Research			On-site Research		Pilot Prod Prog	
Working Group						
Meetings		Annual meetings (5 days)				
Training			Annual training (3 months)			

Project Cost:

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H. Stage of Preparation :

Implementation.

I. Background Information:

There has been an increase in water availability due to the rehabilitation of irrigation facilities and construction of new irrigation systems. But with earlier maturing varieties and other new component technologies there is the potential for increased cropping intensities and production efficiencies even for highly developed irrigation systems such as Jatiluhur. Also, poor operation and maintenance (O&M) of irrigation infrastructure lead to low technical efficiencies even in the developed systems. These problems may be aggravated by ineffective water users' associations (institutional and socio-economic aspects). However, production and engineering technologies for irrigation water use within the small scale (Sederhana) irrigation systems are even less well developed and are exacerbated by the new agronomic, social and institutional problems that come with development. On site cropping systems research is needed for both the highly developed and simple irrigation systems but tailored to meet the special conditions of each. From this research, which will include studies of the socio-economic conditions and agronomic potentials of the systems bases for development of more efficient water management techniques may be established. On site pilot production research

will be carried out to further test the technology in cooperation with the various relevant governmental agencies; such as, extension, irrigation, cooperatives and local government.

AGENCY FOR AGRICULTURAL RESEARCH AND DEVELOPMENT
NATIONAL PROGRAM FOR WATER MANAGEMENT RESEARCH

ON-FARM WATER MANAGEMENT RESEARCH

INTRODUCTION

Water is a major constraint for crop production in Southeast Asia either because of drought or flooding. In the past, considerable investments in water control for agriculture were primarily directed toward the building of structures, such as, drainage ditches, dams, reservoirs and irrigation canals. It was assumed that crop production would increase once sufficient water was provided to the farmers. Only a small portion of the expenditures were used to improve conditions at the farm level.

Evidence gathered from independent field research and from experiences of individuals dealing with crop production, indicates that some of the irrigation systems fail to achieve their targeted levels of crop production and farm income. More recently, it has been questioned whether the irrigation water of a sophisticated large scale irrigation system like Jatiluhur Reservoir in West Java, Indonesia is utilized efficiently and economically. For these reasons, improvement of on-farm water management becomes an important issue.

Background and Supporting Information

Food Crops Production

Construction of new and rehabilitation of the existing irrigation systems over thepast 10 years have helped increase the area planted to lowland rice. Adequate supplies of irrigation water have accelerated the intensification of rice production through such programs of MASAGANA 99 in the Philippines and BIMAS in Indonesia.

In the next 10 years increases in carbohydrate-rich as well as protein-rich crop production still will be a major target of agricultural development. These goals may be more readily attained with increased irrigation capability by:

- constructing new irrigation systems,
- improving existing systems,
- increasing irrigation water use efficiency.

The Agricultural Research Agencies within each collaborating ASEAN country are responsible for providing techniques to increase the efficiency of irrigation water use through research on crop and water management.

Irrigation Water Use Efficiency

The use of irrigation water for expansion of planting area through intensification and diversification programs may be broken into

two different categories which are both related to irrigation water efficiency[1/].

Production efficiency. The ratio of the quantity of crop production (t/ha) to the quantity of water used (mm/ha); and

Technical efficiency. The ratio of the volume of water used for production to the volume diverted from the source.

There has been an increase in water availability due to the rehabilitation of irrigation facilities and construction of new irrigation systems. But with earlier maturing varieties and other new component technologies there is the potential for increased cropping intensities and production efficiencies even for highly developed irrigation systems such as Jatiluhur. Also, poor operation and maintenance (O&M) of irrigation infrastructure lead to low technical efficiencies even in the developed systems. These problems may be aggravated by ineffective water users' associations (institutional and socio-economic aspects). However, production and engineering technologies for irrigation water use within the small scale (Sederhana) irrigation systems are even less well developed and are exacerbated by the new agronomic,

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1/ Levine, G. 1979. Water Use and Water Management - Tradeoff Implication for Water Efficiency. Paper presented at the IFPRI-IRRI-IFDC Symposium on Rice Policy, Los Banos, the Philippines.

social and institutional problems that come with development. On site cropping systems research is needed for both the highly developed and simple irrigation systems but tailored to meet the special conditions of each.

OBJECTIVES

Short term

1. To identify the problems of on-farm water management through on-farm surveys and research for large and small scale irrigation projects.

Long term

1. To develop crop and water management techniques for more intensive cropping patterns and higher technical efficiencies of irrigation water use in developed large scale irrigation schemes (such as Jatiluhur) in Southeast Asia.

2. To provide data for use in improving on-farm water management in the small scale (Sederhana) irrigation systems in Southeast Asia.

3. To promote these research activities through the development of an ASEAN On-farm Water Management Working Group.

Project Description

Scope

Our goal is to develop High Performance Irrigation Systems (HPIS) through on-farm research over the next 5 years. Increased production and technical efficiencies will be the criteria for evaluation of the HPIS, as reflected by:

a) higher production and cropping intensity

b) higher farm income

c) equitable distribution of irrigation water throughout the command area

d) effective water users' association

e) the establishment of an ASEAN Water Management Working Group.

Duration

Minimum of five years

Locations

Initially, the research will consider the two extreme of irrigation the highly developed systems such as the Jatiluhur in Indonesia and the Sederhana (or simple) systems. The primary research effort will be carried out within the Jatiluhur Systems and in three Sederhana Systems (West Java, Lampung and South Sulawesi) in Indonesia. Collaborative research, funded by national programs, will be supported through an ASEAN Water Management Working Group Coordinator.

Implementation

In both cases, the research will build on previous research and, consequently, will be highly focused. In the Jatiluhur system the rice-rice-legume pattern has been studied extensively in cropping systems research and evaluated in pilot production programs. Further research is

needed to study problems that have been identified, such as:

a) synchronizing of water availability with a defined cropping calendar
b) defining management techniques to minimize excess water problems for legumes after two rice crops
c) determining alternative cropping patterns for problem areas.

Within the small scale irrigation systems research will be focused on sites, within the Sederhana Irrigation Project, because

a) limited command area (100-600 ha); thus, the impact of research will be easily noticed
b) the command area is a small economic unit that can be relatively easy to be studied
c) considerable infrastructure has been developed and background information is available.

Three small scale (Sederhana) command areas (Table 1) will be the target areas for the research.

Table 1. Sederhana irrigation command areas selected for research.

Province	Location	Command area (ha)	No. of farm family
West Java	Cimanggala	340	700
Lampung	Way Lunik	353	400
South Sulawesi	Leang-leang	640	?

These command areas have not been subjected to intensive studies. Tertiary canals have been constructed and are working. Rice production is ranging from 1 to 2.5 t/ha. Cropping intensity is about 50 percent in the dry season.

Organization and Rationale

There are three major activities that will be carried out to meet the objectives of this project.

The first activity will be to improve water use efficiency in large scale and technically developed irrigation schemes. The second activity will be directed toward improvement of crop production and economic well being of farmers on Sederhana irrigation systems. The third activity will be the development of a Working Group of collaborating ASEAN countries for Water Management studies and training. Through this approach more effective research and research implementation can be expected.

Jatiluhur Water Management and Cropping Systems Research. There are about 250,000 hectares of irrigated land within the Jatiluhur irrigation system. The Sukamandi Research Institute for Food Crops lies within the Jatiluhur system. The command area is close to ports, large cities, markets and sources of inputs and is interlaced with paved and secondary road systems. This is a major rice producing area and farmers have widely adapted new high yielding and early maturing varieties. Extensive cropping systems research has been conducted and results show the feasibility of growing two consecutive rice crops followed by a legume crop in one crop year. This practice has been implemented through extension programs with some success. But wide scale adoption has not taken place because of limited time for the legume crop after harvest of the second rice crop and onset of the driest time of the season and rehabilitation of the irrigation canals. Yet a simple calculation of the timein the field (90 days) to grow a rice crop plus time for land preparation (14 days) and turn around time (10 days) shows that time should not be a limiting factor. Consequently, the problem is not biological but rather a problem of timing and synchronization. The solutions to the problems are simplified if a decision is made, based on past research, to follow a defined cropping pattern within a specific time frame. The irrigation water can then be allocated on an agricultural bases rather than on rationalization. Furthermore, it is important that the times for water arrival and termination are fixed rather than rotating from year to year among irrigation groups as is presently practiced.

1. Cropping Systems Research. The production, management and marketing potentials for rice and soybeans are very good throughout Indonesia. The agronomic potentials for these crops have been well demonstrated for a rice-rice-soybean cropping pattern in the fully irrigated areas of West Java. However, a better understanding of biological and socio-economic conditions is necessary. Also, there will always be a need for further component research on varieties, soil fertility management, insects and diseases. The most pressing research problems, however, concern seed technology, excess soil water at planting and pest control.

Researchable issues:

- Agro-economic profile description of target area
- On farm methods of seed multiplication and seed storage
- Community and on site water drainage
- Integrated pest managment

2. Irrigation Systems Management Research. The distribution of water in an irrigation system is not just dependent upon farm needs but is confounded by the seasonal requirements for water, quantity of impounded water, extent of water control capability, irrigation staff and policy. However, if the cropping patterns and on-farm water needs are established and these are determined to be the main criteria for water distribution these confounding factors can be minimized.

Researchable issues:

- Determine the maximum spread in time of arrival of irrigation water at the beginning of the crop season that would permit the use of the rice-rice-soybean cropping pattern

- Determine the capability and methodology for irrigation of soybean during dry season
- Study the feasibility of eliminating the need for the rotating golongan system of irrigation water equalization
- Establish through training, workshops and on farm collaboration, a collegial relationship among research, extension, irrigation and local government authorities.

3. Pilot production program. This research would be comprehensi and would include more than simply evaluating the rice-rice-soybean cropping pattern in farmers' fields. In this instance we would invol all of the relevant agencies in planning and executing the project. The focus wouldbe on how to implement the cropping pattern and associated technology rather than on problem identification.

"Sederhana" Irrigation Water Management Research. About 422,000 hectares, approximately 12% of the total irrigated areas in Indonesia, are currently irrigated by some 765 Sederhana systems. The GOI has planned to develop 300,000 hectares of new land for irrigation through the Sederhana program in Pelita IV and as the continuation of the program that was launched in 1974.

A number of studies of Sederhana systems have indicated their complexity and diverse nature but none have made specific conclusions. Although some of the Sederhana systems have contributed significantly to increased crop yields, the projected production potentials have not been achieved. A major reason for this could be due to improper water utilization with poor O&M of system facilities. Water Users'

Association have been formed in many such systems, but only a few association are really active and geared toward full utilization of the developed water resources.

Research will have to be field oriented with specific short and long-term goals, if it is to provide answers to problems in the Sederhana systems where this research will be conducted. Also, the technology generated must be transferred to other applicable systems with similar problems.

The main research issues for the Sederhana Irrigation Water Management Research Program have been identified and grouped into four discipline-oriented areas. These are :a) Agronomy and cropping systems, b) Engineering and system management, c) Organization and d) Biological and Socio-economic constraints. All four areas include a number of disciplines and involve a number of GOI institutions which are generally responsible for issues in each. The conduct of research will, therefore, require multidisciplinary efforts and should be carried out in collaboration with the GOI institutions involved.

1. Cropping Systems Research. There is no suitable alternative to increase food crop production at a desirable rate other than to make the best use of land and water resources. This can be achieved by developing intensive cropping patterns that are more productive, economical, and socially acceptable to farmers. So far little research has been conducted to develop ways of optimizing land and water use in small scale (Sederhana) irrigation systems.

Although water availability is a dominant factor in determining the agronomic potential of cropping patterns, the suitability of a particular pattern to farmers is determined also by community and market conditions. Adapted cropping patterns must, therefore, be developed and evaluated for specific sites. Methodology that has been developed for cropping systems research in Indonesia maybe used to accomplished the objective.

Researchable issues:

- Evaluation of each crop component (e.g. varieties, fertilizer management, insect control, and land preparation, etc.) based on existing and proposed patterns for maximum returns.
- Alternative cropping patterns for specific site and system characteristics to achieve maximum returns from available water.

2. Engineering and System Management Research. A technical assessment of the availability patterns of the water resources over time is critically needed for sound designs and eventually for the successful operations of the Sederhana irrigation systems. There are currently not enough information and guidelines to meet these needs. There is also a need to develop economically viable and socially acceptable procedures for equitable water distribution in the Sederhana irrigation systems. This is especially true since the systems usually have a minimum of measuring, control, and distribution devices.

Research in these and related areas would provide the background and basis for a conceptual framework for further research to improve water availability and more efficient distribution and usage.

Researchable issues:

- Determination of water availability at the diversion and other contributing sources and definition of system boundaries.
- Identification of existing limitations to equitable distribution of irrigation water and implementation of pilot management research to develop more efficient distribution and use of water by farmers.
- Development of management criteria for the improvement of existing Sederhana irrigation systems so as to achieve greater water control, higher management capacity, and increased life of the systems' components.
- Development of economic and effective procedures for design and construction of tertiary facilities with appropriate farmer involvement.

3. Organizational research. If the farmers in the command areas of the Sederhana Irrigation Systems become more actively involved not only in the use of the irrigation water but also in the operation and maintenance of the system facilities, the benefits from investments in the systems will be greatly increased. Pilot research in other countries, for example the Philippines, has shown that such

goals are not unrealistic. However, these procedures must be socially acceptable and economically viable if the farmers are to accept.

Researchable issues:

- Assessment of alternative strategies to encourage farmers' involvement and contribution in all phases of Sederhana system development. This information would be used to facilitate creation and functioning of Water Users' Associations.
- Evaluation of the acceptance of different O&M responsibility models by farmers and relevant government agencies at various levels on the basis of experiences and findings from research item (a).

4. Biological and Socio-Economic Constraints Research. Research has established that there is a gap between the actual farmers' rice yields and the potential yields that can be produced in the farmers' fields with modern technology. Research to determine the reasons for farmers' non-adoption of the modern technology to obtain higher yields is needed. Such research must try to identify not only the biological crop production problems but also the socio-economic problems associated with the farmers' decision making process for use or non-use of the available technology for higher yields. Results of research in these areas will help in the formulation of policies, at the national as well as the local levels to increase food production within the Sederhana Irrigation Systems.

Researchable issues:

- Determination of yield gap between potential and actual farmers' yields.
- Analysis of constraints to higher yields by farmers and to adoption of modern technology in various Sederhana irrigation environments.

ASEAN Water Management Working Group. On-farm water management research programs among the ASEAN countries have been relevant and effective. These programs may continue in their present form. Through this project, however, methodologies and on farm research examples will be generated which will be useful and supportive to the collaborating countries. The Project Leader will enhance this effort by coordinating training, research dissemination, annual meetings and selected collaborative research activities. The Project Leader along with his counterparts in collaborating country programs will constitute an ASEAN Water Management Working Group.

Personnel Requirement

	Time allocation (percent)	Duration (years)
Project Coordinator	100	5
Cropping Systems		
Agronomist	100	3
Economist	100	3
Entomologist	100	3
Water Management Specialist	75	5
Irrigation Engineers	50	5
Research Dissemination and Training	100	4
Field Assistants (6)	100	5
Secretary	100	5
Clerical (2)	100	5
Labor	-	-

Facilities

Land, office and laboratory space will be made available through the Agency for Agricultural Research and Development through the Sukamandi Research Institute for Food Crops in West Java, Indonesia.

Schedule of Activities

Activity	1983 J	F	M	A	M	J	J	A	S	O	N	D
Field Laboratory							Facilities and					
Farm Surveys							Agro-Econ Profile					
On-farm Research												
Full Irrigation												
Simple Irrigation												
Collaborative Research												
Working Group								Organizational				
Meetings												
Training												

Activity	1984 J	F	M	A	M	J	J	A	S	O	N	D
Field Laboratory		Staffing					Back-up studies					
Farm Surveys		Agro-Econ Profile										
On-farm Research							Site selection					
Full Irrigation										On-site		
Simple Irrigation										On-site		
Collaborative Research							On-site Research					
Working Group												
Meetings						Ann.mtg						
Training										Ann. Trng.		

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Schedule of Activities

1985

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Field Laboratory			Back-up Studies and Logistics									
Farm Surveys			Farm Records and Monitoring									
On-farm Research			Problem Identification									
Full Irrigation			Monitor and Data Collection									
Simple Irrigation			Monitor and Data Collection									
Collaborative Research			Monitor and Data Collection									
Working Group												
Meetings						Ann. Mtg.						
Training										Ann. Trng.		

1986

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Field Laboratory			Back-up Studies and Logistics									
Farm Surveys			Farm Records and Monitoring									
On-farm Research		Crop and Water Management Studies										
Full Irrigation			Redesign and Testing									
Simple Irrigation			Redesign and Testing									
Collaborative Research			Redesign and Testing									
Working Group												
Meetings						Ann.Mgt.						
Training										Ann.Trng.		

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Schedule of Activities

1987

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Field Laboratory			Back-up Studies and Logistics									
Farm Surveys			Farm Records and Monitoring									
On-farm Research	Water Mgt. Group							Field Evaluation				
Full Irrigation								Pilot Production				
Simple Irrigation								Pilot Production				
Collaborative Research								Pilot Production				
Working Group												
Meetings						Ann. Mgt.						
Training										Ann. Trng.		

1988

Activity	J	F	M	A	M	J	J	A	S	O	N	D
Field Laboratory			Project Evaluation and Impact									
Farm Surveys				Summary						Impact		
On-farm Research	Field Evaluation									Final Report		
Full Irrigation				Summary								
Simple Irrigation				Summary								
Collaborative Research				Summary						Final Report		
Working Group										Final Report		
Meetings						Ann. Mgt.						
Training												

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Specific Research Activities

Jatiluhur Water Management and Cropping Systems Research

The capability for growing three crops (rice-rice-legume) per year in fully irrigated areas has been successfully demonstrated through on farm research and extension trials. Past research has been initiated primarily from the crop production side. Consequently the focus was on testing cropping patterns in pre determined irrigation regimes and with a minimum of disturbance to existing practices. In an integrated research and production program all parts of the system wouldbe subject to adjustments.

1. Phase I : Collaborative Program Development

   a. Informational meetings

      - Emphasize that justification and feasibility for 3-crop pattern are already established.
      - Collaborative role is to implement concept in a comprehensive manner over an irriagation system.

   b. Planning sessions

      - Description of irrigation and drainage capability.
      - Feasibility of altering water availability to meet crop production needs.
      - Partition area according to irrigation and drainage capability.
        - Full control
        - Partial control
        - Cannot drain
      - Seed production and storage strategies.

2. Phase II : Research and Extension Field Experimentation.

a. First year

- Collaborative trials in at least 3 desas for each area delineated.
- Identify and develop strategies for elimination of irrigation and drainage as well as logistical constraints.

b. Second year

- Expand intensified cropping pattern into all areas that can be effectively accommodated with respect to soil, water control, seed and technical support.
- Develop alternative cropping patterns for areas not suited for rice-rice-soybean.
- Minimize need for "rotating golongans" for irrigation water availability.

c. Third year

- Full scale production programs.
- Transfer of technology to other areas in Indonesia where similar conditions exist.

Sederhana Water Management and Cropping Systems Research

For efficient use of funds and forces the activities in the selected Sederhana Irrigation Systems (Table 1) will be divided into 4 phases. These phases are:

1. Phase I : Site description

a. Environmental factors:

- Soil - soil classification, landscape and soil fertility.
- Climate - amount, distribution and classification of rainfall
- Water supply - amount, distribution and quality of irrigation water.

b. Socio-economic factors:

- Level of technology followed by the farmers including input and output, cropping intensity and production water supply and adequacy.

c. Physical factors:

Ditch and canal densities, water quality and possible siltation and erosion.

2. Phase II: Field Experimentation Research

Field studies will be conducted in selected Sederhana Irrigation Systems (Table 1) to solve the problems in the fields for agronomy and cropping systems, irrigation, engineering, systems management, organization and biological and socio-economic constraints.

3. Phase III : Pre-production

Demonstration of cultural techniques obtained from the results of the on site field research.

4. Phase IV : Pilot Production

Implementation of cultural techniques throughout the command areas of the selected Sederhana Irrigation Systems in the form of Bimas, Inmas and Insus production programs.

ASEAN Water Management Working Group

It is expected that the project will support collaborative research among the ASEAN countries by supporting the development of a Working Group of participating scientists. The Working Group would be supported by the project by providing:

1. Coordination for the Working Group
2. Funds for annual meeting
3. Training Programs
4. Funds for publication and exchange of research information

Costs

Institutional Arrangements

Jatiluhur Command Areas

Water management research will be conducted in the Jatiluhur Command Areas is the responsibility of Sukamandi Food Crops Research Institute (SURIF).

Accordingly, it is important to develop research capability of this institute through:

a) training of research staff

b) recruitment of professional research staff

c) establishment of Sukamandi Water Management Field Laboratory

SURIF is located in the center of Jatiluhur Command Areas. Approximately, 180 hectares of rice field has not been used for field research, because the land has not been developed yet. When the Field Laboratory has been developed, it will be used for: training ground of water user's association and research sites.

Sederhana Irrigation Command Areas.

Several institutions of GOI are involved in water management research in the Sederhana Irrigation Systems.

Those institutions are:

<u>AARD</u>

Central Research Institute for Food Crops

1. Sukamandi Research Institute for Food Crops
2. Sukarami Research Institute for Food Crops

3. Maros Research Institute for Food Crops

Soil Research Institute

Center for Agroeconomic Research

DGFC

Directorate of Food Crop Area Development

DGWRD

Directorate of Irrigation

ASEAN Collaborative Research

This research will be funded and organized by the respective collaborating National programs. It is hoped, however, that close collaboration will exist among country programs and with the primary research effort centered in Indonesia. This collaboration will be supported by the activities of the ASEAN On-farm Water Management Working Group through annual meeting, training programs and research dissemination.

PLANS FOR 1984-85

AARD's (National Program for Water Management Research) activities for 1982 and 1983 in connection with the High Performance Sederhana Irrigation Systems are as follows:

1982

1. Determine site characteristics relating to land, soil and water through agro-economic profile studies on markets, costs of production and farmers' attitudes through socio-economic descriptions of the three selected Sederhana Irrigation Systems (Table 1).

2. Recruit and train staff members to work in water management research programs in the field of agricultural engineering with backgrounds on soil and water engineering.

3. Formalize the working relationships with cooperating agencies and arrange assignments of their staff for their identified roles in the research programs.

4. Organize a workshop for a selected number of informed professionals to establish appropriate methodologies that will be applied uniformly in collecting data on the different variables relating to engineering and system management research.

5. Develop ASEAN Water Management Working Group.

6. Identify participants to the short-term training programs of IRRI on:

   a. Irrigation Water Management Training Course

   b. Agricultural Economic Research Training Program

   c. Cropping Systems

1983

1. Initiate field research relating to agronomic and cropping systems research in the three sites by applying methodologies established in previous cropping systems research work in Indonesia.

2. Initiate research on engineering and systems management research for problems relating to water availability determination and systems biundary delineation in at least one site.

3. Initiate research on biological and socio-economic constraints in one or two of the selected sites.

4. Identify specific manpower development requirements for research in the different problem areas and work out short term non-degree and MS level degree training plans for the period 1983-1985 for staff from AARD as well as for selected staff from the cooperating agencies (DGFC, DGWRD, DGRD).

International Development Research Center

Agency for Agricultural Research and Development
Central Research Institute for Food Crops

and

Central Research Institute for Animal Sciences
Bogor, Indonesia

In Collaboration with Agricultural Research to
Support Transmigration Project

Crop /Livestock Systems Research for
Smallholders in Upland
Rainfed Agriculture

Institutional Administration	Research Project Directors
_____	_____
Head, Agency for Agricultural Research and Development	Farming Systems Research Program Coordinator

Project Summary

Title : Crop/Livestock Systems Research for Smallholders in Upland Rainfed Agriculture.

Objectives : To identify and remove constraints to improved crop and livestock production systems in upland rainfed transmigration areas.

To further develop relevant component technologies for both crop and animal systems.

To develop methodologies for effective and inter-disciplinary farming systems research.

To promote the development of a National Farming Systems Working Group.

To provide training opportunities — locally and abroad for key research and extension staff.

Proponents : Central Research Institute for Food Crops (CRIFC)
and
Central Research Institute for Animal Scienices (CRIAS)
in collaboration with
Agricultural Research to Support Transmigration Project

Location : Headquarters: Bogor, Indonesia
Field Site : Batumarta, South Sumatra

Duration : Three years

Budget	: IDRC	: $ 332,247
	Indonesia:	$ 94,518
	TOTAL	$ 427,765 for three years

Prospective Donor : International Development Research Center (IDRC)

Project Proposal : Abstract

Methodology and research for Cropping Systems have been developed sufficiently to provide technology for food self sufficiency on small farms. Implementation of this technology has progressed and new research issues concerning alternative land use and additional farm power have arisen. The research interface as we progress to the next phases of development involves crops and livestock. The two most important research issues relate to the quantity and quality of feed sources and animal health. This research will focus on these research issues in on-farm studies. Strategies for use of crop residues for both animal feed and maintenance of soil fertility will be evaluated. Supplementary feed sources from pastures, hedge rows, shrubs and trees will be developed to improved quality and supply of forage. The bases for partition of the farmers' land resources among different agricultural enterprises (food crops, animal husbandry, and perennnial crops) will be developed.

Rainfed Farming Systems

Proposal for Crop/Livestock Research in Indonesia

BACKGROUND

The Ministry of Agriculture through its Agency for Agricultural Research and Development and various Directorate Generals has routinely developed technology, provided seeds and plant materials to farmers through provincial agricultural services offices throughout Indonesia. Agricultural research on rainfed agriculture, particularly in support of Transmigration, has been conducted by many different universities and research institutions for the major agro-climatic regions in Indonesia. The research has covered many different aspects of agricultural development – from initial land clearing to marketing of farm products. Much of this research has been supported by special funds provided through either the Directorate General of Transmigration or the Ministry of Public Works to support specific transmigration projects.

Consequently, a large body of agricultural technology has been developed for rainfed agriculture. Nevertheless, special attention is still needed to make sure the technology is provided in the most usable form and has been tailored to meet the farmers immediate needs. This is true for the indigenous farmers in highly developed areas of Java and Sumatra as well as for transmigrant farmers in less developed areas. However, the transmigrant farmers many times have special problems. They are not only financially weak but are subjected

to new and foreign environments. They do not know the opportunities and options that are available to them. Traditions suitable to the new environments have not yet developed and government agencies may also be new and lack experience in dealing with the new problems that arise.

Priorities for Agricultural Research and Development

All farming systems research must take into account socio-economic as well as biological and climatic factors. The socio-economic factors are usually location specific and must be considered case by case. Broad classifications however may be made for the physical biological and climatic factors that are useful. A useful classification of agricultural land areas in Indonesia can be made by considering land use with respect to the chemical and physical characteristics of the soil and water environment without reference to the climate. The breakdown commonly used is as follows:

Classification of Land Areas	Amount of Land: Used for crop prod. (Mil. ha)	Amount of Land: Potential for crop prod. (Mil. ha)
• Lowland rice (padi sawah)		
- Irrigated	1.1	5.5
- Partially irrigated	2.9	
- Rainfed (tadah hujan)	1.7	
• Rainfed upland	1.2	18.0
• Tidal (pasang surut)	0.56	6.6
• Swampy (lebak)	0.25	
• Mangrove swamps		

This simple classification delineates land areas whose uses are largely determined by the soil conditions. The chemical and physical characteristics of the soil environments among these delineated areas are greatly different and have dominating effects upon land use and management. For example, even though rainfed upland and rainfed lowland conditions may exist in the same area under the same soil and climatic conditions adapted cropping systems would be greatly different.

Cropping systems and soil conditions for rainfed lowland agriculture are more closely related to those of the irrigated lowland areas. These areas are usually further delineated according to degree of water availability – either from rainfall or irrigation. The categories usually considered are as follows :

- Full irrigation – 10 months
- Partial irrigation – 7-9 months
- Partial irrigation – 5-7 months
- Rainfed – $\pm$ 5 months water availability.

Within the rainfed upland areas, however, it is necessary to consider some climatic factors. In Indonesia the dominating climatic factor is rainfall. But at higher elevations in the upper river watersheds temperature as well as slope ($>$ and $<$ 50%) become important environmental factors for agriculture. The rainfed upland areas may be divided into three categories:

- Humid regions – 9 months $>$ 200 mm and
  3 months $\gtrsim$ 100 mm

• Drought prone regions	–	6 months > 200 mm and 3 months ≤ 100 mm
• Dry areas	–	3-4 months > 200 mm and 5 months < 100 mm

In the tidal swamp areas the dominating physical factors determining farm systems relate to land development. For example, drainage helps to remove uncertainty and provides a basis for intensification. Lack of water control is also a limiting factor for the swampy areas. Intervention with alternative crops and agricultural enterprises is limited in scope.

Mixed Farming Systems Research

Cropping systems research has been conducted by scientists in AARD and has shown the potential for food crops agriculture in irrigated, rainfed upland, and the tidal affected areas. This research is well documented and shows not only the potential for crop production but also some of the limitations for a stable and sustainable agriculture. It is understood that fertilizers, good seed and other production inputs are required for any sustained, productive and profitable food crops agriculture. Research and development in the lowland rice areas has reached a high level of development. But there are still researchable issues concerning crop commodities and systems; such as, fertilizer materials, methods of applications, management of crop residues and maintenance of soil fertility that are peculiar to upland rainfed cropping systems that need more study over time. Furthermore, long term studies are needed

to evaluate water runoff and erosion under different management systems for food crops alone and in combination with perennial crops in rainfed upland areas. Consequently, even for cropping systems research, there are many researchable issues that need further study – particularly longer term studies that are not amendable for study in farmers' fields.

Other components of farming systems research have been studied but not as intensively as for food crops. New technology for animal husbandry, forestry and fisheries, and industrial crops needs testing and re evaluation under field and under, at least, simulated farmers' conditions but before it is actually introduced to the farmers. There are at least five very distinct steps that should be considered at this stage in the development and introduction of appropriate agricultural technology.

- First, there must be the development or conception of new technology. The various research institutes have done this and will continue to learn of and develop technologies.
- Secondly, these technologies are routinely adapted to the commodity or form of husbandry for which the institute is responsible. This has and is continuing to be done.
- Thirdly, the technology should be evaluated within the system of which it will be a part. For example, food crop commodities (such as corn, rice, legume, etc.) may be tested in a cropping system or small ruminants may be evaluated in an animal system.

- But it would be useful as a fourth step if these various components of farming systems could be studied together in an integrated manner under the researchers management.
- Finally, evaluation under farmers' conditions as is presently done for cropping systems research is still needed as a fifth step.

These steps for farming systems research and development represent a model for starting with an idea or concept and carrying through to implementation. From conception to implementation of any technology some of these steps may be by-passed or carried out simultaneously depending upon the circumstances. For example, in developed countries it is not usually necessary to carry out steps four and five. Farmers are able to take the technology and apply it to their enterprise. For lowland rice farmers in Indonesia and other developing countries, it might not be necessary for research to complete even step three before farmers actively adopt the new technology. Indonesian farmers have readily adopted IR36 before the full impact of the variety could be tested in the field. The farmers were willing to accept the variety primarily because it was resistant to existing biotypes of brown planthoppers. Later with the help of research and extension they became aware of its potential for more intensive cropping. The stability and long history of lowland rice in Indonesia and the ability to readily transfer lowland rice technology from country to country permits these kinds of research and development short cuts. Perhaps similar transfers of technology can be carried out with other components of

farming systems after the bases for transfer have been studied and further developed. Figure 1 indicates how technology developed by the Research Centers in AARD (steps 1, 2 and 3) may be further evaluated and developed in a Field Laboratory (step 4) before (or simultaneous) testing under farmers' conditions (step 5). Consequently, the research thrusts for farming systems research should include the following activities.

1. Facilitate the feedback of perceived problems and new ideas from farmers, extensions and onsite research workers that may be used by scientists in the research institutes to focus more precisely their research efforts.

2. Support the development of Farming Systems Field Laboratories in which relevant studies, such as, land clearing methods and component technologies for rainfed farming systems may be evaluated on an integrated, comprehensive and longer term basis for humid, drought prone and upper river watershed regions.

3. Develop on site rainfed farming systems research in areas selected to represent a cross section of conditions for agriculture specifically in upland, humid, drought prone and upper river watershed regions of Indonesia.

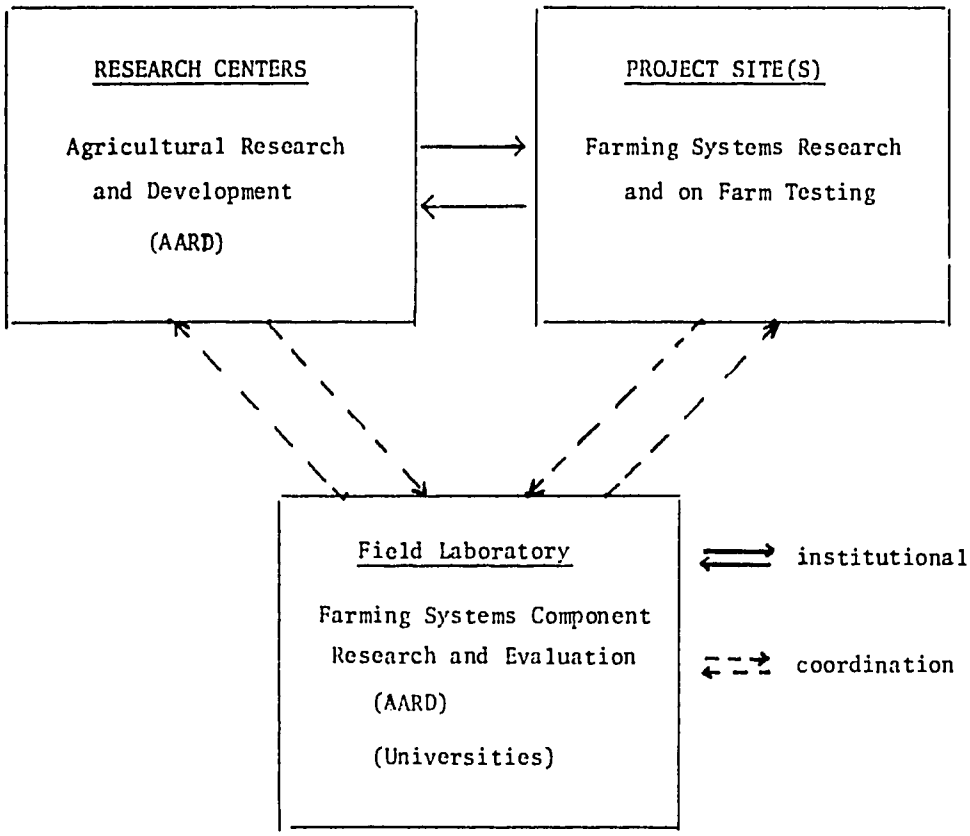

Figure 1. Development, evaluation, testing and flow of technology for Farming Systems Research and Development.

STRATEGY

Component Technology from Research Centers

It is important that farming systems research encourages the development of new ideas and technology for the various components of small farms systems in Indonesia – for indigenous as well as transmigrant small farm families. This kind of research is within the mandate of existing AARD Research Centers and Institutes. But further effort is needed to support present basic and component research by:

- facilitating the identification and feedback of relevant researchable issues that appropriate research institutions can tackle,
- providing the framework for interdisciplinary farming systems research under farmers' conditions,
- providing a research environment for technology development that closely resembles the farming system in which the technology will be used, but which permits more experimentation over a longer period of time under researchers control.

Farming Systems Field Laboratories

It is important to support the development of Farming Systems Field Laboratories in areas similar, agroclimatically, to major target areas but where infrastructure and research facilities presently exist. The objectives will be:

- to provide a central location for more efficient collection, evaluation and transfer of appropriate component technology,

- to provide an opportunity to conduct long term experiments on topics, such as, land clearing, perennial crops, soil conservation, water control, fertilizer efficiency, crop residue management, crop/livestock and stability and sustainability of different farming systems and land management,
- to provide an environment for conducting interdisciplinary farming systems research before technology is transferred to farmers.

On Site Farming Systems Research

This kind of research must be on farm and not as long term and comprehensive as that in the Field Laboratory. Since the methodology for cropping systems research and basic technology for cropping patterns and management have been developed for many agricultural areas, new studies will concentrate on the development of stable and sustainable mixed farming systems. The research will focus on the crop/livestock components with the intent of reducing farmer labor and risk and improving soil conservation practices. Since past research on cropping systems has developed much relevant technology for that component this project will emphasize animal, pasture and perennial crops research.

Consequently, farming systems research under farmers conditions should be carried out in an area as an additional means of:

- identifying,
- developing,
- testing,
- implementing, and
- transferring new technology.

METHODOLOGY

On Site Farming Systems Research

Figure 2 diagrams the scheme used for farming systems research and development in Indonesia. This approach is being used in a similar fashion in many other countries in South and Southeast Asia. The approach represents an attempt by agricultural research scientists to develop, through a process of understanding and redesigning farm systems in specific target areas, technology that will be more directly relevant to small farmers. This approach is not critical of existing agricultural research that has more discipline and commodity orientation but is intended to identify and remove constraints to farmer adoption of new technology in a more responsive and direct manner. The feedback to the existing research and extension agencies from farming systems research can be especially valuable. It helps create an awareness of farmers' problems and stimulates scientists to design research projects that are problem oriented.

Unfortunately farming systems research may imply more than can be actually accomplished. There are practical consideration that must be taken into account and rational judgments made. For example, many scientists are not farmer oriented. They may prefer indepth studies of a particular commodity or subject within a discipline. There are funding, managerial and logistical problems. Finally there are so many different kinds of farm systems in so many differ agro-climatical environments that it is impossible to work on all with the number of scientific staff that may be interested in this

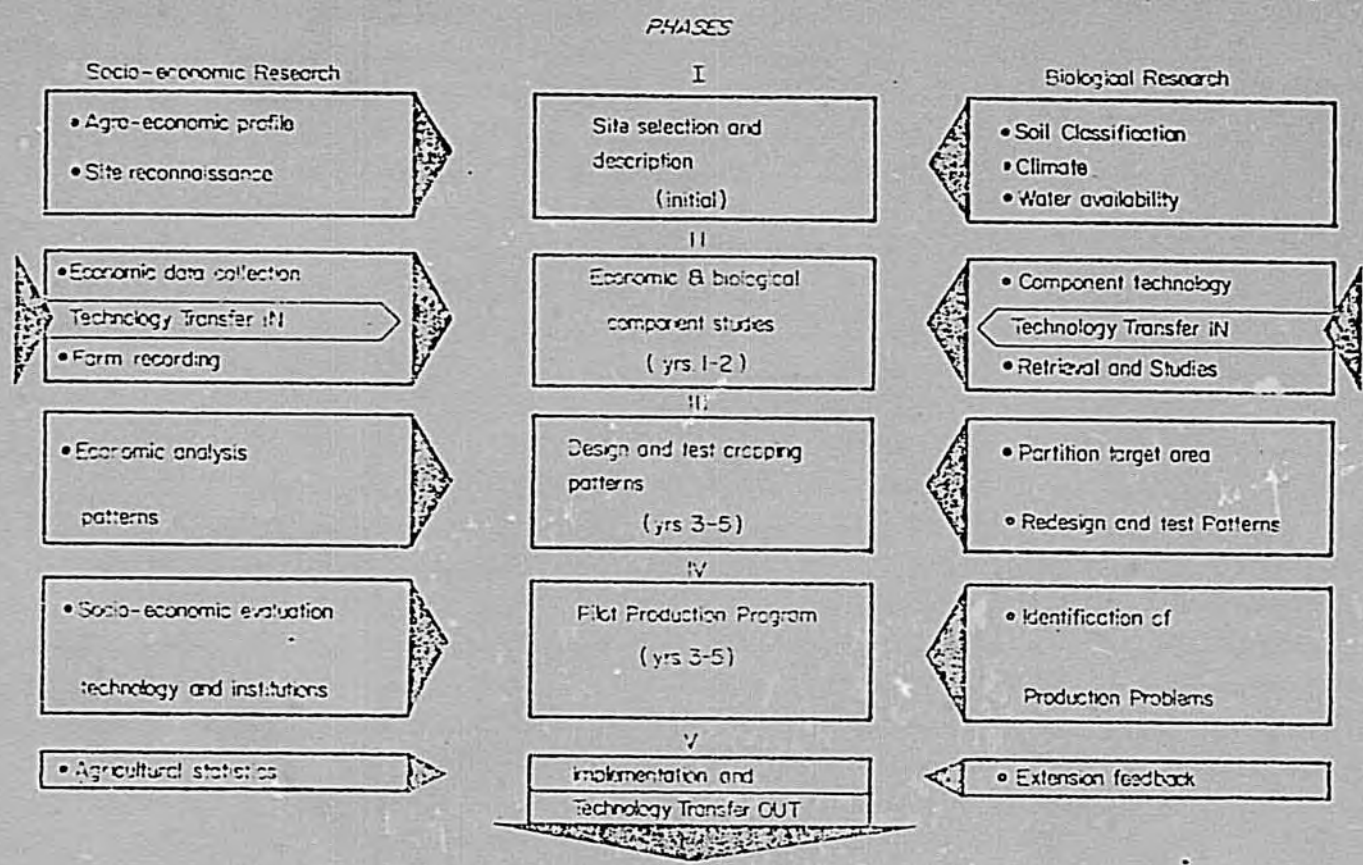

Fig. 1. Parallel biological and socio-economic activities required for the five distinct research and implementation phases of a Farming systems program with little inflow of technology.

approach. Consequently, major policy decisions are needed to decide where and when on site farming systems research may take place. These decisions may be based on rational scientific reasoning but usually a more pragmatic approach is taken. A combination of funding and technical considerations usually prevail.

Consequently, at any one time in Indonesia only a limited number of target areas and research sites can be tackled. But through adequate site descriptions (socio economic and biological) transfer of technology from one place to another place with similar site descriptions can occur quite successfully (Figure 3). This is basically the process that has taken place in the upland rainfed areas in Indonesia. There has been a considerable inflow of technology from previous projects. This has been supplemented by a limited amount of onsite research — for example, research technology developed in Lampung has been successfully transferred to other similar areas in Sumatra, Kalimantan and Sulawesi. But implementation of this technology always uncovers the constraints to adoption and the need for more research. This should not be considered a problem but progress toward problem identification. A viable research organization will respond to these identified problems. Implementation also uncovers institutional constraints. Interdisciplinary research that is integrated with other government agencies is necessary but may not always happen smoothly (Figures 4 and 5). But again this may be viewed as progress if positive steps are taken to resolve the identified problems. But solutions to these technical and institutional problems will not solve themselves. Considerable coordination is needed —

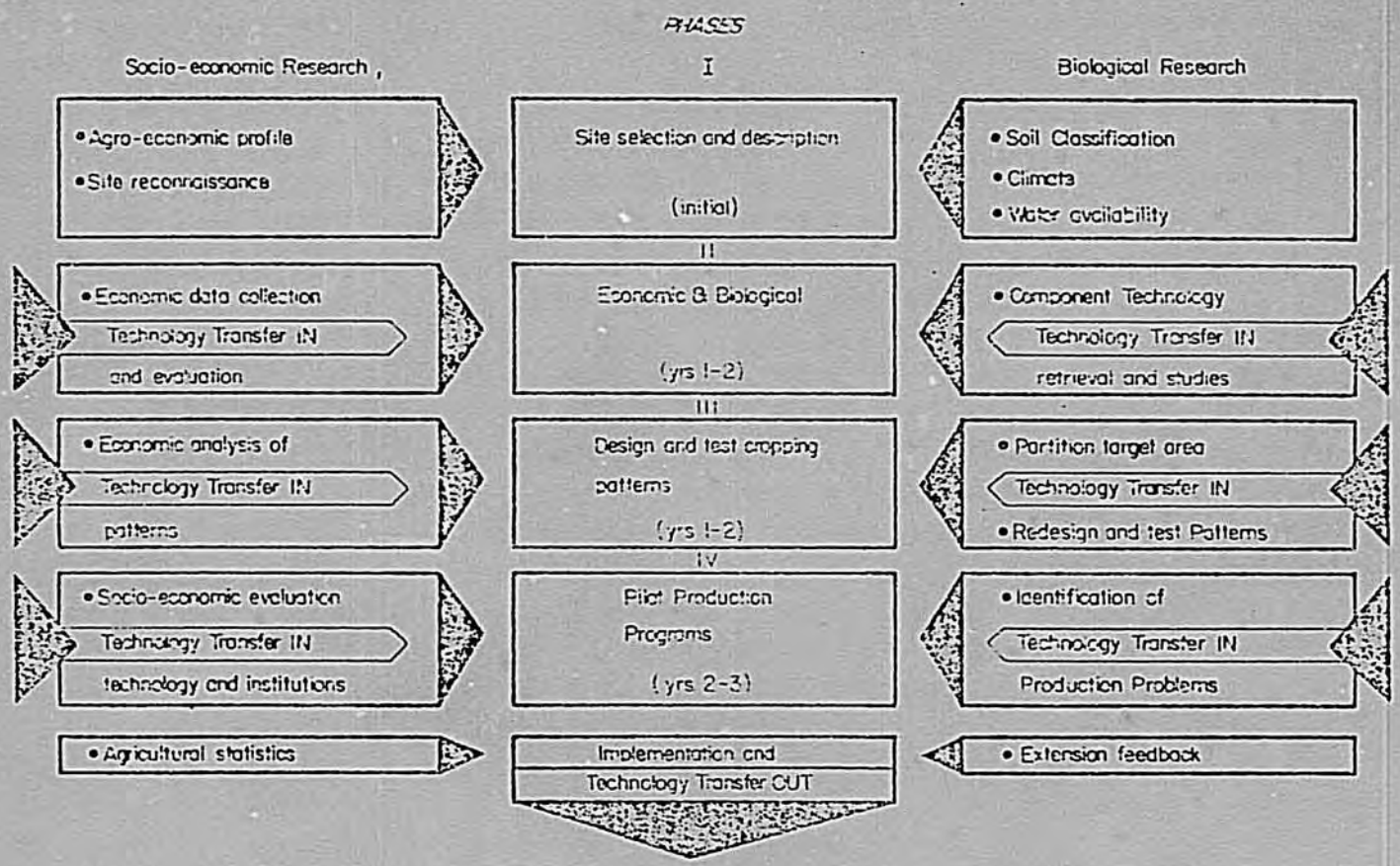

Fig. 2. Time frame for research and implementation phases of a farming systems program with significant inflow of technology from research in areas with similar site descriptions. This technology transfer may reduce the research time in a target area by two or more years.

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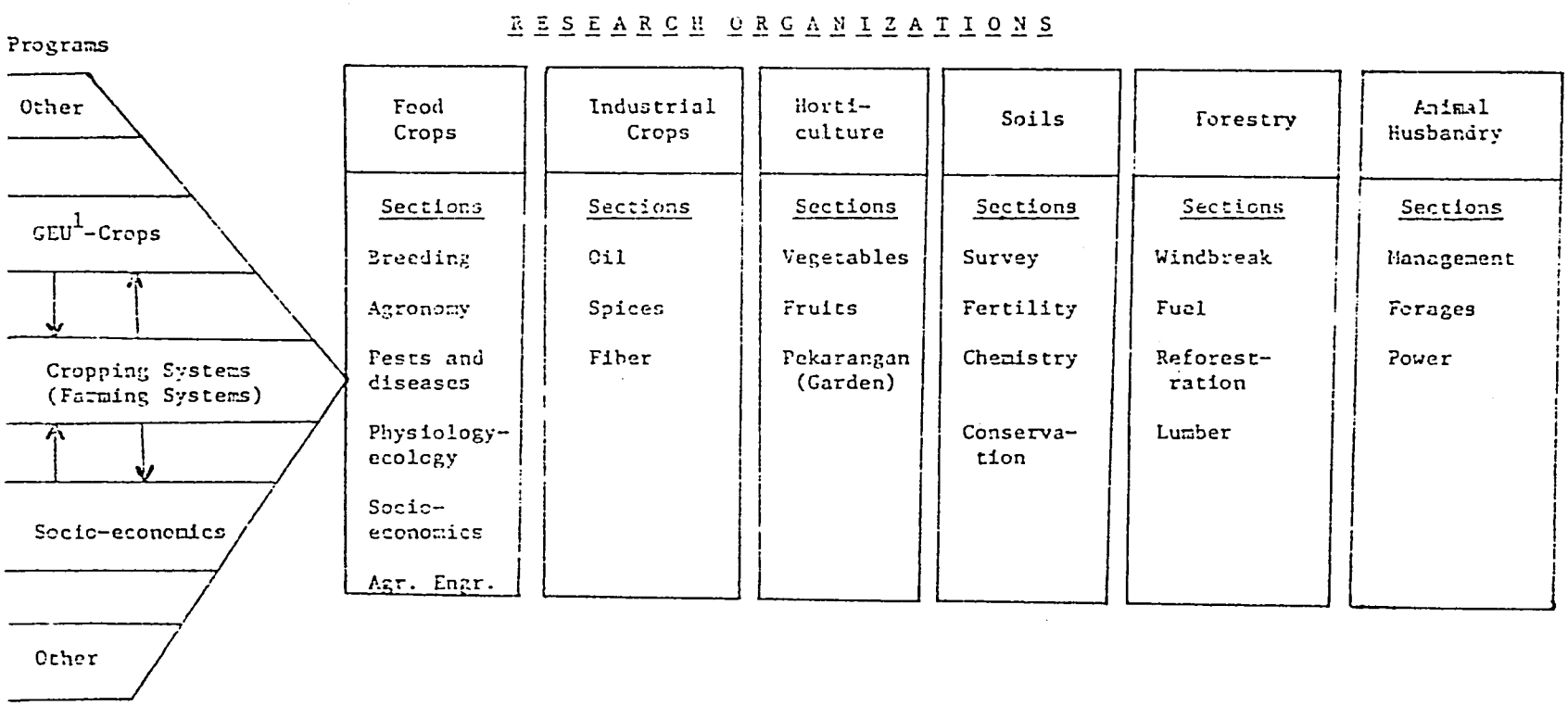
Framework for integrated Farming Systems Ressearch



[1]GEU - Genetic Evaluation and Utilization refers to systematic varietal improvement studies for food crops such as: rice, corn, legumes, etc.

Fig. 3 This diagram illustrates how research in a Farming systems program (FSP) interacts with other systems, programs and traditional commodity and discipline-oriented research activities.

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Research-extension interface over different phases of a Farming systems program

Target Area Selection	RESEARCH AND IMPLEMENTATION PHASES					Technology transfer
	I Site description	II Econ & Biol.Pot'l	III Design & Test	IV Pilot Prod. Prog.	V Implementation	
FSWG[1]	FSWG	FSWG	FSWG	FSWG	FSWG	FSWG
Extension Local Gov't. Nat'l Gov't.	Extension Local Gov't.	Extension Farmer Local Gov't. Bureau Stat.	Extension Farmer Local Gov't.	Extension Farmer Dir. Prod. Local Gov't.	Extension Farmer Nat'l Prod Prog Local Gov't.	Extension Other Nat'l. Gov't. Agen.

[1]FSWG - abbreviation for Farming systems working group which is the multi-disciplinary research group that coordinates and carries out the research plans of Farming systems programs in a target area.

Fig. 4 . This is a schematic representation of the research-extension workload distribution and interaction with farmers and other government agencies in different phases of Farming systems research and implementation.

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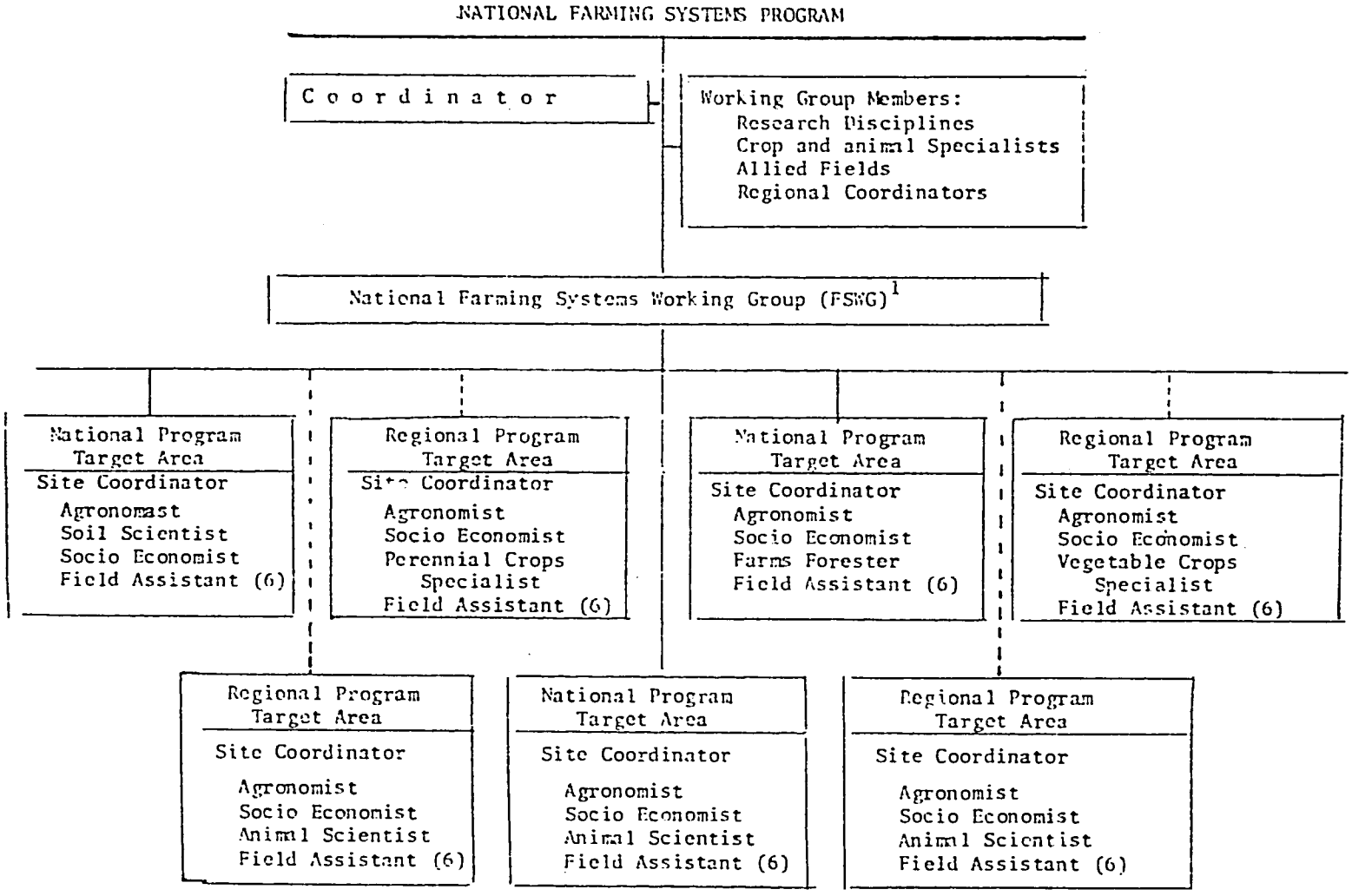
administrative and technical. Administrative coordination can solve the institutional pronlems and provide the collaborative environment in which the scientists can carry out their responsibilities. But at the national level there must also exist technical coordination to insure that appropriate technologies are transferred and that duplication of effort is minimized. The technical coordinator may need support through a Working Group of appropriate colleagues and authority through some control of funding (Figure 6). Specific research issues that arise may require indepth study on site or within the selected target area. As pointed out in the previous section and in Figure 1, field laboratories are needed to provide the environment for technology development to supplement on site farming systems research activities and bring together scientists from different research centers, universities, and institutes. It is hoped that this more indepth kind of research will be carried out by the Farming Systems Research planned for Baturaja. This research project, however, will be narrowly focused to carry out on farm research involving crops and livestock. The same general approach used for cropping systems research in the past will be followed. But closer monitoring and control will be maintained in order to permit quick identification of research and management problems.



[1]Regional Programs would be the administrative responsibility of the Regional Research Institute, but hopefully in collaboration with the National Program. There would likely be more than one site within a target area, and different technical expertise may be needed for different areas.

Figure 5. Possible organizational chart and staffing requirements for a Farming Systems Program.

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Integrated Crop/Livestock Research Planned

Batumarta, South Sumatra

This proposal is made as a follow up of the Crop/Livestock conference held at IRRI, April 1983. Indonesia suggested one site in South Sumatra be included in the Asian Farming Systems Network. The proposed site is Batumarta, one of the Cropping Systems outreach sites.

Site Description

The target area, Batumarta, South Sumatra is relatively newly opened for settlement by Transmigrants from Java, Madura and Bali. The project area covers about 65,000 ha and is representative of the upland areas in humid regions of Indonesia. The annual rainfall is more than 2,000 mm and is evenly distributed throughout the year. There are 6 to 7 consecutive months starting in October when the rainfall exceeds 200 mm. There are only 2 dry months (July and August) with rainfall of about 100 mm. With this type of rainfall, the possibilities of growing crops continuously throughout the year are quite good.

The topography of the area is rolling to undulating with an average slope of 8-15%. Soil and water conservation is of major importance for managing the land and developing a stable and sustainable agriculture. Small dams or ponds may be developed to collect water from rainfall and run off. These water sources would be useful for many purposes, especially during the dry season.

Most of the land area is made up of red-yellow podzolic soil which has been infested with alang-alang (Imperata cylindrica). The soil has low inherent fertility and is shallow (top soil varies from 5-15 cm). The pH is about 4.5 and the base saturation is low. Most of the nutrients contained in the soil are in the organic component. However, results from previous research indicate that with good soil and crops management and fertilizer inputs, the productivity of the soil can be increased substantially.

Status of Development

Transmigration schemes are projected toward permanent settlements. A permanent agriculture, that is productive and economocally viable determines the success of the transmigration program. The first priority for a new settlement is to produce adequate food for the family and some surplus to sell.

The first group of transmigrants in Batumarta arrived in 1976. The proposed land allocation for each family was as follows:

Land use	Area
Home lot	0.25 ha
Food crops	1.50 ha
Feed grass	0.25 ha
Rubber plantation	1.00 ha
Reserve for food crops	1.00 ha
Reserve for rubber	1.00 ha
T o t a l	5.00 ha

The rubber plantation was developed on a credit basis. The development and management of the plantation, until the first tapping, was carried out under the PNP (Government Estate Crops). The government also provided a house, cow, seeds and agricultural inputs for each family. Besides these, rice and fish for food consumption were provided for the first three years.

Present land use. Out of the 5 hectares of land to be allocated to each family, about 3 hectares (including one hectare of rubber) have been allocated. The most common cropping pattern used by the transmigrant farmers consists of upland rice, corn, cassava and legume crops. With only manual labor there is a shortage of power and each family can only cultivate about one hectare of land and the rest lies idle. In order to use all the land a more diversified farming operation is needed. Some farmers presently use draft animals for land preparation. But due to the land condition and erosion problems, major research emphasis must be put on soil and water conservation. Recently, farmers became aware of these problems and began to develop bench terraces. However, some improvements are still needed — especially proper techniques for lay out, design and building of terraces and deployment of water. The inclusion of animal and perennial crops components are quite necessary not only for increasing the farmers welfare but also for stabilizing the land and sustaining the farming systems.

Livestock. The project was to provide one large ruminant for each family and the animal was intended to be used as a draft animal.

Based on the results of monitoring and evaluation studies carried out by IPB (Bogor Agricultural University), the average holdings of animals per family are:

Animal	Number
Large ruminant	0.74 animal unit/family
Small ruminant	0.05 " " "
Poultry	0.21 " " "

But the records from 1980-81 show that about 20% of the family income had been derived from the selling of livestock. This hinders the build up of animal units in the settlement. Consequently, many aspects of the livestock component still needs further investigation.

Aside from the 0.25 ha that was programmed to be planted to forage grasses by the farmers, the project also develop communal grazing lands in several village units. The IPB reports also indicate that not many farmers make use of these grazing lands.

Previous Cropping Systems Research

The Central Research Institute for Food Crops (CRIFC) in cooperation with the Directorate General for Transmigration has been conducting cropping systems research in Batumarta since 1976-77. The cropping patterns tested and the technology developed were similar in many respects to those from a previous upland research site in Bandarjaya, Central Lampung. There has been substantial technology transfer from one location to another. But due to its undulating

topography, soil erosion is a greater problem in the Batumarta area. To permit sustained agricultural production the following practices are incorporated into the cropping systems:

1. Maintain year round crop cover. By having crops grow continuously, the soil will be shaded and protected from direct sunshine and raindrops. This will help to minimize erosion and leaching.

2. Increase and maintain soil fertility. The soil is quite responsive to fertilizer. Fertilizer applications, especially the phosphate, will promote vigorous crop growth and yield. As a result, it will increase also the availability of crop residues.

3. Return crop residues. Maintaining the level of soil organic matter is quite important for these podzolic soils. By returning the crop residues some of the nutrients will be saved. But also the microbial activity will be increased and the water infiltration rate maximized.

4. Prevent erosion. If ground cover is not sufficient, even after increased fertilizer use and more intensive cropping patterns, other practices such as contour farming and terracing will be used.

Cropping patterns developed. From the last five years of research and testing, the introduced cropping pattern of Corn + Upland rice / cassava / peanut - cowpea had shown consistent results. An impact evaluation study has been carried out as part

of the overall research program to evaluate the farmers adoption and other changes brought about by adopting the introduced cropping patterns. These impact studies have also helped identify constraints for further development and implementation.

The cropping systems research program has stimulated 44% of the farmers to adopt the cropping pattern. This represents about 45% of the cultivated land in the target area. About 18% of the adopters come from among farmer cooperators and the rest from non cooperators.

In 1981-82 preliminary studies were begun to integrate the food crops, perennial crops, and forage grass research. This research was conducted on terraced land covering about 5 hectares and involved several farmer cooperators. The forage grasses, Setaria and Brachiaria were planted along the ridges of the terraces. All components showed good performances. However, evaluations of farming systems (technologies) that are designed on the bases of levels of inputs and complexity may be more useful than those that are based simply on levels of intensity.

WORK PLAN

The research activities will follow the same basic procedures that were used for past cropping systems research. The research will include preliminary agro economic profile studies and record keeping, component technology research and on farm testing. The basic operational procedures for these research activities are as follows.

Socio Economic Research

These research activities will consist of two parts. A series of cross sectional surveys including an initial agro-economic profile description of the target area and complementary daily record keeping studies of selected farms over a period of at least three years will be carried out. The survey will assemble all basic information on farm operations as well as background information needed for the study. The farm record keeping system is designed to cross-check critical information gathered from the surveys and cover a narrower scope of data. The wage and price monitoring system will be set up to monitor fluctuations in wages and general agricultural prices. Data gathered from these monitoring studies will be used for making comparisons and in checking survey data.

Agro-economic profile. The preliminary agro-economic profile survey will be carried out at the beginning of the study to characterize the existing farming systems with emphasis on crop/livestock. The purpose of this survey is to understand the agro-economic environment within which crop/livestock production takes place. Data collected from this survey may be used in selecting the samples needed for the study. Data collected will include:

1. Demographic information.
2. Farmland description, including data on soil type, topography and restricting factors and water availability.
3. Cropping pattern history.

4. Assets including:
   - draft animals,
   - productive animals (animals which produce eggs, meat or milk), and
   - buildings.

5. Financial liabilities intended to primarily assess the financial position of the farmers.

6. Numbers of livestock owned — including the following information:
   - value of livestock and livestock production by breed and sex,
   - average use of draft/pack animals by farm operation,
   - sources of livestock,
   - purposes for keeping livestock,
   - feeding practices,
   - carrying capacities.

Specific issues. In addition to the preliminary survey, other farm surveys will be carried out as needed after the experiment has started. Kinds of information needed may include the following:

1. Inventory changes — to record changes (addition or losses) in the farmers' inventories during the crop season. The survey would be administered at the end of each season.

2. Resource utilization — to trace the flow of sources by collecting data on every input.

3. Disposal of production – to collect data on the production and its disposal for every crop in each cropping season.

4. Sale/marketing of production.

5. Animal diseases and medication/vaccination.

6. Disposal of livestock.

7. Sources of returns from livestock.

8. Livestock labor requirement by type of activity.

Record keeping. The information from surveys will have a number of weaknesses. Consequently, it is important to conduct farm record keeping as a part of the farming systems research. This will permit cross-checks of information gathered from the survey. The record keeping will cover a narrower scope of data and fewer samples. Monitoring forms will be filled out daily by the farmers. Village assistants will visit respondents (farmers) to check whether data has been recorded correctly.

Data collected will include:

1. Crop/livestock activities – to collect input data for field operations for every crop and parcel operated and input data on livestock components.

2. Production – to determine the quantity and value of the farmer's output. Data on disposal of products and by product will also be collected.

3. Marketing — To trace marketing channels through collection of information on the types of products sold, market locations, prices and manner of sale.

4. Income — off-farm income, non-farm income, pension and others.

5. Animal care and maintenance.

6. Animal diseases, accidents, and other losses.

7. Resource utilization.

Component Technology Studies (Crops)

These studies will be conducted at a central location as researcher managed trials. For the crop components, there are several studies that need to be continued.

A. Varietal testing. Further testing of promising lines of upland rice varieties that are resistant to blast disease and brown planthoppers is of prime important. Intensive selection will be carried out by the rice breeder in collaboration with IRRI.

Varietal testing for legumes will also be continued. Legume crops such as soybean, peanut, mungbean and cowpea have good potential on these upland red-yellow podzolic soils. The legume breeding project to be financed by IDRC and carried out by Dr. Sumarno is expected to be especially useful to this project.

B. Fertilizer efficiency and soil management. The podzolic soil is quite responsive to fertilization — especially to phosphate

fertilizer. Low pH and aluminum toxicity are the other major problems. To ameliorate these problems, phosphate fertilizer and liming can be used. But also, incorporation of organic matter (crop residues) is quite useful. These practices are being used in the upland rainfed cropping patterns but their effects on a longer term basis need to be evaluated.

C. Simple agriculture tools and implements. Intensive agriculture can not depend entirely on manual labor. This is especially true if the transmigrant farmers are to be able to cultivate all of their land that has been allocated by the Government. Studies on supplemental power sources, whether it is from draft animal or from semi mechanized tools or implements is needed. For transmigration areas, animal power and simple implements are likely most appropriate because of cost and simplicity. Farm implements, however, must be made more effective and efficient compared to the traditional tools. But newer designed tools must be produced locally and be economical. Farm operations that require supplemental power, include land preparation, planting, weeding and harvesting.

Component Technology Studies (Livestock)

Livestock have an important role in the farming system of the small farmer because of the synergistic interaction among food crops, cash crops and other agricultural enterprises. Livestock concentrate forages into manure that may be used to maintain the fertility of cropland and also provide draft power for land preparation. These are

important on farm processes and can increase the efficiency of farming and the fulfillment of the farmer's need.

A number of studies, mostly of applied and multi-disciplinary nature will be conducted. The primary aim will be to provide information needed to improve productivity and profitability of large and small ruminants within an integrated farming system of crops and livestock at the village level. Component technology studies needed for the animal research are as follows:

A. Forage species evaluation. Forage species will be evaluated on the bases of yield and suitability for particular uses in village farming systems. For example, what species are most adapted for communal grazing lands, lands particularly susceptible to invasion by weeds, backyard forage production, relay sowing with and after rice, and sowing under industrial tree crops such as rubber, coconuts, and fruit trees?

A large number of locally available and introduced species of grasses and legumes will be tested. Some of these species of grasses are *Panicum maximum*, *Paspalum plicatulum* and *Brachiaria spp*, and some of the species of legumes are *Stylosanthes spp*, *Macrotyloma axillare*, *Macroptilium Antropurpureum*, *Lablab purpureus*, and *Centrosema pubescens*.

B. Seed production. Scarcity of available seed is still a major constraint in pasture development work. Increased attention will be given to management requirements for maximizing seed production;

for example, seeding rates, fertilizer requirements and harvesting techniques.

Seed production is a highly suitable venture for low income farmers with large families who have but/little in the way of land resources. Using family labor, seed can be produced cheaply. Provided there is a market for the seed, even at a quite modest prices, the venture may be highly profitable and an additional source of income. Studies will be conducted to develop these possibilities.

C. Utilization of crop residues or animal feed (feeding trials). In a crop/livestock system, the crop residues and crop by-products are important feed sources. Varying types and amounts of crop residues are available on farms which practice intensive cropping systems. These residues need to be used more intensively in animal feeding.

Generally, crop residues are poor in nutrient content and therefore need to be supplemented with other high quality forage. Alternatively, crop residues could be treated with urea or other chemicals so as to improve their feed value.

Information is required on the yield and quality of fodder, as well as the crop residues, that may be expected from different forage species when used for livestock feeds in village farming systems. Feeding trials will be carried out to determine how this fodder can be used best in combination with other crop residues locally available.

D. Legume fodder trees. Shortages of green feed during the dry period (or other times) can be prevented by the use of products from some species of deep rooted legume fodder trees. These can also provide high protein green feed that may be used to supplement other poor quality forages.

Gliricidia maculata and Leucaena leucocephala are examples of species that will be used as the deep rooted legume fodder trees. These species will be grown in contours, and leaf collections from these trees will be studied for their general forage value.

E. Forage conservation. Animals need a year around source of nutritions feed in adequate quantities for maintaining production and sustaining satisfactory reproduction rates. Therefore, stored forage is a vital need even for the small scale farmers either as green, dry or ensiled forage. Studies will be conducted to develop inexpensive production and appropriate forage conservation methods suitable for adoption by smallholder farmers.

F. Communal grazing development and pasture establishment. In addition to promoting the development of pastures by small farmers individually, the community may develop the non-crop areas into communal grazing lands. Studies will be conducted to find out how to develop such communal lands as well as how to manage them properly.

G. Animal health. There is an urgent need for field studies at the village level to identify the major health problems affecting

village livestock production. For example, there are indications that calf mortality is a major problem, but the extent to which this is true, and the underlying factors are not well known.

Available information indicates that low fertility is a major factor limiting the growth of the large and small ruminant populations. Internal parasites are considered to be a major cause of mortality among young animals. Parasites probably also contribute significantly to the poor growth rate of young animals and the resultant low productivity of the adult animals.

A training program will be carried out continuously to educate junior staff, extension workers and farmers on the benefits of parasites control and to provide remedies for sale and/or distribution to the farmers at a price they can afford.

Designing and Testing of Crop/Livestock Systems

The crop/livestock systems to be tested will be based on a conceptual design that include certain rationale. The treatments and their rationale are as follows:

A. Farmers' system(s) — (with livestock)

B. Farmers' system(s) — (without livestock)

Rationale: (A&B)

To establish baseline checks for comparison

C. Farmers' system + Improved Feed

Rationale:

To determine production and economic potential of the livestock component with improved feed.

D. Farmers' system + Improved Feed and Animal Health Practices

Rationale:

To determine the production and economic potential of the existing crop/livestock system with improved management practices.

E. Introduced Crop/Livestock System

Rationale:

To determine the maximum production and economic potential of crop/livestock system under farmers physical setting but with major technological inputs.

The treatments will be replicated six times, with selected farmer cooperators as replications. Farmer cooperators will be selected from among those who have adopted the Introduced Cropping Pattern of Corn + upland rice / cassava / peanut - cowpea (including the farmers for treatment A) with the holding of livestock as uniform as possible. For all treatments, technical guidance will be provided for the cropping systems and livestock components as mentioned in each treatment. The Farming Systems Research Team will be composed of scientists from cropping systems, animal nutrition, and forage agronomy. This team will take records and monitor intensively the performance of each treatment on the collaborating farms. The project will provide seeds, fertilizer and other necessary inputs

and possibly some additional animals for treatment D (will be decided after the initial survey).

Meetings and Workshop

The farming systems research program in Indonesia is executed by a coordinated group of scientists from various disciplines and research centers. It is interdisciplinary and integrated with other government agencies and activities. It has been our experience in the previous CRIA-IRRI Cooperative Project on Cropping Systems (which was funded by IDRC) that frequent meetings and annual workshops improved understanding and generated better relationships among members of the working group and other personnel from different agencies working in the same program.

This project will continue to sponsor an Annual National Workshop in order to bring together all researchers, extension workers and other key personnel involved in farming systems research and development throughout the country. This will provide a forum for the researchers as well as policy makers to exchange technical information, discuss problems and plan field research and training. Meetings among the working group members will be held as often as necessary to assess the progress of the project and to provide guidance for field experiments.

Training

Indonesian Cropping Systems program for the past ten years has developed trained personnel through formal training both in country and abroad and through experiences in the field. An inter-

disciplinary group of scientists has developed but mostly for crops. Trained personnel with a broader scope of expertise is needed to deal with holistic farming systems research. The personnel that will carry out the research project must have sufficient knowledge and understanding of the crop/livestock systems to ensure the success of the project.

Incountry training will be conducted for research personnel and extension workers. The training will cover the different aspects of the farming systems, including all the commodities involved, their interaction and means of developing stable and sustainable farming systems. Monitoring tours will be organized at least once a year to see the progress and accomplishments made in the various sites and to share information and experiences among research, extension and local government personnel working on the same types of programs.

RESEARCH PERSONNEL

Bogor	Degree	Number
Project Leader	Ph.D.	1
Crops Coordinator	Ph.D.	1
Livestock Coordinator	Ph.D.	1
Agronomist	Ir/MS	3
Entomologist	Ir/MS	2
Agro-economist	Ph.D.	1
Statistician	Ir	1
Livestock specialist	Ir/MS	3

Project Site	Degree	Number
Coordinator	Ir	1
Agronomist	Ir	1
Agro-economist	Ir	1
Livestock specialist	Ir	1
Field assistant	SPMA/SNAKMA	6
Research aide	SMA	2
Driver		1

TOTAL BUDGET FOR THREE YEARS (US $)

Item	IDRC	INDONESIA	TOTAL
1. Salaries & Allowances	35,532	15,228	50,760
2. Research expenses	86,330	45,570	131,900
3. Travel			
Local	12,180	5,220	17,400
International	33,600	-	33,600
4. Training & Workshop			
In country	17,000	7,000	24,000
International	31,500	-	31,500
5. Workshop & publication	21,000	9,000	30,000
6. Equipment	38,500	13,500	52,000
7. Supporting services (9.5%)	26,186	-	26,186
8. Contingencies	30,419	-	30,419
Total for three years	332,247	95,518	427,765

BUDGETARY REQUIREMENTS – IDRC CONTRIBUTION TO OPERATIONAL BUDGET
(US $)

Item	Year 1	Year 2	Year 3	Total
Salaries & Allowances				
Professional staff	6,888	6,888	6,888	20,664
Technicians	3,780	3,780	3,780	11,340
Research aide	1,176	1,176	1,176	3,528
Research expenses				
Labor	5,600	3,500	2,450	11,550
Materials and supplies	20,500	10,000	5,000	35,500
Seeds and fertilizers	12,000	7,500	5,500	25,000
Expandable equipments	700	700	700	2,100
Office supplies	560	560	560	1,680
Vehicle maintenance and operation	3,500	3,500	3,500	10,500
Travel				
Local	4,060	4,060	4,060	12,180
International	11,200	11,200	11,200	33,600
Training				
In country	7,000	5,000	5,000	17,000
International	10,500	10,500	10,500	31,500
Workshop & publications	7,000	7,000	7,000	21,000
Equipment	21,000	10,500	7,000	38,500
Supporting services	10,969	8,157	7,060	26,186
Contingencies	12,643	9,502	8,374	30,419
Total $	139,076	103,423	89,748	332,247

COUNTERPART BUDGET FROM INDONESIA

Item	Year 1	Year 2	Year 3	Total
Salaries and allowances	5,076	5,076	5,076	15,228
Research expenses	26,940	11,040	7,590	45,570
Travel (local)	1,740	1,740	1,740	5,220
Training (in country)	3,000	2,000	2,000	7,000
Workshop & publications	3,000	3,000	3,000	9,000
Equipment	6,000	4,500	3,000	13,500
Total $	45,756	27,356	22,406	95,518

STATEMENT OF DEVELOPEMENT ACTIVITY
EXTENSION OF SMALL SCALE AGRICULTURAL EQUIPMENT
(PROJECT ATA - 220/IRRI)

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1. Name of project and code : Extension of small scale - Agricultural Equipment;ATA-220/IRRI

2. Location of project : - Central (Jakarta)
   - Regional : West Sumatera
     South Kalimantan
     South Sulawesi
     West Java

3. Main of project : a. To take part Indonesia on the program of IRRI for"Industrial Extension of small scale - Agricultural Equipment" in order to advantage fully of the research, develop, testing and evaluation of the small scale Agricultural Equipment by IRRI for food crops plantation so that to be hoped Indonesia will become self sufficient and self-reliant country in adequate for the need of the internal sufficient Agricultural Equipment Machine.

   b, To create climate that suitable for development of manufacture and utilization of the agricultural equipemnt machine internal production.

4. Target of erection : The person who use the Agricultural Equipment Machine or the Institution of farmer and (Industry Department-Manufacturer of the Agricultural-Equipment Machine.)

5. Time limitation : September 1978 through September 1985
6. Executor (Indonesia) : Sub Directorat Development Equipment And Machine Agricultural
7. Sponsor : USAID/IRRI
8. Kind of support : Grant
9. Budget : See the attachments
10. Activity :

10.1. Physic Realisation (On percentage)

NO	LOCATION	BUDGET / YEAR			
		1979/1980	1980/1981	1981/1982	1982/1983
1.	Central	100	100	99,98	70,15
2.	West Sumatera	100	100	100	99,95
3.	South Kalimantan	100	100	100	64,15
4.	South Sulawesi	100	100	100	96,35
5.	West Java	-	-	-	-

Note : Data from West Java have not receipt

10.2. Development of project

NO	KIND OF ACTIVITY	PERIOD/YEAR				
		1978/1979	1979/1980	1980/1981	1981/1982	1982/1983
1.	Personal and office					
	a. Office	Not (Expert office- at H.I.)	Yes (The earlier of 1980 at Tanjung Barat)	Yes	Yes	Yes
	b. Personal	Expert and Counterpart	Yes	1 expert 4 engineers 2 draftman 27 Workshop staff 2 secretarial	Yes	Yes
2.	Pilot project area	-	W.Sumatera S.Kalimantan S.Sulawesi	Yes	Yes	Yes + W.Java
3.	Development of Manufacturer	6	12	14	18	27

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4. Development Agricultural Equipment Machine IRRI design internal production (see attachments 2)	230	560	2737	5744	9994
5. Practise/Training					
a. Abroad	2	3	5	12	-
b. Indonesia (+Regional)	-	7	22	97	-
6. Exhibiton and meeting/seminar Agricultural Equipment Machine design by IRRI	-	Centre : Hilton Htl.	-Centre: Tj.Barat Jakarta -West Sumatera 1X	xCentre/ Bogor : -Horizon Htl. -Bina Graha -Campus IPB -BPTP Muara xWest Sumatera2X xSouth Kalimantan1X	-
7. Development, Modification prototype Agricultural Equipment Machine made by Workshop Tanjung Barat (See attachments 3)	-	8	20	47	38 continued
8. Testing Agricultural Equipment Machine	-	8	20	47	38

10.3. Sending Agricultural Equipment Machine to district (See attachments 4)

11. Problems :

11.1. Manufacture and modification Agricultural Equipment Machine

11.1.1. Raw materials and componen has not a good standard on qualification and dimension.

11.1.2. The skill of the makers Agricultural Equipment MAchine is not qualified.

11.1.3. The tools of workshop is not complete.

11.1.4. To many input modification, so that it needs the standard for each machine

11.2. Testing Agricultural Equipment Machine

11.2.1. The tools of testing is not complete

11.2.2. The testing has done likely testing in the field and laboratory

11.3. Manual

11.3.1. The capability ofthe manufacturer in regional is not ready (Quantity and skill)

11.3.2. The total activity and fund is used for regional manual activity so small, so that the motion of the official is limited to instruct.

11.3.3. The cooperation among institution so little especially in South Kalimantan and South Sulawesi

11.3.4. The skill of the instructor the Agricultural Equipment Machine at district is not available.

11.4. Training

11.4.1. The tools is not satisfied

11.4.2. Fund and time is limited

11.4.3. The back ground Heterogenitas of education and profession

11.4.4. Distribution officials that have been trainned is not suitable and fit with the skills.

11.5. Counter Budget

11.5.1. Counter budget Rupiah is not available with the activity

12. Conclusion

12.1. To observe from the aim of the project is to help the preparation of Agricultural of small scale Equipment that can make it locally, not expensive and easy to use, to maintain and to repair, this project is sufficient advantage.

12.2. To observe from the reality this project has appear the result :

- To lead many manufacturer so that they can make Agricultural Equipment Machine in locally style.
  * outside Java island = ± 20 manufacturer
  * inside Java island = ± 7 manufacturer
- The total production of manufacturer until April 1983 = 9.994 unit, it's consist of many kinds of the Agricultural equipment machine.
- Most of the Agricultural Equipment machine is used by the farmer
- The total of the officials that has been trainne is 109 persons

12.3. Thinking about this project that give the best reality and the fund from USAID inclined go down, so the precaution fund from DIP must be ascend

Jakarta , May 1983

Attachments : 1

The total budget in DIP and fund from USAID :

NO	Location	Budget/Year	Cost of resource (x1.000)			
			G.O.I. (Rp.)	USAID ($)	USAID (RP.)	Total (RP.)
1.	Central	1978/1979	-	80	52.800	52.800
		1979/1980	12.480	125	82.500	94.980
		1980/1981	6.050	56	36.960	43.010
		1981/1982	16.780	75,9	50.099	51.879
		1982/1983	16.808	50**	33.000	49.808
		Sub Total	52.118	386.9	255.359	292.477
2.	West Sumatera	1979/1980	3.790	-	-	3.790
		1980/1981	3.225	-	-	3.225
		1981/1982	4.675	-	-	4.675
		1982/1983	4.850	-	-	4.850
		Sub Total	16.540	-	-	16.540
3.	South Kalimantan	1979/1980	3.890	-	-	3.890
		1980/1981	3.725	-	-	3.725
		1981/1982	2.150	-	-	2.150
		1982/1983	3.375	-	-	3.375
		Sub Total	13.140	-	-	13.140
4.	South Sulawesi	1979/1980	4.460	-	-	4.460
		1980/1981	2.535	-	-	2.535
		1981/1982	1.625	-	-	1.625
		1982/1983	6.175	-	-	6.175
		Sub Total	14.795	-	-	14.795
5.	West Java	1982/1983	18.740	-	-	18.740
	Total Amount		96.593	386,9	255,359	355.692

Note : *) 1 $ = Rp. 660,-

**) = Estimate

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Lampiran 2

Appendix V

PROGRESS OF MANUFACTURE OF IRRI SMALL FARM EQUIPMENT IN INDONESIA

Manufacturers	Hand Tractors up to		THRESHERS up to		AXIAL FLOW PUMP up to		Dryers up to		Transplanters up to		Other implements up to		Rem
	79/82	82/83	79/82	82/83	79/82	82/83	79/82	82/83	79/82	82/83	79/82	82/83	
WEST SUMATRA													
PT. SUTAN MASIN, PADANG	-		40	5	-		-		-		10*		*Weed
PT. SARASAN Industri Bukittinggi	1		70	32	-		-		-		55*	30 *	*Weed
PT. TAMI MAKMUR, PADANG	-	-	5	-	-	-	-	-	-	-	-	-	
PUD. DEWISRI, PADANG - PARIAMAN	-	-	8	17	-	-	-	-	-	-	-	-	
BENGKEL Karya Indah, Sicincin	-	-	-	6	-	-	-	-	-	-	-	-	
Bengkel Hidah Tehnik, Padang	-	-	-	10	-	-	-	-	-	-	-	-	
Bengkel Jaya (Agam)	-	1	23	28	-	-	-	-	-	-	-	20*	* Weed
Bengkel Alam Gadut (Agam)	-	-	18	14	-	-	-	-	-	-	-	-	
Bengkel Batu Batungak (Agam)	-	-	3	3	-	-	-	-	-	-	-	35*	* Weed
Bengkel Sarasah Indah (Sijunjung)	-	1	-	13	-		-	-	-	-	-	52*	* Weed
BENGKEL DIPERTA BUKIT-TINGGI	2	2	3	3	3	-	-	-	4	-	200*	-	* Weede
Bengkel Mochtar Bukittinggi	-	-	15	3	-	-	-	-	-	-	-	-	
BENGKEL KONSTRUKSI DSM BUKITTINGGI	-	-	-	6	-	-	-	-	-	-	-	-	
BENGKEL PANDAI BESI URRA BUKITTINGGI	-	-	-	-	-	-	-	-	-	-	-	200 *	* Weeder
Sub Total	3	4	185	140	3	-	-	-	4	-	265	327	
SOUTH KALIMANTAN													
BENGKEL H. SABLI K BANJARMASIN	1	-	6	-	9	10	-	-	-	-	2*	-	*Weeder
BENGKEL ANTOSA, KANDANGAN	-	-	-	-	-	-	-	-	-	-	2*	-	* Weeder
Bengkel Johan Negara	-	-	-	-	-	20	-	-	-	-	-	-	
SOUTH SULAWESI Sub Total	1	-	6	-	9	30	-	-	-	-	4	-	
BENGKEL DIPERTA SULSEL UJUNG PANDANG	-	1	-	10	1	-	-	-	-				
BENGKEL DIANA, PAPANG	-	-	-	1	-	-	-	-	-	-	-	-	—
BENGKEL USAHA TENAGA MAJU, Maseppe, Sidrap	-	-	-	2	-	-	-	-	-	-	-	-	
BENGKEL SIMODADI, PALOPO	-	2	-	-	-	-	-	-	-	-	-	7 #	# 1 Traile 6 Puddl
Sub Total	-	3	-	13	1	-	-	-	-	-	-	7	
JAVA													
BENGKEL TANJUNG BARAT, JAKARTA	7	2	9	2	10	1	1	-	8	1	12	4	
PT. TUGAS, JAKARTA	26	3	5	3	3	3	1	1	1	4	-	37#	# 20 Weede 13 tran
PT. HEN RUHAAK INDONESIA, JAKARTA	100 ¢	60 ¢	-	-	1535	900	20 #	980#	-	-	-		¢ imported # Husk bur
PT. KARANI SAPUTRA, PAMANUKAN	-	-	-	-	-	-	-	-	-	-	13*	8 *	* Trailers
PT. BUMA SAKTI (KOPO METAL) BANDUNG	11	-	148	2	4	-	79	-	45	-	52	2 #	# Grain cl
PT. MUSUHANA, TEGAL *	30	-	60	-	-	-	9	-	-	-	135	-	* Not repo
PT. HERCOA, SEMARANG	6	75	-	-	-	-	-	-	-	-	-	-	
PT. KARYA HIDUP SENTAUSA, YOGYAKARTA	940**	724**	235	455	-	530	-	-	-	-	-	-	** Thai tyn
PT. PURATIMA, SOLO *	60	-	94	-	6	-	-	-	-	-	1500*	-	*Weeder
Sub Total	1180	864	551	462	1558	1434	110	981	54	3	1712	51	* Not repo
SOUTH SUMATRA													
PT. MARTANI, PALEMBANG *	27	-	-	-	-	-	-	-	-	-	-	-	* Not repo
TOTAL	1,211	871	742	615	1571	1464	110	901	58	5	1981	305	
CUMULATIVE TOTAL	2,082		1,357		3,035		1,001						

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Attachment : 3

Total Agriculture Equipment Machine that made by Prototype Tanjung Barat Workshop and ordered by manufacturers (Project ATA 220/IRRI)

Kind of equipment	YEAR/UNIT					
	1979/1980	1980/1981	1981/1982	1982/1983 (March)	Total	Note
Made by Tanjung Barat-Workshop.						
1. Hand Tractor 6HP	1	2	4	-	7	
2. Hand Tractor 4HP	-	-	-	2	2	
3. Transmission Box 4HP	-	-	-	2	2	
4. Axial Flow Pump 6"	2	4	-	2	8	
8"	-	-	1	-	1	
10"	-	-	2	-	2	
5. Transplanter	2	3	3	1	9	
6. Weeder						
- Rice field	-	5	7	-	12	
- Dry land	-	-	-	4	4	
7. Thresher						
- TH-6	2	5	2	2*	11	*Modification
- TH-7	-	1	-	-	1	
- Pedal(Dian Desa)	-	-	-	2	2	
- Peda (ITB)	-	1	-	-	1	
8. Dryer						
- Drier Husk Furnace	-	-	-	-	-	
- Solar sryer	1	-	-	-	1	
9. Jig/Fixture :						
- Axial Flow Pump	-	2	8	-	10	
- Transplanter	-	-	-	1	1	
- Reaper	-	-	-	2	2	
10. R I P	-	-	-	4	4	
11. Reaper 1,0 m	-	-	-	2	2	have done
1,6 m	-	-	-	1	1	
12. Harrow	-	-	2	1	3	
13. Puddler	-	-	-	2	2	
14. Plough	-	-	-	4	4	
15. Trailler	-	-	2	-	2	
16. Testing blower	-	1	-	-	1	
17. Leveller	-	-	-	1	1	
18. Grain Cleaner	-	-	-	1	1	
19. Harrow triangle	-	-	-	1	1	
20. Cage wheel	-	-	16 pcs.	3 pcs.	19 pcs.	

Attachment : 3.

Kind of equipment	Year / Unit					Note
	1979/1980	1980/1981	1981/1982	1982/1983 (March)	Total	
Order from - manufacturers						
1. Hand tractor 6HP	-	-	14	-	14	
2. Tire wheel	-	-	11 pcs.	-	11	
3. Mold Board plough	-	-	28	-	28	For Rice field and dry land
4. Harrow	-	-	11	-	11	
5. Puddler	-	-	11	-	11	
6. Trailler	-	-	11	-	11	
7. Thresher	-	-	3	-	3	
8. Dryer						
- Solar sryer	-	-	5	-	5	
- Drier Husk - Furnace	-	-	1	-	1	
9. Plow sole - applicator	-	-	2	-	2	
10. Jig/Fixture	-	-	1	-	1	For Hand-Tractor 6HP

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THE TOTAL OF AGRICULTURE EQUIPMENT MACHINE THAT HAVE SENT TO DISTRICT (UNIT) FROM 1980 THROUGH 1983 (MARCH).

NO	DISTRICT	HAND TRACTOR		PLOUGH		HARROW		PUDDLER		CAGE WHEEL	TIRE WHEEL	BOX TRANSMISSION		TRAILLER	WATER PUMP			TRANSPLANTER	WEEDER	R I P	THRESHER	DRYER	JIG & FIXTURE	N O T E
		6 HP	4 HP	6HP	4HP	6HP	4HP	6HP	4HP			6 HP	4 HP		6"	8"	10"							
1.	West Sumatera	2	-	2	1	2	-	1	-	2 pcs.	-	5 *	3 *	-	1	-	-	2	-	-	2	1	2 set	*Include 1 set gear
2.	South Kalimantan	2 +	-	2	-	2	-	-	-	2 pcs.	-	-	-	-	2	-	1	2	2	-	2	1	-	+ 1 Unit Hand Tractor
3.	South Sulawesi	2	-	2	-	2	-	-	-	2 pcs.	-	3	-	-	-	-	-	2	2	-	2	1	-	and Plough and 1
4.	West Java	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	unit power tiller
5.	North Sumatera	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
6.	Central Java	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
7.	BPTP SUKAMANDI	1	-	1	-	1	-	1	-	1 pcs.	-	-	-	1	1	-	-	1	4	1	1	1 £	-	£ Dryer Husk Furnace
8.	Project Luwu	10	-	20	-	10	-	10	-	20 pcs.	10 pcs.	-	-	10	-	-	-	-	-	-	-	-	-	
	T O T A L	17	-	27	1	17	-	12	-	27 pcs.	10 pcs.	8	3	11	5	-	1	7	8	1	8	6	2 set	

Name of project	: Extension of small Agricultural Equipment/ IRRI ATA 220
I. Discription of project	:
1.1. Programme	: To extend production
1.2. Project/DIP	: To extend food crops production
1.3. Executor	: Directorat of food crops production Ir. Imam Satoto/Chaidir
1.4. Location	: Centre + 5 Provinces (West Java, North - Sumatera, West Sumatera, South Kalimantan, South Sulawesi).
1.5. Sponsor	: USAID/IRRI
1.6. No./Date of appointment	:
1.7. Expired project	: 1980-1985
II. The purpose of project	: To help Indonesia become self sufficient and self reliant country in order to adequate the needs of Agricultural Equipment Machine by strengthen and institute the small manufacture Agriculture equipment.

III. The target of project :

3.1. Must be reach : Extension of the capability in Agriculture Equipment Machine Department for self sufficient and self reliant.

3.2. Have been reached until now : To plan design and test griculture Equipment Machine like in Indonesia condition
- Prototype workshop

3.3. Still reach : To support the extension of smallIndustry Agriculture equipment machine for self sufficient and self reliant

3.4. Problems :

*) The end of July 1982

IV. YEARLY WORK PLAN PROJECT

ACTIVITY \ YEAR	I (FIRST) 1980/1981	II (SECOND) 1981/1982	III(THIRD) 1982/1983	IV (FOURTH) 1983/1984	V(FIFTH) 19 /19	VI(SIXTH) 19 /19
4.1. Physic						
L.C.						
F.C.						
4.2. Financial	156.535	25.230	49.945	-	-	
L.C.				69.000 (Central)		
Rp. 360.000,-				74.000 (Regioanl)		
$ 337.3						
F.C.	$ 80	$125	$56	55.000		

Name of project	: Regional Network for Agricultural Machinery
I. Discription of project	:
1.1. Programme	: To extend production
1.2. Project/DIP	: To extend food crops production
1.3. Executor	: Directorat of food crops production Ir. Imam Satoto D.
1.4. Location	: 1. Indonesia (Directorat General of food-crops Agriculture, Jakarta), 2. India, 3. Korea Selatan, 4. Pakistan, 5. Philippines, 6. Sri LAngka, 7. Thailand, 8. Iran.
1.5. Sponsor	: United Nations Development Prog. amme Australia, Jepang
1.6. Number/Date appointment	: Phase I, Nomor RAS/76/013/A/01/53, Date January 25,1978. (With Industry Dept./ MIDC Bandung) Phase II, Number RAS/81/117, Date (With Agriculture Dept./Directorat General of Agriculture)
1.7. Expired porject	: Phase I, 1978 until 1981 Phase II, 1982 until 1984
II. The purpose of project	:

Short period :

- To identify problems in Agriculture - Mecanisation and Agriculture Equipment Machine Industry
- To extend the capability of Institution National Level in testing, evaluation, design, and development for making prototype fitting with local Industry Commodity.
- To support manufacturer and local Industry for making Agriculture Equipment MAchine.

Long period :

- To extend the small farmer life level by using the equipment and Agriculture machine and Efficient technology with locally equipment product.

IRRI-DITPROD INDUSTRIAL EXTENSION PROJECT
P.O. BOX 18/KBYPM. PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782557

May 18, 1983

To : Dr. J. Ritchie Cowan
IRRI-Liaison Scientist

From : V.R. Reddy
Agricultural Engineering

Subject : Quarterly Report
April through June 1983

Trips :

April 5th - April 7th	: To visit Padang with Dr. C.W Bockhop to see the progress of project extension work in West Sumatera.
April 16th - April 18th	: To visit M.I.D.C., I.T.B. and D.T.C. Centres in Bandung.
April 22nd	: To see the field trials (with Sdr. Zaidir) of IRRI equipment in Seedfarm and visit B.P.T.P. at Sukamandi
April 25th - April 27th	: To visit Banjarmasin with Sdr. Zaidir and Sdr. Suwardi to attend demonstration of IRRI equipment and hold discussions with Provincial Government officials.
May 5th	: To visit B.P.T.P. and see the field trials of IRRI equipment.
May 3rd - May 4th	: To visit Puncak to attend the Post-Harvest seminar with Mr. Bob Stickney.

May 6th - May 11th : To visit Bali to hold discussions with Provincial Government and Bank Indonesia Officials who showed interest in IRRI equipment.

Dr. Clarence Bockhop, Mr. Kevin Rushing and myself had a good visit with the Junior Minister of Agriculture Mr. Wardoyo and Director Mr. Jafri Jamaluddin at Salemba. Mr. Wardoyo expressed his general satisfaction with the progress of this project work in Indonesia. However, he expressed due to the general policy of tightening of Government's expenditure this year, the budget contribution from G.O.I. for this project will be less than last year and wanted IRRI/USAID to bear with it.
The Junior Minister expressed the hope that due to devaluation and the Governments policy to decrease imports, the inidigenously produced farm equipment should get a spurt in meeting the rising local demand.
He advised us to approach cooperatives in the Provinces whose financial liquidity is being considerably improved due to the recent Government decision and they should be in a better position to purchase the equipment and rent it out to their members.

Visited several cooperative manufactures in West Sumatera with Dr. Clarence Bockhop. In general their production and sales are continuing to rise. Three manufacturers have received orders from two dealers to export TH 6 threshers to Aceh, Jambi and Riau

Provinces. More than 15 numbers were already dispatched and 30 were on order. At the same time the interesting development that has taken place (mainly due to the dealers coming into the picture) is that while the quality of the product has improved but the price has come down due to competition from Rp. 450.000,- to Rp. 300.000,- (without engine). We estimate at this price also there is sufficient profitability (more than Rp. 100.000,-/pce.) to the manufacturers.

We met Mr. Nurmawan, Inspector of Diperta at Padang. He has stressed the need to accelerate the promotion of hand tractors and water pumps in W. Sumatera during the coming months. We have prepared a background note for promoting hand tractors in W.Sumatera, a copy of the same is enclosed herewith. It may be noted we are planning to conduct a special training programme for fabricating hand tractors by the potential manufacturers in that province.

In South Kalimantan Diperta has organized a major demonstration of IRRI equipment in Kabupaten Hulu Sungai Selatan on April 26th. Senior Provincial Government and district officials of Agriculture, Industries, Planning (Bappeda), Bank Indonesia and Bank Rakyat Indonesia along with two of our counterpart staff and myself were present.

More than 60 leading farmers from nearby districts and three cooperative manufactures were also present at this occasion. After

demonstration of hand tractor, TH 6 paddy thresher, pedal thresher and axial flow pump, discussions were held among those present. Many farmers there seemed quite satisfied with the performance of the equipment that was demontrated and indicated their readiness to purchase such locally fabricated equipment provided the credit was made available from the Banks. The Bank officials present responded favourably and expressed their willingness to consider few cases to start with in certain potential areas with the recommendations of local Diperta officials. Meanwhile Bank Indonesia Consultant has taken all the necessary information from us to make the proposal with feasibility studies. The most interesting development (in Kecamatan Negara of this district) that is taking place is that the demand for axial flow pumps is rapidly rising. Already one local manufacturer there has produced 20 pumps to pump into water channels used for transporting with small boats. This manufacturer has shown his interest in taking up the manufacture of hand tractors also.

During this period 1 meter reaper that has been produced in Tanjung Barat workshop is being tested at Sukamandi seed farm. Also various attachments like plough, puddler, harrow, small-trailer (1/2 ton capacity) are being tested with the small hand tractor so that this unit can be used not only for harvesting but also for land preparation, and transporting also.

At present 4 Agricultural Engineering college students are undergoing practical training mainly in testing of pump, hand-tractor, thresher and reaper in preparation for their thesis. Previously six students from I.P.B. Bogor, Gajah Mada University also used our facilities and equipment for their thesis work.

Visited Denpasar on receiving special request from the Consultant to Bank Indonesia to advise them with regard to the introduction of IRRI type farm equipment in Bali and Lombok islands. Detail tour report is enclosed. The main findings of our visit are as following :

In the province of Bali, extention of pedal thresher and pedal winnower is to be taken up on priority. The usage of hand weeders also needs to be popularised as at present mostly hand weeding is done taking more than 3 times the cost and the time to weed. In the two areas where some imported hand tractors are finding increasing use can be encouraged to take up IRRI type hand tractors.

It appears the need for IRRI type farm equipment in N.T.B. is greate seeing the higher wages prevailling and the scarcity of Agricultural labour there. However, for taking up this province also for extention work in addition to the existing 4 provinces, the project needs the consent of G.O.I. and also more staff and more budget.

Leaving Jakarta on May 28th for attending ASAE meeting in Montana, USA and also going on home leave until July 12th, '83.

PROMOTION OF LOCALLY MANUFACTURED HAND TRACTORS IN WEST SUMATERA.

Background Information

West Sumatera is facing increasing shortage of Agricultural labour for growing food crops in the province. This is particularly so in West Sumatera because of the customary practice of young men of Minangkabau leaving their 'kampung' to towns/cities and even to other provinces seeking new and better careers. This phenomena (called-'merantau' in local language) is causing higher agricultural wages, now ranging between Rp. 1.500 to Rp. 2.500,- per day, and leaving several *thousands of hectares of sawah land uncultivated in certain areas of the province.

Therefore the provincial Government has been emphasising the need to introduce agricultural mechanisation on priority basis. Infact during '78/'79 a proposal was made to offer about 1.000 imported mini-tractors to cooperatives and leading farmers of the province through soft loans of Bank Rakyat Indonesia. This proposal was, however, turned down by Bank Indonesia due to the sudden increase of tractor prices after the devaluation in 1978. Also from the experience in South Sulawesi, it was found that due to the high cost and shortage of spareparts, and higher skills required for operation and maintenance of these imported tractors, large number of them were found

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* As per the Government and Inspector of DIPERTA of West Sumatera.

under repair and idle.

Therefore the introduction of locally manufactured simpler hand tractors and other small farm equipment seems to be more appropriate choice from a long range point of view and for the real "bottom-up" development process to take place. Comparative cost analysis between locally made hand tractor and imported mini-tractor is enclosed herewith.

The Progress of IRRI-DITPROD project in West Sumatera.

IRRI- designed small farm equipment has been introduced in this province from the year '78/80 onwards. Within the period of last three years, particularly the progress of weeders and paddy threshers'local production and sales has been quite impressive. Infact it is reported that presently more than 14 manufactures are producing paddy threshers. More than 300 threshers thus produced locally are being used by the farmers and most of them are renting to others farmers, as they find it very profitable both for the renter and the farmer using the equipment. Therefore the demand is steadily increasing.

However, the spread of IRRI-designed hand tractors has been delayed due to initial difficulties of getting transmission gear-box manufactured locally with the necessary quality and standardisation. This problem has

been solved by developing necessary jigs and fixtures and training few local manufacturers in Java. They are now being successfully manufactured and supplied to outside Java provinces.

Out of the three hand tractors manufactured from the improved gear-boxes by DIPERTA workshop at Bukittinggi, one unit was tested during the last season in Muarobono, Sijunjung. They have been able to complete 12 Ha of sawah land ready for transplatation by using for about 180 hours within a period of six weeks. This successful demonstration cum testing has induced immediately about five-farmers in that area to purchase this type of hand tractors.

Plan of Action For Manufacturing Hand Tractors in West Sumatera

In view of the priority to meet the increasing needs of the land preparation equipment in this province, it is suggested a special programme of action be prepared to accelerate the tempo of this local manufacture along the following lines :

1. To identify two/three potential manufacturers (preferably in Kabupatens where need for such hand tractors is greater, for example Kabupaten Agam, Solok, Sijunjung, ...etc.) in addition to Bengkel DIPERTA at Bukittinggi for conducting a special training programme for the manufacture of hand-tractors.

Trainers from IRRI-DITPROD and MIDC will give practical training showing the actual fabrication of entire hand tractor (except engine and standard parts) and its accessories like plough, puddler, trailer, etc. with the help of jigs & fixtures etc. over a period of two weeks or so. One set of jigs and fixtures to be supplied to each of the selected manufacturers to enable them to fabricate in their workshops.

2. Meanwhile DIPERTA to identify atleast two/three more areas like Muarabono in Sijunjung for demonstration cum testing through local leader farmers to create interest among several farmers around there. Those interested farmers can be recomended for getting credit from B.R.I. as per the rules and conditions stipulated in the circular dated July 30, 1981 No.B-2531/KON1981.

In order to stimulate the demand and accelerate the tempo of this whole scheme, it is important that there are atleast five/six farmers to start with, who are ready to purcase from each of the above selected and trained hand-tractor manufacturers. From our previous experience we feel this initial thrust will create proper climate for continuous growth as is happening in the case of paddy threshers in W. Sumatera . Since the cost of hand-tractor with important attachments like plough, puddler, harrow and one ton trailer will cost the farmer about Rp. 2.0 X 10^6, the role of Bank Credit is much more crucial than it has been in the case of paddy threshers costing only around Rp. 500.000,-

Benefits of Local Production of Hand Tractors.

The cost analysis profitability for the manufacture and for the custom work of these hand tractors is enclosed herewith. It may be noted that it is profitable not only for the manufacturer, but to the custom hirer and to the farmer renting the equipment. Further this process will increase the skills of local manufacturers and provide increasing number of off-farm jobs, which as we all know is a necessary sign of economic growth.

Monitoring of The Programme during the Initial Period.

It is very important that during the initial period (may last for 6 to 9 months) proper supervision and technical support is given to both the manufacturers and the users of the equipment until all concerned are satisfied with the quality and performance of these locally produced hand tractors as is happening in the case of paddy thresher's production growth. The team taking this responsibility is suggested to consist of a representative from DIPERTA, Perindustrian, B.I./B.R.I. and IRRI-DITPOD.

In a meeting among these members, detail schedule, activities and additional budget required can be discussed and decided.

VRR/March '83.

IRRI-DITPROD INDUSTRIAL EXTENSION PROJECT
P.O. BOX 18/KBYPM. PASAR MINGGU, JAKARTA SELATAN INDONESIA TELEPHONE : 782557

May 18, 1983

To : Dr. J.R. Cowan
IRRI-Liaison Scientist

From : V.R. Reddy
Agricultural Engineering Consultant

Subject : Bali Tour Report

Left for Bali on May 6th evening flight. On May 7th morning, met Mr. Marcel Boegaerts, consultant to Bank Indonesia in Bali at the hotel. He took me to DIPERTA office and introduced me to Mr. Tenaya, inspector of DIPERTA.

Mr. Tenaya informed me that there are two districts, Tabanan and Singaraja where due to shortage of labour, the need for farm mechanisation is greater. The total area in Bali under Sawah is about 98.000 Ha and more than 60 % is cultivated two times/year and 90 % of area is using H.Y.V. of paddy. There are about 1.200 subaks, (farmer groups) which are unique in Bali only and are known for their effectiveness in not only controlling water distribution but also other agricultural inputs. According to DIPERTA records, as on '81 ending they have about *300 Hand Tractors, 20 Mini Tractors, 1000 Water-pumps, 400 pedal threshers, 1.550 Rice mills.

* Most of them are in Tabanan and Singaraja districts.

Mr. Rakka Mulyan Adi, officer of DIPERTA looking - after mechanisation has taken me to Desa Kapal near Denpasar to visit their seed farm and repair shop for hand tractor nearby. The field survey for post-harvest losses conducted by this group has revealed that threshing losses alone are up to 3,5 %. Their major priority area now is to decrease these post-harvest losses through extention. Their seed farm had two imported hand tractors, two IRRI-type paddy threshers manufactured by Kobuta, Yogya, one pedal thresher and one winnower. Except for the hand tractors, the above equipment was not being used.

We then visited small repair shop Bakti Pertiwi and met the owner Mr. Nyoman. He had one lathe machine, one drilling machine and one electric welder. He had 5 hand tractors which came for repairs from farmers of that area.

He seemed very confident young man and already made plans for expanding to manufacture and sell farm equipment. He showed great deal of interest to manufacture IRRI type hand tractors and threshers. Finding him a very potential candidate for our assistance, on the recommendation of DIPERTA, we have supplied him 'Memorandum of Agreement'. After he fills up the form, we shall be sending the technical drawings and other information he requires.

IRRI·DITPROD

Since Mr. Lulu Yusuf, Managing Director of Bank - Pembangunan Daerah had come for a meeting to Bali from Mataram, I had to cancel my visit to Mataram. I and Mr. MArcel Boegaerts had a very good visit with him on May 9th at Pertamina Cottage. He shows great deal of interest in the entire range of IRRI type farm equipment. According to Mr. Yusuf, Lombok is very short of labour and that is why their daily wage for Agricultural labour is around Rp. 3.000,-/day.

Since most of the Agricultural operations like land preparation, transplantation and harvesting are carried out simulataneously during peak seasons there is a marked shortage of labour during such periods. One of the units, Bank Pembangunan Daerah promoted Wisaya YAsa is already manufacturing some agricultural tools and other engineering equipment. He recommends that this unit be provided the technical information and training to take up the manufacture of IRRI type equipment. However, after discussing various details, it has been decided that Mr. Yusuf will discuss with the Governor of N.T.B. and will coordinate with DIPERTA and Perindustrian to send a team to visit Jakarta and see our facilities and also discuss with DITPROD officials for including N.T.B. as one of the provinces to take up field extention work.

We visited interior areas of Tabanan and Singaraja on May 11th to get some information from the farmers in the field and also met few potential manufacturers. We were able to collect the following information from the farmers in the field.

The hand tractors operating in the area are generally in great demand and they are renting out for Rp. 45.000,- to Rp. 50.000,-/HA. Some of the custom hirers are owning more than two hand tractors and find them quite profitable. However, after recent devaluation the cost of imported hand tractors has further increased, therefore showed greater interest for less expensive locally manufactured IRRI type hand tractors. Traditional bullock ploughing comparatively costs up to Rp. 80.000,-/Ha. The cost of pair of cows is around Rp. 300.000,- and can cultivate 15 are/day (4 to 5 hours only) and need to plough 4 times ready for transplanting. Threshing capacity of each person/day in traditional manner is around 50kg and the wage paid is Rp. 1.500,-/day.

To start with, it seems more appropriate for Bali is to introduce improved pedal threshers and pedal winnowers. We have given the sketches showing the dimensions of improved pedal threshers which are now being used in Central Java.

The DIPERTA official has indicated that they will build few proto-types and show demonstrations during the coming season.

We also visited a small workshop in Singaraja, 'Kelana' and met the owner Abdillah Hery. He has already manufactured threshers mainly used for local variety paddy and supplied to local rice milling units. The quality of these threshers were not found up to the mark and they were not under use in a rice mill unit, which we visited later. He, however, shows great interest to take up manufacturing of IRRI-type farm equipment provided the demand is created.

We recommend Bali will do well to take up the extention of pedal thresher and pedal winnowers as first priority.

The usage of hand weeders also needs to be popularised as at present mostly hand weeding is done taking more than 3 times the cost and the time to weed.

In the two areas where some imported hand tractors are finding increasing use can be encouraged to take up IRRI-type hand tractors.

It appears the need for IRRI-type farm equipment in N.T.B. is greater seeing the higher wages prevailing and the scarcity of agricultural labour there. However, for taking up this province also for extension work in addition to the existing 4 provinces, the project needs the consent of G.O.I. and also more staff and more budget.

THIRD INTERIM FIELD REPORT ON THE PERFORMANCE OF HAND-TRACTORS IN PROJECT LUWU AREA (FROM OCT.'82 TO MARCH'83)

This year due to late rains, the wet season started in the month of January and was expected to last until late March. We are, however, still awaiting the data collected by the record keeper on the utilisation of 10 hand tractors in Bone-bone. As soon as we receive the data, the summary of their utilisation sheet will be sent separately.

Meanwhile we had received a very disturbing letter from Proyek Luwu authorities about the performance of the above 10 hand tractors. Immediately Mr. V.R. Reddy went to Luwu to investigate into the matter. On his return he has submitted a detail report, a copy of the same is enclosed. It may be noted that the charges made in the above letter were exaggerated and the actual situation was nowhere as bleak as was made out in that letter. We have had to terminate the services of the assistant site supervisor and hand over the office and the remaining staff to FCC Bone-bone office, as was mutually agreed then.

On march8th, Mr. Bart Duff, associate economist from IRRI has presented the detail report* which was prepared from the data collected for the first two seasons which was processed by the computer and was analysed at Los Banos. The list of the participants in this meeting is enclosed. In this meeting the consensus that emerged was that the emphasis from the record collection

* See Cowan's letter to Col. Heru - attached appendices provide copy of report and other pertinent details

of field data is to be changed to entrepreneurial development for the manufacture and sale of hand tractors and other IRRI type farm equipment in the project area. As reported earlier already one manufacturer in Palopo has been assisted to manufacture two hand tractors complete with attachments which were successfully tested in the field.
The initial demonstrations of paddy thresher and transplanter were conducted in Bone-bone. Two paddy thresher manufacturers were also assisted to fabricate them in Sidrap and Rappang districts. IRRI-DITPROD Industrial Extention Project is continuing to assist the local fabricators to manufacture IRRI type small farm equipment within the province.

Current developments in West Sumatera is worthy of note in this report. Appendix 1 reflects some pertinent information which will be interest to those directly involved with this project.

List of invitees attended the Luwu Meeting in
Sahid Java Hotel
March 8,1983

A. IRRI	- 1.	Mr. Bart Duff
	2.	Mr. V.R.Reddy
	3.	Dr. J.R.Cowan
B. USAID	- 4.	Mr. W.Tappan
	5.	Mr. Prusner
	6.	Mr. Barrau
	7.	Mr. Ackerman
	8.	Mr. Machmer
C. BPLPP	- 9.	Mr. Swastiko
	10.	Mr. Arifin
	11.	Mr. Hidayat
D. DITPROD	-12.	Ir.Zaidir Said
	13.	Mr. Made Dasnaya
E. S.Sulawesi Luwu Project	14.	Mr. Sam Filliaci
	15.	Mr. Sudiro
	16.	Mr. Purnomo

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Therefore the provincial Government has been emphasising the need to introduce agricultural mechanisation on priority basis. Infact during '78/'79 a proposal was made to offer about 1.000 imported mini-tractors to cooperatives and leading farmers of the province through soft loans of Bank Rakyat Indonesia. This proposal was, however, turned down by Bank Indonesia due to the sudden increase of tractor prices after the devaluation in 1978. Also from the experience in South Sulawesi, it was found that due to the high cost and shortage of spareparts, and higher skills required for operation and maintenance of these imported tractors, large number of them were found

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200

Trainers from IRRI-DITPROD and MIDC will give practical training showing the actual fabrication of entire hand tractor (except engine and standard parts) and its accessories like plough, puddler, trailer, etc. with the help of jigs & fixtures etc. over a period of two weeks or so. One set of jigs and fixtures to be supplied to each of the selected manufacturers to enable them to fabricate in their workshops.

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Monitoring of The Programme during the Initial Period.

It is very important that during the initial period (may last for 6 to 9 months) proper supervision and technical support is given to both the manufacturers and the users of the equipment until all concerned are satisfied with the quality and performance of these locally produced hand tractors as is happening in the case of paddy thresher's production growth. The team taking this responsibility is suggested to consist of a representative from DIPERTA, Perindustrian, B.I./B.R.I. and IRRI-DITPPOD.

In a meeting among these members, detail schedule, activities and additional budget required can be discussed and decided.

VRR/March '83

Report of Consultancy to Indonesia
January 28 to March 13, 1983

H. M. Beachell

Introduction

The terms of reference for the consultancy referred specifically to the hybrid rice project. In view of the consultant's rather intimate contact with the Indonesian rice breeding program during the period 1972-1982, it was felt that a general review of breeding methods and brown planthopper problems should be discussed as well.

During the course of the consultancy the consultant attended GEU meetings at Bogor and the Indonesia-IRRI collaborative research planning meetings held at Ujung Pandang March 3-5, 1983. He was also asked to visit the area of North Sumatra where the new biotype of the brown planthopper has developed.

Itinerary

January	28	Leave Houston, Texas
	31	Arrive Bogor, Indonesia
January February	31- 8	Bogor
	9-11	Sukamandi
	12-17	Bogor
	18-19	Jakarta (Attend INSFFER conference)
	20-25	Bogor
	26-28	Medan (Observe BPH damage)
March	1	Bogor
	2- 5	Ujung Pandang (Attend Indonesia-IRRI collaborative research planning meeting)

March	5- 7	Bangkok
	8-10	Manila
	11-12	Seoul
	13	En route to Houston, Texas
	13	Arrive Houston

Stopover in Bangkok to review hybrid rice studies in Thailand.

Stopover in the Philippines to review hybrid rice studies at IRRI and discuss consultancy with IRRI administrators and scientists.

Stopover in Korea to review hybrid rice program of Office of Rural Development, Suweon, Korea.

Executive Summary

- During the decade of the 1970's Indonesia developed a successful interdisciplinary rice breeding program. Many rice varieties have been released which encompass a wide range of varietal types for lowland irrigated, upland, rainfed, high elevation and tidal swamp cultures.

- Many of these varieties are very well adapted to specific areas of the different cultures, but they lack one or more essential characteristic such as resistance to diseases and insects, problem soil tolerances, or suitable eating quality.

- This core of well-adapted varieties should be used as the genetic base for further improving Indonesian rice varieties by using them as recurrent parents in backcross programs.

- By using the backcross method the basic gene complex of the leading varieties would not be changed, except for the new characteristics being incorporated from the donor parents. Consequently the new varieties developed would require only limited testing and evaluation.

- Indonesian breeders have several backcross programs already underway for incorporating disease and insect resistances, problem soil tolerances and improved eating quality. An excellent collection of donor varieties has been compiled by AARD, IRRI and other countries.

- For the future, the backcross method of breeding should be strengthened in Indonesia as well as in other countries.

- The brown planthopper (BPH) is again causing concern in North Sumatra following a similar outbreak in late 1981.

- A colony of the North Sumatra biotype of BPH was brought to Bogor more than a year ago and a very limited screening program was started. Only 80 entries per month can be screened. This

should be increased to at least 500 entries. Also, more basic research should be undertaken on the BPH to better understand the biotype possibilities in future years.

- Indonesian breeders have many promising breeding lines that should be screened immediately for the new biotype. The urgency for such studies is pointed out by the fact that IR42 is more susceptible than IR36. These varieties showed similar reactions to biotypes 1, 2 and 3 at IRRI.

- It is essential that immediate action be taken to intensify basic studies on the new biotype to have a better understanding of the inheritance of varietal resistance.

- An integrated control program is needed for control of the BPH. In view of the North Sumatra outbreak it has been proposed that a cropping-systems type research project be started immediately in North Sumatra to formulate and evaluate different rotation and management practices for BPH control.

- This project would be all-inclusive by conducting on-farm research and taking into consideration constraints to adoption of integrated practices. This information would be useful in other areas where outbreaks might occur.

- More than a year ago AARD decided to embark on a hybrid research project to find out within a 3-year period whether hybrid rice might be feasible in Indonesia.

- In order to move the hybrid program rapidly a senior rice breeder has been designated team leader and will devote full-time to the hybrid rice program. A team of GEU scientists should be named to work cooperatively with the breeder.

- A project with USAID has been formulated to develop cytoplasmic male sterility (CMS), maintainer and restorer varieties, determine yield potential of hybrid varieties and study methods of seed

production. Within a period of two to three years improved maintainer and restorer lines can be developed and the yield potential of hybrids can be determined. In China hybrid varieties are reported to yield 20 to 30% higher than standard varieties. AARD should find out whether the Chinese varieties will produce similar yields in Indonesia.

- The Chinese maintainer varieties should be used as base for developing new maintainer varieties by using a modified backcross method. IR24, IR26 and other IRRI varieties are leading restorer varieties in China. Since they are also well adapted to Indonesia they should be used as recurrent parents in developing disease- and insect-resistant restorer varieties of suitable eating quality for Indonesia.

- The collaborative programs with IRRI for developing new sources of cytoplasmic sterility and for identification of maintainer and restorer varieties should be pursued.

- Several hybrid varieties are being grown in a preliminary yield trial at Maros. On the basis of their performance, seed of selected hybrids should be produced at Maros during the coming dry season (November/December 1983 seeding).

- By the end of the 1983-84 wet season considerable information on the yield potential of hybrid varieties can be obtained.

Rice Breeding Strategies for Indonesia

During the decade of the 1970's Indonesia put into operation an interdisciplinary rice breeding program. This was stimulated by the organization of a Genetic Evaluation and Utilization (GEU) program in 1976. The GEU provides the linkages between disciplines that are so necessary in modern breeding programs.

The breeder must take full advantage of the varietal evaluation opportunities that GEU scientists contribute. He is the catalyst that leads to success.

The breeder must project the varietal needs of the country. He can do this only when he has full knowledge of climate, soils, management practices and social conditions. Much of this information he obtains from the GEU scientists. The breeder then selects the parents, makes the crosses, and continually supplies GEU scientists with breeding material for evaluation. When a new variety is ready for release it is the breeder's responsibility to provide the breeder seed for multiplication and distribution.

This is all possible when the organizational structure and program organization are sound and when participating scientists band themselves together in a spirit of cooperation and unity.

Indonesia has released many rice varieties since 1971 when Pelita I and Pelita II were released. Many of the releases were developed in Indonesia by Indonesian scientists. They encompass a wide range of varietal types adapted to lowland irrigated, upland, rainfed, high elevation and tidal swamp cultures.

Several of the varieties are particularly well adapted to specific areas of the different cultures, but in most cases they lack one or more essential characteristic such as 1) resistance to one or more biotypes of the brown planthopper (BPH), green leafhopper (GLH), or gall midge; 2) resistance to blast, bacterial leaf blight (BLB),

tungro, grassy stunt virus; and 3) suitable eating quality for Indonesia.

Breeding strategies are being concentrated on the incorporation of these essential traits into Indonesian promising leading varieties through the "backcross method" of breeding. The backcross method is ideally suited for the pyramiding of these essential genes which are available from donor varieties identified locally and at IRRI. The backcross method has a distinct advantage in that the basic gene complex of the leading varieties is not changed except for the added donor genes.

The F_1 plants of the leading variety and the donor parent are backcrossed to the leading variety. From 300 to 1000 backcrossed (B/C) F_1 plants are needed, depending upon whether the inheritance of the donor gene/genes is simple or complex. The large number of F_1 plants in B/C-1 allows the breeder to select for plant type, maturity, and other visible or readily identified traits.

GEU teams determine which of the F_1 B/C plants are carrying the donor genes. The breeder again backcrosses these F_1 plants to the leading variety and the process of identifying the F_1 plants that carry the new genes is repeated. After several backcrosses the breeder selects F_3 generation plants that carry the new genes. Through pedigree line selection true breeding lines are obtained which are essentially identical to the original variety, except that they possess the new traits from the donor parent.

Several backcross programs have already been started. One program designed to incorporate lower amylose into IR36 is nearing completion. New backcross programs to incorporate genes for resistance to BPH biotypes are getting underway. Other programs for tungro resistance, gall midge resistance and improved eating quality are being organized.

Indonesia will continue to use donor varieties from IRRI and elsewhere to supply the new genes that will be needed in future years.

The backcross method has another advantage in that as many as three backcrosses can be completed in a single year. This means that in some instances new varieties can be developed in less than three years. Since the maturity, plant type, yield potential and general adaptability of these backcross-developed varieties are essentially the same as the recurrent variety, their response to given farming conditions is already known. This not only saves time but gives added security.

Examples of what might be accomplished during the next several years by using the backcross method of breeding are:

1. Incorporation of resistance to North Sumatra BPH biotype into IR36, IR42 and other varieties.

2. Incorporation of new genes for bacterial leaf blight resistance into IR36, IR42, Cisadane and leading upland varieties.

3. Incorporation of tungro resistance into Cisadane and other leading varieties grown in tungro-prone areas.

4. Incorporation of improved eating quality into IR36, IR42 and other leading varieties having high amylose content.

5. Incorporation of gall midge resistance into Cisadane, IR36 and IR42.

6. Incorporation of resistance to several of the leading blast races into C22, S55 and several other promising upland breeding lines.

Brown Planthopper Studies

The possibility that new BPH biotypes might occur has occupied the minds of rice breeders for several years. The further possibility that the biotype might spread to other parts of the country has also been considered and appropriate steps have been projected

to put into production new varieties that are resistant to the new biotype(s).

Several years ago crosses were made between leading Indonesian varieties and introduced donor varieties that carry the four known gene sources of varietal resistance to BPH. Advanced lines that possess resistance to biotypes 1, 2 and 3 are being tested. Screening for resistance to biotype 4 has not been possible because Indonesian entomologists have not been able to successfully maintain such a colony of BPH. Varietal resistance to biotype 4 may be controlled by the same gene(s) that control the North Sumatra biotype. Now that Indonesia has a colony of the North Sumatra biotype, screening for reaction of breeding lines is underway.

The screening for varietal reaction to the new biotype is hampered by very limited facilities. Only 80 entries per month can be screened. This should be expanded to 500 entries per month.

To cope with this national disaster, funds for financing an enlarged facility must be provided immediately and construction started so that the facility will be operational within three months. This is an example of the type of administrative and financial flexibility that the breeder must have.

The BPH biotype screening facility should provide space for evaluating other new biotypes that might arise. Competent personnel should be assigned to give accurate and fast results. The facilities must provide assurance that test insects do not escape.

Indonesian breeders have several hundred new lines from which to select lines that resist the new biotype. They are comparable to present varieties in yield potential and maturity. Furthermore, many of them possess the eating qualities that Indonesians prefer.

Provisions should be made to increase seed of promising lines to provide at least 5 kg or more of seed within 3½ months.

This means that the varietal testing and release regulations be amended to allow breeders to use existing research lands for seed increase. By the time the first seed increase is completed (May 1983) biotype evalution of the lines to confirm which lines are resistant to the new biotype should be completed. From the resistant lines the most promising should be selected for further seed increase. This number should be no more than 20 lines. The second increase of the 20 lines would be planted by June 1983. The first increase should give 4 tons of seed and the second increase 800 tons of seed of each of the promising lines, for seed increase and distribution through the normal channels. Breeders are confident that the lines are available to carry out this program in the projected time frame. They will need administrative support to get the job done.

Seed of all promising lines should be sent to IRRI (within the framework of the Indonesia/IRRI collaborative research agreement) for biotypes 1, 2 and 3 screening and perhaps other characteristics.

As a safeguard against other situations that demand prompt and definitive action selected lines that have resistance to new biotypes of BPH, greenleafhopper (GL), blast, tungro, grassy stunt and possibly other traits should be stockpiled in a safe place for maintaining viability of germination. Quantities of 6 kg per line are suggested. If this is done immediately seed of new varieties to combat the insect would be available for producing several hundred tons only four months after the new biotype is reported.

The facility for storing the seed should be airconditioned (about 21°C temperature) and seed stored in glass bottles with activated silica gel as a dessicant. Silica gel should be reactivated periodically. Viability can be maintained for 5 to 10 years under storage conditions as herein described.

The lines in storage would be revised after each season. Those found no longer of value should be replaced by superior lines.

Such a program was outlined by a GEU team more than a year ago. Indonesia cannot afford to be without such a facility. For a pittance national disasters affecting food supplies would be diverted. The responsibility of maintaining the collection rests squarely on the shoulders of the plant breeder.

Hybrid Rice

More than a year ago AARD decided to embark on a hybrid rice research project to find out within a period of three years whether hybrid rice might further increase rice yields in Indonesia. In China, hybrid varieties are yielding 20 to 30% higher than standard varieties.

A project with USAID was proposed and approved in mid-1982. The project objectives emphasize: (1) development of adapted disease- and insect-resistant maintainer and restorer lines of satisfactory eating quality; (2) conduct yield trials on hybrid varieties/lines to determine their yield potential compared with standard varieties; and (3) development of methods to economically produce hybrid rice seed.

Maintainer and Restorer Varieties

CMS, maintainer and restorer varieties used in China and elsewhere were supplied to AARD by IRRI. They are being grown in Indonesia at three locations (Sukamandi, Bogor and Maros).

Indonesia should utilize the basic genetic background of the Chinese maintainer and restorer varieties in developing improved adapted maintainer and restorer lines because of the high heterosis of their hybrids. Resistance to brown planthopper (BPH), bacterial leaf blight (BLB), virus diseases and suitable eating quality for Indonesia must be incorporated into the Chinese maintainer and restorer varieties.

By using them as recurrent parents in backcross programs it should be possible to incorporate the desired donor traits and retain much of the genetic background that provides heterosis to hybrids.

Only one or possibly two backcrosses should be used in developing the new maintainer varieties. The donor traits should be obtained from Indonesian and/or IRRI varieties/lines. By using this approach it should be possible to retain the high level of pollen sterility and exposed stigmas of the CMS lines (to increase outcrossing). The Chinese maintainer varieties should be used as the female parent to maintain their cytoplasm in the new maintainer lines.

The screening of F_1 backcross (B/C) plants, F_2 seeds or F_2 plants must be well organized to make certain that the donor traits are identified as early as possible. There are screening techniques for disease and insect reaction and for grain quality evaluation that can be effectively used. Every effort should be made to grow three generations per year. If this is done improved maintainer varieties for experimental use should be available within two years.

The leading restorer varieties used in China are IR24, IR26, and perhaps other IRRI varieties. They are well adapted to lowland irrigated conditions in Indonesia and are capable of producing very high yields when diseases and insects are controlled. By incorporating suitable eating quality and resistance to BPH, BLB and the viruses, IR24, IR26 and similar restorer varieties would be ideal for Indonesia.

They should be used as recurrent parents and as female parents in backcross programs to incorporate the desired disease and insect resistances and preferred eating quality. Three or more backcrosses should be used. By growing three generations per year much progress could be made within two years.

It is possible that the work at IRRI has identified equally promising restorer varieties that already have the needed disease and insect resistances. If so they should be used immediately.

Korea has developed several restorer varieties that should be tried in Indonesia. Korean scientists find that when they are crossed to Chinese CMS lines hybrid varieties showing high heterosis are produced.

Yield Trials

We need to know whether or not the Chinese hybrid varieties are capable of producing high yields in Indonesia and if they express the high heterosis exhibited in China. To do this a quantity of hybrid seed is required. Replicated trials to measure yield potential should be conducted at several locations and involve different management practices such as age of seedlings at transplanting, seedlings per hill, row spacing and fertilizer timing, rates and ratios.

These rather extensive yield trials should be managed by an experienced agronomist. The breeder would, of course, cooperate with the agronomist in organizing the trials. The trials should be grown in both wet and dry seasons.

The first Indonesian farmers to use hybrid rice would be the INSUS farmers who produce yields of 5 to 7 t/ha with standard varieties. Therefore, standard varieties grown in experimental trials should yield this high. Hybrid varieties would be expected to yield 20 to 30% higher if they are to be adopted by farmers. These factors need to be considered in setting up the trials. Rat fences, protection from birds, seedbed sanitation and other recommended management practices should be used.

Since the Chinese hybrids do not have resistance to BPH, BLB and viruses, the plots would have to be grown under protected conditions until the appropriate resistances are incorporated into

maintainer and restorer varieties. The trials should be located in areas where diseases and insects can be controlled and where farmers are making very high yields.

If adequate hybrid seed can be supplied the yield information could be obtained in two years. Possibly IRRI can assist in the production of hybrid seed for the trials and by conducting similar trials. New hybrids could also be included in the trials as soon as seed is available.

The Maros station appears to be an ideal location for producing seed for the trials and for conducting some of the yield trials.

Seed Production

Seed production of hybrid varieties is a serious constraint. China is gradually improving seed field yields and Indonesia should be able to do the same. The USAID project suggests that a seed technologist be considered. Certainly agronomists, breeders, seed technologists and engineers should work as a team to develop improved methods. Indonesia should engage in these studies but in the early stages the program would benefit from very close cooperation with IRRI to take advantage of all that China and IRRI have done.

The incorporation of the recessive tall trait reported by Dr. Neil Rutger should be incorporated into restorer varieties. Their taller height should increase the spread of pollen across the seed fields and thus increase outcrossing. The taller height which is controlled by recessive genes would not be expressed by the hybrid varieties.

Other plant and floral traits that might increase outcrossing should be investigated. Collaboration with IRRI should be encouraged.

The project leader is to be located at the Sukamandi station. Three or more Ir. level staff will be needed at Sukamandi and one or more at Maros and Bogor.

Some equipment has been ordered and other items are to be ordered in the near future. Rat fences for all experiments at the three locations should be considered. In the very near future seed production plantings should be started at the Sukamandi seed farm.

During the coming dry season, seed for planting yield trials should be stressed, particularly at Maros.

During the 1983-84 wet season (November 1983) extensive yield trials should be conducted.

The ideas and suggestions mentioned in this report have been discussed in detail with Indonesian breeders and administrators.

Korea has made considerable progress in hybrid rice. It is suggested that the Indonesian project leader and possibly one other scientist visit Korea in September 1983 to observe the Korean program.

TRIP REPORT
INDONESIA
APRIL 3-8, 1983

S. S. Virmani

Itinerary

April 3, 1983		-	Manila/Jakarta/Bogor
April 4, 1983	AM	-	Meeting with Drs. Cowan, Siwi and Harahap at Bogor
		-	Travel to Sukamandi
	PM	-	Visit hybrid rice experiments at Sukamandi with Dr. Bambang Suprihatno
April 5, 1983	AM	-	Sukamandi - Jakarta
	PM	-	Jakarta - Ujung Pandang (accompanied by Mr. Kenneth Prussner and Dr. B. Suprihatno)
April 6, 1983		-	Visit hybrid rice experiments at Maros Evening - Ujung Pandang - Jakarta
April 7, 1983		-	Jakarta - Singapore
April 8, 1983		-	Singapore - Manila

Objectives

- To review the on-going research on hybrid rice.
- To suggest guidelines for future research on hybrid rice.

OBSERVATIONS ON ON-GOING RESEARCH ON HYBRID RICE IN INDONESIA

1. Bogor

Dr. Z. Harahap continues to supervise hybrid rice research at Muara Bogor. The work is being done by his graduate student, Mrs. Sertiaty Silitonga. Mrs. Silitonga evaluated a number of hybrid combinations in a replicated trial during 1982 dry season (July-November). Seeds of these hybrid combinations were supplied by IRRI. Two of the combinations viz. IET 3257B/IR42 and IET 3257/IR36 showed about 13% higher yield than check varieties IR42 (5.4 t/ha) and Cisadane (5.3 t/ha). The trial was adversely affected by extreme dry weather and volcanic dust in the atmosphere.

During the ongoing wet season, Mrs. Silitonga also evaluated 132 hybrid combinations in replicated trial with a net plot size of 1 m^2. These F_1 combinations were derived from 12 x 12 diallel crosses. The yield data were not yet available, however, the trial is not expected to give the desired information on extent of heterosis for yield, since 9 out of 12 parents were tall to intermediate height and the hybrids showed extensive lodging.

Observations made at Muara indicated that the varieties, Cisadane, Ayung, Batang Agan, Krueng Aceh, Asahan and Bainto were restorers of 'WA' cyto-sterile line V20A. However, results needed further confirmation.

Dr. Harahap remarked that he can not spend sufficient time in hybrid rice research on account of his obligations to the conventional breeding program.

2. Sukamandi

Hybrid rice research at Sukamandi, until January 1983 has been carried out under the supervision of Dr. Tohar Danakasuma on part-time basis. However, since February 1983, when Dr. Bambang Suprihatno shifted to Sukamandi from Maros, he has been given this responsibility on full time basis. Bambang is assisted by a Research Assistant, Mr. Bambang Sutaryo.

The on-going work aimed to: 1) identify effective restorers and maintainers for 'WA' cyto-sterile lines, and 2) multiply seeds of the available cms and maintainer lines. Out of 41 lines/varieties test crossed, only two viz., IR50 and IR2797-105-2-2 appeared to be effective restorers, while others were partial restorers. IR50 did not show heterosis in the crosses made. Surprisingly, IR36 identified as effective restorer at IRRI showed partial restoration at Sukamandi. It has to be checked if the restoration ability of the restorer lines is influenced by environment. A number of tall varieties viz., Intan, Peta, Bengawan had been test-crossed with Chinese cytosteriles out of curiousity but these won't serve any useful purpose in the hybrid breeding program since the hybrids were tall and lodging susceptible.

Seeds of three cytoplasmic male sterile lines viz., V41A, Zhen Shan 97A and Er-Jiu Nan 1A were being multiplied in small seed increase plots using partially the techniques developed in China. An outcrossing rate of 10-15% was observed on cms lines. Considering that no GA was

sprayed and the panicle exsertion was only partial, this rate of outcrossing on cms lines was satisfactory.

About 100 additional test crosses have been made involving the Chinese cms lines and elite lines identified at Sukamandi. These will be evaluated in the coming dry season to identify additional restorers and maintainers.

3. Maros

The hybrid rice research at Maros is being conducted under the supervision of Dr. Bambang Suprihatno with the help of a Research Assistant, Mr. Oman Suherman. During my two visits to Maros, I have found Mr. Suherman very hardworking and conscientious worker, although he works part time in hybrid rice breeding.

Fifteen F_1 combinations involving three Chinese cms lines viz., V20A, 97A, and V41A and elite lines identified in Indonesia viz., IR54, IR50, IR42, IR26, Cisadane, Sameru (IR2307 line) were being evaluated in comparison with IR42, Cisadane, IR40, IR54, and Semeru in a replicated yield trial. The entries were at flowering to hard-dough stage. Two combinations viz., V20A/IR42 and 97A/IR42 appeared to be promising, but we must wait for the yield data. I believe that the hybrids developed from Chinese male sterile lines may not be successful in Indonesia.

In the test cross nursery, a number of restorers and maintainers (Table 1) have been identified. However, the F_1s with maintainer lines had still to be backcrossed with the male parent to initiate process of sterilizing the maintainer line.

Seeds of V41A were being multiplied using: 2A:1B row ratio. Leaf clipping was done but GA was not sprayed. The seed set on V41A due to natural outcrossing, was estimated to 25-30% which is quite encouraging to produce bulk quantities of seed.

From the foregoing observations it is evident that Indonesian rice scientists are interested to explore the potentials of hybrid rice technology. They are organizing themselves to do the job in a systematic manner. The USAID funded project ($150,000 for two years) on hybrid rice should give a good start. A close collaboration with IRRI's hybrid rice program would be helpful.

GUIDELINES FOR 1983-84 RESEARCH PROGRAM ON HYBRID RICE

1. Studies on extent of F_1 superiority for yield and other traits of economic importance using intervarietal F_1 crosses and F_1 hybrids developed at IRRI.
2. Evaluation of newly developed cytoplasmic male sterile, maintainer and restorer lines.
3. Identification of effective maintainer and restorer lines among elite lines developed and/or selected in Indonesia.

4. Evaluation of fertility restoration ability of restorer lines and comparison of results obtained at IRRI.
5. Study of natural outcrossing on cms lines.
6. Determination of seed yield in cms line multiplication and hybrid seed production plots in wet and dry season.
7. Identification of germplasm possessing desirable floral traits influencing outcrossing on cms lines.

RESOURCES REQUIRED

Discussions held with Drs. Siwi, Suprihatno and Mr. Prussner from USAID indicated that:

1. Manpower requirements for hybrid rice research at Sukamandi, Maros, and Bogor can be met by recruiting research assistant against available vacant positions or reallocation of responsibilities among the available research assistants.
2. Dr. Suprihatno and his research assistants at Sukamandi and Maros should receive 4-6 months on the job training in hybrid rice at IRRI starting from June-July, 1983. Funds for this training will be provided by USAID project.
3. Equipment and supplies required for hybrid rice program can be procured out of funds from USAID project.
4. Hybrid rice project in Indonesia would like to procure a vacuum emasculator through IRRI.

Table 1. List of restorers and maintainers of 'WA' cytosterile lines identified at Maros, Sukwasi, Indonesia.

Restorers	Maintainers
BR 10	M 61b-118-4
Cisadane	Latisail
M 28d-79-3	IR9575 sel.
M 6	
M 61b-33-1	
M 61b-18-2-1	
B334bd-Pn-79-3	
IR13429-287-3	
Chianung Sen Yu 13	

THE ASIAN WALL STREET JOURNAL
Monday, April 4, 1983

It May Be Time to Rethink Indonesia's Rural Programs

By Robert Keatley

DIRO, Indonesia – This isn't a precisely typical Javanese village. It boasts solid brick and concrete homes, while 15 families have electricity and even more – thanks to auto batteries – have television.

It's not far from the old royal capital of Jogjakarta, giving easy access to busy markets. This puts Diro, unlike many other villages, squarely in the money economy. "Goofy Bubble Gum" reads the T-shirt on a young girl who plays near a village elder's courtyard, where Japanese motorbikes rest.

Beyond that, Diro enjoys a bit of cultural fame. It's home to 90-year-old Warnowaskito, Java's best-known carver of wooden masks for traditional *topeng* dances, which tell tales of Gods and kings at war and in love. He lives in a simple home with his elderly wife and 96-year-old sister, sometimes selling masks to visitors and occasionally visiting Jakarta for special performances.

Yet in many ways Diro is not so different. It contains more people (833) and less rice land (25 hectares) than seems desirable. The village's only other important locally produced food product is beancake from imported soybeans. A birth control program has slowed population growth but the numbers keep rising. Assorted rural development programs affect Diro – it's

The Region

not far to a school and a clinic, for example – but there's no government presence inside the village. And farmers buy their soybeans, pesticides and fertilizers on the open market rather than receive subsidized goods from official agencies nearby; dealing with bureaucrats is too tedious to be worth the trouble, especially since supplies are erratic.

This makes Diro much like the rest of Java, the England-size island home to 100 million of Indonesia's 150 million population. Despite having too many people on too little land, life has improved markedly since President Suharto replaced the bombastic President Sukarno 17 year ago. The government's rural programs may be inefficient, riddled with corruption and often distrusted by villagers but even so they have brought important gains. Meantime, a nationwide birth control program has slowed the population growth rate to 2% – a major accomplishment.

So a look at Diro can tell much about the country and its prospects. And whether places like Diro thrive will determine whether Indonesia itself maintains the remarkable growth and stability of recent years. Its record is one reason East Asia as a whole stands so much apart from the troubled record of Third World development elsewhere.

"Life is better and happier" than in earlier years, says Prapto Mugiroharjo enthusiastically. He's the youngish man who – thanks to the consensus process of Javanese society – serves as village chief.

For one thing, farmers often get three crops a year, rather than two, from the paddy land, thanks partly to government programs that introduced better fertilizers, pesticides and seeds. Improved roads and the spread of motor vehicles (six Diro families have cars) gives access to markets. A primary school opened nearby in 1970 and added a few more grades in 1975. Most Diro children attend it.

Diets have improved. "Many more products are available," says the village chief, "now we can get eggs." He says most people in Diro eat three meals daily and enjoy spicy side dishes with their rice. If illness strikes, the nearby clinic has a doctor who visits twice a week, plus an *apotek* (drugstore). None of this existed in Sukarno days.

Nationwide, the record is also good. Last year Indonesia harvested 23 million tons of rice – double the early 1970s figure – and imported little (it once was the world's biggest buyer). Other products have shown lesser yet still real growth. Some experts even think relative rural prosperity has all but halted the drift of jobless people from farms to cities, where they pose social and political problems.

Yet these basic issues aren't resolved for good. A drought this year threatens to cut farm output. Under present plans there's little potential for long-term crop increases on Java and Bali without massive investment beyond Indonesia's financial and technical means. Falling oil prices make other exports more important than ever but their prospects aren't bright. The currency was just devalued by 27.5%, a $10 billion deficit looms and domestic prices are rising, partly because the government cut costly subsidies of consumer goods. There's a growing belief that some development plans need revision.

Strategic change is difficult and opinions vary. But in agriculture, some experts – while acknowledging past successes – think it's time for the government to step aside a bit. They argue that "top down" programs – by which bureaucrats tell farmers what's good for them and then allot resources – stifle incentive. They'd rather see more "bottom up" programs, which promote local initiative and restrict government involvement. They argue greater economic incentives are needed to make production rise. This means government price controls would have to be eased or eliminated.

One advocate of such change is the government-aided Institute of Development Studies in Jakarta. It wants bureaucratic powers restricted, grandiose plans trimmed and more village-level authority to make decisions that fit local conditions. This includes more reliance on free markets and less on national agencies to fix prices, buy and sell produce and distribute such necessities as seed and fertilizer.

"I agree with Ronald Reagan that the best government is the one that governs least," says Adi Sasono, the institute's director. That's a rather radical view in a country where government fears relaxing economic control might bring loss of political controls.

But talks in Diro indicate that farmers might well agree with Mr. Sasono. They don't talk much about politics or national policies. They simply find that official plans don't work well in practice so they ignore them as much as possible.

For example, one agency makes farm loans available – a good theory. In practice, however, this means daunting paperwork for villagers (who distrust official forms) plus the need to take large loans for a whole year's supplies rather than small sums for immediate needs. So the villagers ignore the Jakarta plan and take credits from commercial suppliers. "We're uncomfortable with large loans, and anyway getting them is difficult," says the Diro village chief.

The same is true with fertilizer, pesticides, soybeans and seeds. In theory, government agencies provide cheaper goods. But getting them means more forms, more negotiations with bureaucrats and, in general, more trouble. In any case, official stocks disappear at times, perhaps illegally into the commercial market. In this relatively rich area, farmers prefer to pay extra on the open market and get precisely what they need, when they need it. Dealing with the government involves too much hassle to be worth the effort.

Such bureacratic weaknesses are a major problem in this nation, which remains short of technical and administrative skills. There's no doubt that President Suharto takes economic progress seriously (partly to preserve political calm) and he's even had himself named "Father of Development" by his docile parliament. But many Indonesians, and some others, now believe it's time to rethink vital rural programs even if this means relaxing central control and increasing local authority.

This involves a bit of risk for a government that likes its politics placid. But these analysts argue that only by encouraging local initiatives can Indonesia build effectively on its admirable achievements of the recent past.

Robert Keatley is editor of The Asian Wall Street Journal.

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