COCONUT RESEARCH OPPORTUNITIES

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EXECUTIVE SUMMARY

The need for international cooperation on coconut research to bring together a critical mass of expertise and resources to solve some of the pressing problems of the crop and its farmers, has long been recognized amongst producing countries, coconut researchers, and several development agencies. A number of proposals have been prepared for international cooperation, particularly in the area of coconut germplasm collection, evaluation and breeding. These proposals date back to 1972. All have lapsed. The needs of the crop and the millions of people who depend on it for their livelihood have not abated in the meantime.

The key problem has been the lack of follow through to establish a consortium of producing countries, consumers and development agencies, that would design and implement a high quality research program that addresses the major issues facing the crop, and provides the continuity of funding that is essential for a perrenial tree crop such as coconut. The Consultative Group on International Agricultural Research (CGIAR) is ideally placed to sponsor the design and conduct of such a program, and provide the necessary continuity of financial support.

The 1986 CGIAR Priorities paper concluded that coconuts were one of three priority areas requiring international support (the other two being tropical vegetables and aquaculture).

In 1988-89, TAC considered two papers which described: 1) the current status and future trends in coconut production within the context of the world fats and oils market; 2) existing research programs; 3) future research needs; and 4) possible institutional options for an international initiative on coconut research.

The present paper summarises: 1) The importance of coconut as a smallholder crop that is an important component of long-term farming systems in coastal and island regions throughout the world; 2) The needs and opportunities for research; 3) The priority areas for research appropriate for international support. 4) The possible institutional mechanisms for conducting an international coconut research program, either within or outside the auspices of the CGIAR.

The coconut palm is believed to have originated in the Western Pacific. It is now a pan-tropical crop, grown on approximately 11.6 million ha in 82 countries. The main producers are the Philippines, Indonesia, India, Sri Lanka, Papua New Guinea and the Pacific Islands. Total world production in 1985 was 7.5 million metric tons of copra equivalent.

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Approximately 85% of production comes from Asia (13 countries) and the Pacific (18 countries). Coconut is also a locally important crop in 29 countries in Latin America and the Caribbean, and in 22 countries along the coasts of East and West Africa.

Coconut is predominantly a smallholder crop, with at least 96% of total world production coming from smallholdings of 0.5-4.0 ha. It is an ecologically sound crop. It is able to grow in harsh environments, such as atolls, high salinity, drought, or poor soils. It plays an important role in the sustainability of often fragile ecosystems in island and coastal communities. Coconut is used as a source of food, drink, fuel, stock feed and shelter for village communities, where it is often referred to as the 'Tree of Life'. It is also a cash crop, able to be used to produce many items for sale, at either the local, national, or international level. About 70% of the total crop is consumed in producing countries. Coconut is also an important export crop for some countries. The main internationally-traded products are copra, coconut oil, copra meal, and desiccated coconut.

The rationale for further research on coconut is based on: 1) The importance of coconut as a smallholder crop, produced largely for domestic consumption. There are more than 10 million farm families (about 50 million people) directly involved in its cultivation. A further 30 million people in Asia alone are directly dependent on coconut and its processing for their livelihood; 2) The increasing importance of domestic consumption of coconut in producing countries to meet the growing demand for vegetable oils and fats; 3) The predictions of future decreasing production in the Philippines (the world's major exporter of coconut oil), due to the increasing age of the palms; 4) The continuing price premiums paid for the lauric acid oils (coconut and palm kernel oil), primarily for their industrial uses; 5) The declining competitiveness of coconut, which means it is presently unable to take advantage of the expanding vegetable oil market and is losing ground to other crops; 6) Virtually all the benefits from coconut research accrue to developing countries. Furthermore, the majority of these benefits go to the smallholder producers. The balance go to consumers in developing countries.

Promising research results from only a few programs suggest that a well-organized and adequately funded international research effort could yield high returns on the investments.

Appropriate methods will be required for the transfer of new technologies to smallholders, if these returns on research investments are to be realized. Coconut breeding in several countries over the past 30 years has demonstrated that hybrids are capable of yielding up to 6 tons copra/ha/year, under favourable conditions (cf. world average yield of 500 kg/ha/year). Progress has also been made in the identification of the causal agents of diseases of previously unknown etiology.

Coconut research is presently under-funded. There are several national research programs. With few exceptions, they are not well-supported financially nor do they have sufficient appropriately trained staff and facilities. Most suffer from a lack of continuity in funding, both from national sources, and from external agencies. Many small producing

countries are not able to support a coconut research program at all. At present there is no means by which small countries can access new technologies, especially for higher yielding planting material. Yet they could be active participants in an international germplasm evaluation program. The present research efforts are not addressing the needs of the crop internationally, nor capitalizing on the promising results from breeding and other areas of research, for the benefit of smallholders.

The long-term nature of coconut research, the history of discontinuity and lack of support in its funding, the prospects of high returns from research investments, and the likely distribution of research benefits to smallholder producers, make coconut a particularly suitable target for an international research initiative.

The priority research areas to be addressed by an international effort are: 1) Coconut germplasm improvement; (collection, conservation, breeding and evaluation); 2) Disease and pest control; 3) Sustainability of coconut-based farming systems; 4) Postharvest handling and utilization

It is proposed that there be a socio-economic component within each of the priority research areas. The issues influencing the participation of farmers in rehabilitation and replanting programs are of particular importance.

After consideration of various options, an international initiative, termed an International Coconut Research Council is proposed as the most appropriate institutional model. It would conduct research on a limited scale, especially in relation to germplasm collection, conservation, and utilization; contract research to national and other research institutes on the identified priority areas; and establish subject-matter and regional research networks, to encourage greater exchange of research results, and technology. A socio-economic component would be included in each research area. A total complement of 14 senior staff was proposed.

The proposed international coconut germplasm improvement programme would require the establishment of an international germplasm research unit under whose auspices coconut germplasm would be collected and conserved and research on techniques for germplasm conservation and breeding would be conducted. The germplasm unit and the headquarters of the Council would be located in Asia (possibly in two different countries, to maintain the decentralised style of the Council).

The proposed initial complement of senior staff would be 14. In addition, the Council would require some support staff. It would also require a significant contractual research budget. The Council would then have the responsibility to commission research of international significance with national programs, other interested research organisations, and advanced laboratories within its identified high priority areas.

The administrative mechanisms by which an international research program on coconut could be established are compared. These options include ones which could be incorporated into the CGIAR system and ones which could be conducted under international auspices but outside the CGIAR system. The critical elements are to establish international auspices for the programme, especially in regard to germplasm conservation, evaluation and improvement, and to provide a mechanism for continuity of funding for coconut research.

A case is presented for establishing an international research initiative on coconut. This subject has been examined since the early 1970's by several bodies interested in improving the productivity of coconut, and increasing the incomes of millions of smallholders dependent on the crop. Although the needs have been demonstrated, and the potential returns from research appreciated, all these efforts have failed.

In the intervening period, research workers have shown the potential for substantial increases in yield, the development of new technologies for pest and disease control, and the improvement in processing of coconut products. The management of the coconut lands to ensure their long-term productivity is also of increasing concern. Investment in research in these priority areas would benefit directly smallholder producers and coconut consumers in many countries. Coconut research is commended to TAC for its consideration as an international research initiative appropriate for support by the CGIAR.

G.J. Persley*

1. The need for international cooperation on coconut research to bring together a critical mass of expertise and resources to solve some of the pressing problems of the crop and its farmers, has long been recognized amongst producing countries, coconut researchers, and several development agencies. A number of proposals have been prepared for international cooperation, particularly in the area of coconut germplasm collection, evaluation and breeding. These proposals date back to 1972. All have lapsed. The needs have not abated in the meantime. The key problem has been the lack of follow through to establish a consortium of producing countries, consumers and development agencies, that would design and implement a high quality research program that addresses the major issues facing the crop, and provides the continuity of funding that is essential for a perrenial tree crop such as coconut. The Consultative Group on International Agricultural Research (CGIAR) is ideally placed to sponsor the design and conduct of such a program, and provide the necessary continuity of financial support.

PRIORITY OF COCONUT RESEARCH

2. The 1986 report on "CGIAR Priorities and Future Strategies" by the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR), concluded that coconuts were one of three priority areas requiring international support (the other two being tropical vegetables and aquaculture). The report states:

> "Coconut is the oil crop most in need of international research support. International research on the crop is currently underfunded and it has the potential for high pay-off. Furthermore, coconut is a smallholder crop that is ecologically sound and offers a broad range of dietary, income, and employment opportunities. It is not only a primary source of edible oil, but also of fibre and livestock feed, once it can be processed into a variety of end-products. Furthermore, there appears to be good research potential for coconut... TAC, therefore, encourages the creation of a research network to strengthen and coordinate coconut research and supports CG system involvement in such a network."

Discussion paper prepared for the CGIAR Technical Advisory Committee, IITA, Ibadan, Nigeria, June 1990. This paper is complementary to two earlier papers prepared for TAC:

1) Coconut Research: An International Initiative. June 1988

2) Coconut: International Research Priorities, September 1989

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3. The Consultative Group adopted this recommendation from TAC at the Group's meeting in Ottawa in 1986.

4. In June 1988, TAC considered a paper which described:

   1. the current status and future trends in coconut production within the context of the world fats and oils market;
   2. existing research programs;
   3. future research needs; and
   4. possible options for an international initiative on coconut research.

5. TAC noted at its June 1988 meeting that coconut research had a high potential for pay-off because there were significant researchable problems, and it was a crop important to smallholders. TAC requested a further elaboration of the research needs for small-scale producers, and the role of coconut in meeting domestic demand for vegetable oil.

6. A second paper entitled "Coconut: International Research Priorities" was discussed by TAC in October 1989. The priority areas identified represented a consensus amongst coconut research workers, who had discussed the matter at the May 1989 COCOTECH meeting sponsored by the Asian and Pacific Coconut Community (APCC) in Bangkok and an ACIAR-sponsored working group meeting held in Singapore in September 1989.

7. The October 1989 paper provided an analysis of the world market for fats and oils and the future prospects for coconut. It then considered the need for an international initiative in coconut research. Four priority research areas were identified: 1) germplasm improvement, 2) disease and pest control, 3) post-harvest technology, and 4) the sustainability of coconut-based farming systems.

8. After consideration of various options, an international initiative, termed an International Coconut Research Council was proposed as the most appropriate institutional model. It would conduct research on a limited scale, especially in relation to germplasm collection, conservation, and utilization; contract research to national and other research institutes on the identified priority areas; and establish subject-matter and regional research networks, to encourage greater exchange of research results, and technology. A socio-economic component would be included in each research area. A total complement of 14 senior staff was proposed.

9. The proposed international coconut germplasm improvement programme would require the establishment of an international germplasm research unit under whose auspices coconut germplasm would be collected and conserved and research on techniques for germplasm conservation and breeding would be conducted. The germplasm unit and the headquarters of the Council would be located in Asia (possibly in two different countries, to maintain the decentralised style of the Council).

10. TAC considered in late 1989 that the paper provided a sound basis for its future deliberations on coconut, but that it would not be possible to make a recommendation to the CGIAR on coconut in isolation. TAC's position on coconut as a possible new venture would be incorporated into TAC's overall recommendations on the expansion of the CGIAR System in 1990.

11. The present paper to TAC in June 1990 summarises

    1. The importance of coconut as a smallholder crop that is an important component of long-term farming systems in coastal and island regions throughout the world.
    2. The needs and opportunities for research.
    3. The priority areas for research appropriate for international support.
    4. The possible institutional mechanisms for conducting an international coconut research program, either within or outside the auspices of the CGIAR.

COCONUT PRODUCTION

12. The coconut palm is believed to have originated in the Western Pacific. It is now a pan-tropical crop, grown on approximately 11.6 million ha in 82 countries. The main producers are the Philippines, Indonesia, India, Sri Lanka, Papua New Guinea and the Pacific Islands. Total world production in 1985 was 7.5 million metric tons of copra equivalent. Approximately 85% of production comes from Asia (13 countries) and the Pacific (18 countries). Coconut is also a locally important crop in 29 countries in Latin America and the Caribbean, and in 22 countries along the coasts of East and West Africa. The major producers in Latin America and the Caribbean are Brazil, Mexico and Jamaica. The major producers in Africa are Tanzania and Mozambique.

13. Many of the producing countries are small island countries in the Pacific, Caribbean and Indian Oceans. Coconut is both their primary subsistence crop, and their only significant source of export earnings. There are few (if any) alternative crops able to substitute for coconut in these ecosystems.

14. Coconut is predominantly a smallholder crop, with at least 96% of total world production coming from smallholdings of 0.5-4.0 ha (Table 1). It is an ecologically sound crop. It is able to grow in harsh environments, such as atolls, high salinity, drought, or poor soils. It plays an important role in the sustainability of often fragile ecosystems in island and coastal communities.

15. Coconut is used as a source of food, drink, fuel, stock feed and shelter for village communities, where it is often referred to as the 'Tree of Life'. It is also a cash crop, able to be used to produce many items for sale, at either the local, national, or international level. About 70% of the total crop is consumed in producing countries. Coconut is also an important export crop for some countries. The main internationally- traded products are copra, coconut oil, copra meal, and desiccated coconut. The major exporter

is the Philippines. The main buyers are the USA, Japan and the European Community countries. Prices for coconut products have, on average, been decreasing over the past 20 years, in line with other vegetable oil crops.

16. There has been some perception in North America of a health risk associated with coconut oil, due to its high content of saturated fatty acids. However, research by the Harvard Medical School has shown that there is no evidence that coconut oil leads to high cholestrol levels and associated heart disease. The composition of coconut oil is largely short chain fatty acids which are rapidly burnt up by the body, and do not contribute to cholestrol deposits in the arteries. For millions of people in developing countries, coconut is indeed their primary energy food.

FUTURE NEEDS AND OPPORTUNITIES

17. The opportunities are:

    1. The increasing demand for oils and fats and animal feed sources, particularly in developing countries as incomes rise;
    2. The ability of the coconut tree to produce a wide variety of food and non-food products, additional to the traditional products of copra, coconut oil and copra meal.

18. The key problems are:

    1. The low productivity of many coconut trees due to their age and poor nutrition. The world average yield of 500 kg/ha/year of copra equivalent has not improved in at least 25 years;
    2. The failure of many replanting programs designed to replace old trees with higher yielding hybrids or locally adapted types. These failures have been due largely to a lack of incentive for smallholders to replant when prices are low;
    3. The fluctuating productivity due to variable environmental conditions;
    4. Inefficient handling and processing, with a low farm gate price to smallholders.

19. The needs are:

    1. To increase the productivity of the crop by the use of locally adapted high-yielding, pest and disease tolerant varieties in any replanting or new planting schemes;
    2. To increase the productivity of existing plantings by encouraging better agronomic practices, including the control of diseases, insects and weeds, use of fertilizers, and profitable inter-cropping systems;
    3. To develop improved methods of handling and processing coconuts;
    4. To diversify the coconut products traded and actively promote new products in the marketplace, so as to utilize fully the potential of the crop.

Table 1 Coconut Production Data for Asian Pacific Coconut Community 1986
Area, Producers, domestic Production, Consumption

Country	Area (1000 ha)	Avg size Holding (ha)	No farm families (1000)	Estimated % Product from Small holdings	Total Coconut Production Nut equiv million nuts	Copra equiv 1000 metric tons	Estimated Domestic Consumption Nut equiv million nuts	Copra equiv, 1000 m tons	% Crop consumed domestically	Copra 1000 mt	Coconut Oil 1000 mt	Copra Meal 1000 mt	Desic Coconut 1000 mt	Shell 1000 mt	Fibre 1000 mt	Other 1000 mt	Total Export Earnings US$ millions	% Control Export Earnings
ASIA APCC																		
INDIA	1,209	2	5,000	98	6,620	988	6,741	1,006	100						24		26	0.3
INDONESIA	3,182	4	3,000	97	10,491	2,098	10,397	2,079	99			380	303	1			37	0.25
MALAYSIA	335	3.5	90	99	1,054	200	793	150	75	41	49	-	7	-			26	2.2
PHILIPPINES	3,267	3.0	1,800	98	11,675	2,631	2,386	402	15	136	1,238	818	68	27	n/a	129	558	11.5
SRI LANKA	419	0.5	715	99	3,048	617	1,916	391	63	10	85	40	60	35	85		101	8.3
THAILAND	415	n/a	n/a	99	707	200	541	153	76	-	-	6	-	-	5	415	3	0.04
TOTAL APCC ASIA	8,807	Range 1.5 - 3.5 ha	9,805+	98*	33,587	6,734	22,586	4,181	70*	187	1,372	1,244	438	63	114	544	751	
PACIFIC - APCC																		
PAPUA NEW GUINEA	241	1.5	104	60	1,248	208	300	50	24	93	41	28	-	-	-	-	23	2.2
SOLOMON ISLANDS	63	4*	60*	80	299	46	81	78	30	32	-	-	-	-	-	-	3	5.2
VANUATU	93	4*	50*	70	429	59	131	18	30	40	-	-	-	-	-	-	4	50
WESTERN SAMOA	48	n/a	n/a	98	150	35	46	10	28	3	14	6	-	-	-	-	4	35
F S MICRONESIA	16	1.5	n/a	99	50	10	49	9	99	1	-	-	-	-	-	-	n/a	n/a
TOTAL - APCC PACIFIC	461	Range 1.5 - 4.0 ha	214+	62*	2,095	358	607	105	30*	169	55	26	-	-	-	-	34	
TOTAL - APCC ASIA/PACIFIC	9,623	Range 0.5 - 4 ha	10,019+	96	35,682	7,092	23,113	4,886	69*	356	1,427	1,270	438	63	114	544	785	

Source APCC 1986
* approximately

RATIONALE FOR AN INTERNATIONAL INITIATIVE

20. The rationale for further research on coconut is based on:

1. The importance of coconut as a smallholder crop, produced largely for domestic consumption. Approximately 96% of total world production comes from smallholdings, and at least 70% is consumed in the producing countries. There are more than 10 million farm families (about 50 million people) directly involved in its cultivation. A further 30 million people in Asia alone are directly dependent on coconut and its processing for their livelihood.
2. The increasing importance of domestic consumption of coconut in producing countries to meet the growing demand for vegetable oils and fats.
3. The predictions of future decreasing production in the Philippines (the world's major exporter of coconut oil), due to the increasing age of the palms. The Philippines provides the core of the export market, and other smaller exporters depend on the Philippines to keep the market open for coconut oil.
4. The continuing price premiums paid for the lauric acid oils (coconut and palm kernel oil), primarily for their industrial uses in soaps and detergents. Buyers still favour the lauric acid oils, and there is a continuing demand for regular supplies. This provides an opportunity for increasing coconut oil exports, if the productivity of the crop and the continuity of supply could be improved.
5. The declining competitivenes of coconut, which means it is presently unable to take advan e of the expanding vegetable oil market and is losing ground to ther crops. Coconut oil's share of the total vegetable oil market has been declining steadily. It provided 6% of the total world market in 1986, and is predicted to fall to 5% by 1990.
6. Virtually all the benefits from coconut research accrue to developing countries. Furthermore, the majority of these benefits go to the smallholder producers. The balance go to consumers in developing countries.

COCONUT RESEARCH PROGRAMS

21. Research results in recent years suggest that there are areas from which there could be a high rate of return on research investments. Appropriate methods will be required for the transfer of new technologies to smallholders, if these returns on research investments are to be realized. Coconut hybrid breeding in several countries over the past 30 years has demonstrated that hybrids are capable of yielding up to 6 tons copra/ha/year, under favourable conditions (cf. world average yield of 500 kg/ha/year). Progress has also been made in the identification of the causal agents of diseases of previously unknown etiology, such as cadang-cadang disease in the Philippines and Lethal Yellowing in the Caribbean. Nutritional studies have shown that coconut responds to fertilizer application, particularly potassium and chlorine.

22. These promising results from only a few programs suggest that a well-organized and adequately funded international research effort could yield high returns on the investments.

23. Coconut research is presently under-funded. There are several national research programs (Table 2). With few exceptions, they are not well-supported financially nor do they have sufficient appropriately trained staff and facilities. Most suffer from a lack of continuity in funding, both from national sources, and from external agencies. Many small producing countries are not able to support a coconut research program at all. At present there is no means by which small countries can access new technologies, especially for higher yielding planting material. Yet they could be active participants in an international germplasm evaluation program. The present research efforts are not addressing the needs of the crop internationally, nor capitalizing on the promising results from breeding and other areas of research, for the benefit of smallholders.

24. The long-term nature of coconut research, the history of discontinuity and lack of support in its funding, the prospects of high returns from research investments, and the likely distribution of research benefits to smallholder producers, make coconut a particularly suitable target for an international research initiative.

PRIORITY RESEARCH AREAS

25. The priority research areas to be addressed by an international effort are:

1. Coconut germplasm improvement
   (collection, conservation, breeding and evaluation)
2. Disease and pest control
3. Sustainability of coconut-based farming systems
4. Postharvest handling and utilization

26. It is proposed that there be a socio-economic component within each of the priority research areas rather than a separate socio-economic program. This would better ensure that socio-economic issues relevant to smallholders are addressed within each of the areas of technology development. The issues influencing the participation of farmers in rehabilitation and replanting programs are of particular importance.

Coconut Germplasm Improvement

27. The key areas requiring research are:

1. Germplasm Collection and Conservation

   The critical need is to establish a coconut germplasm collection under international auspices. Such an international collection would be best built around one primary site, with several sub-sites to duplicate different portions of the collection in different parts of the world. The collection would be managed by

a Coconut Germplasm Research Unit, established under international auspices. It would involve sponsoring both the establishment of a new field-based collection and providing additional support to some existing collections in Asia, Pacific, Latin America and Africa, to duplicate parts of the collection elsewhere. Several of the existing collections were established with assistance from the International Board for Plant Genetic Resources (IBPGR). Unfortunately, IBPGR was unable to provide support for the continuing maintenance of the collections, and the evaluation of the germplasm.

The primary site of the new international collection should be in the Asia/Pacific region, as this is the centre of origin of the crop, in a location free of lethal diseases, and out of the typhoon region. From a scientific perspective, Indonesia would be a suitable location as the primary site of the international collection, and for the base of the germplasm research unit.

2. Inter-country Testing of Natural Selections and Hybrids

There is a long-established need for the inter-country comparison of the best available material from different countries. Protocols are required to enable results from different countries to be compared. The staff of the germplasm research unit would collaborate with national programs in the design and evaluation of these inter-country trials.

3. Coconut Tissue Culture

One technology that would be a valuable adjunct to coconut breeding is tissue culture. Scientists in several countries are working on coconut tissue culture. Embryo culture techniques have been established (with support from IBPGR and others) which can be used in germplasm collection. Limited success has been reported with clonal propagation, with several laboratories reporting the clonal propagation of a few palms. None are able to replicate coconut palms on a routine basis. Clonal propagation would enable the rapid propagation of high yielding trees.

Techniques also need to be established for cryopreservation to enable the long-term, in-vitro storage of germplasm. This would reduce the need for large and expensive field-based collections to preserve coconut germplasm.

Regeneration and transformation systems are required for coconut, in order to establish systems by which useful genes could be introduced into the plant by genetic engineering. This is a long-term prospect, but could be usefully sponsored internationally on a contract basis in suitable molecular biology laboratories.

An international initiative would enable the establishment of research network on coconut tissue culture, to link existing efforts, and to bring additional resources to these important research targets.

4. Genetic Mapping of Coconut

A genetic map of coconut, based on the use of RFLP markers would be valuable for coconut breeding programs, especially for complex characters such as drought tolerance. Such a map could be commissioned by an international coconut germplasm improvement program and be prepared by collaboration between existing breeding programs and advanced laboratories.

Disease and Pest Control

28. The priority diseases, important in all coconut-growing areas are:

- Phytophora palmivora
- Lethal diseases
- Virus/viroid diseases (such as cadang-cadang)

29. Of the lethal diseases, mycoplasma diseases such as lethal yellowing and related mycoplasma diseases are especially damaging in Africa, Latin America and the Caribbean. There appears to be several virus and viroid diseases affecting coconut in the Asia/Pacific region, some of unknown etiology.

Suitable indexing methods need to be developed to enable the safe interchange of germplasm. Modern diagnostics, based on monoclonal antibodies or nucleic acid probes could be prepared in suitably-equipped laboratories, for the major coconut diseases.

30. In regard to pest control, priority should be given to the development of integrated pest management methods for pests important in several countries.

Sustainability of Coconut-Based Farming Systems

31. Coconut-based systems are amongst the oldest farming systems in the world. They contribute to the sustainability of farming systems in coastal areas and islands, where few other crops will grow. Palms, including coconut palms, are under threat from excessive logging in various parts of the world. An international initiative could sponsor research on new ways to ensure the sustainability of coconut-based farming systems.

Post Harvest Handling and Utilization

32. There are several problems of copra and coconut oil processing important to many countries which could be more efficiently investigated under international auspices. The results could be made widely available through regional networks.

INSTITUTIONAL OPTIONS

33. Four options for supporting an international research effort were considered in the earlier two papers to TAC in 1988 and 1989. These were:

    1. To provide additional support to existing national coconut research programs.
    2. To establish an international coconut research centre, similar to a commodity research centre such as IRRI.
    3. To establish an international coconut research network.
    4. To establish an International Coconut Research Council able to identify, support, promote and conduct research on priority problems of coconut of international significance.

INSTITUTIONAL ARRANGEMENTS

34. The preferred institutional arrangement in the consultations that formed a part of this study, is option 4, to establish an International Coconut Research Council which would operate in a decentralised fashion.

    The new body would be able to:

    1. Undertake research itself on a limited number of topics of international significance, with some emphasis on those related to germplasm conservation, evaluation and improvement;
    2. Contract research to national programs and to other existing research institutions on the priority research topics of international significance;
    3. Establish subject-specific research networks amongst active research workers, on problems of international significance and contract additional research on these subjects; and
    4. Establish regional networks, to identify the priority problems requiring additional research, and to facilitate the distribution of research results to all coconut producing countries.

35. The advantages of establishing such an international initiative are that it could:

    1. Identify important research priorities relevant to several producing countries, which cannot be addressed adequately by any one country.
    2. Build on existing research capacity by providing additional funds to enable national programs to undertake research of relevance to many countries.
    3. Provide additional support for germplasm collections held under international auspices and breeding programs of international significance.
    4. Allow small countries with no national coconut research program to participate in the evaluation of new technologies, including new coconut varieties, and improved processing technologies.
    5. Provide continuity of funding, especially for coconut germplasm collection held at several sites under international auspices, and related research on coconut improvement of importance to many countries.

6. Facilitate participation in an international coconut research effort by both public and private sector organisations. The buyers of coconut oil in industrialized countries would benefit from continuity of supply from producing countries. These private sector interests could be invited to participate in, and contribute to, an international research effort.

INTERNATIONAL COCONUT RESEARCH INITIATIVE

36. Components

The components of the proposed International Coconut Research Council are illustrated in Figure 1. It would comprise:

- Board of Directors

- Headquarters Unit
  - Administration
  - Information Services
  - Training Program
- Germplasm Research Unit
- Regional Networks
  - Asia/Pacific
  - Africa
  - Latin America and the Caribbean
- Subject Specific Research Networks
  - Tissue Culture
  - Diseases
  - et al.

37. The proposed initial complement of senior staff would be 14. In addition, the Council would require some support staff. It would also require a significant contractual research budget. The Council would then have the responsibility to commission research of international significance with national programs, other interested research organisa- tions, and advanced laboratories within its identified high priority research areas.

38. The indicative staffing of the Council is as follows:

Headquarters Unit

Director
Administrative Officer
Information Officer
Training Officer
Socio-economist

Germplasm Research Unit

Germplasm conservator - germplasm collection and conservation
Plant breeder - hybrid production
Plant breeder - international testing network
Plant pathologist
Research station manager

Regional Networks

Four regional coordinators for 1) Asia, 2) Papua New Guinea and the Pacific Islands, 3) Africa, and 4) Latin America and the Caribbean.

Germplasm Research Unit

39. The germplasm research unit would be responsible for the management of the coconut germplasm collection established under international auspices, with a primary site in Asia (preferably in Indonesia), and secondary sites elsewhere in Asia/Pacific, Africa, Latin America and the Caribbean.

40. The unit would also conduct research on the collection, conservation, dissemination and evaluation of coconut germplasm, including both natural selections and hybrids.

Regional Networks

41. The primary role of the regional networks would be to provide guidance on the identification of problems affecting several countries, and the relative priority of these problems. The regional networks would also be important in facilitating the international exchange and evaluation of germplasm. The regional networks would be the major vehicle for the dissemination of results coming from the subject-specific research networks and contracted research projects. A Regional Coordinator would act as the secretary to the Steering Committee in each geographic area.

42. It is proposed that three regional networks be established for 1) Asia/ Pacific; 2) Africa; 3) Latin America and the Caribbean. Ideally, there would be two coordinators within the Asia/Pacific network, one responsible for Asia, and the other for Papua New Guinea and the Pacific Islands, as well as one coordinator for Africa, and one for Latin America and the Caribbean.

43. The regional coordinators would be research workers who would also coordinate at least one of the subject-specific networks appropriate to their technical area of expertise. Each would be based at a suitable coconut research institution in their geographic area of responsibility.

Subject-Specific Research Networks

44. The international coconut research council would also sponsor subject-specific collaborative research networks. These networks could be large or small, depending on their subject matter and amount of relevant research in progress. Not all member countries need belong to all networks, since the research results would be made widely available through the regional networks.

45. Illustrative subject matter areas on which the Council could sponsor collaborative research networks are:

- Tissue culture
- Coconut diseases
- Biological control of coconut pests
- Post-harvest handling and utilization

Information Services

46. The international coconut research council would provide the necessary information services to assist the collaborating scientists. The information and documentation services would complement the activities of existing agencies such as the Asian and Pacific Coconut Community and the Coconut Research Institute in Sri Lanka. The International Development Research Centre (IDRC) is likely to support a new coconut information project, based at APCC in Jakarta. An information officer would be located with the Headquarters Unit to be responsible for these services.

Training Program

47. The international coconut research council would organise a training program associated with the priority research areas. This program would include training of junior researchers and technicians from national programs and training courses for scientists and technicians on specialised research techniques. A training officer would be attached to the Headquarters Unit to manage the program.

Locations of Activities

48. It is proposed that the international coconut research council establish itself in a decentralised fashion so as not to build itself into a centralised-commodity institute, and to facilitate participation of existing research institutes in the international program.

49. The Germplasm Research Unit and the main site of the international germplasm collection should be located in the centre of origin of the crop in the Asia/Pacific region, in a country without lethal diseases; and outside the typhoon belt, since the primary site would be a field-based collection.

50. In keeping with the decentralised nature of the initiative, it would be preferable for the Headquarters Unit to be located in a different country to the Germplasm Unit. Given that Asia is the main producing region, the headquarters should be located in Asia, in a country with substantial scientific capacity, efficient international communication facilities, and good international airline connections.

RELATIONSHIP OF COCONUT RESEARCH TO THE CGIAR SYSTEM

51. In regard to TAC's considerations of the non-associated IARCs:

1. The area of coconut research is appropriate for support by the CGIAR, since coconut is a crop grown primarily by smallholders, both as a subsistence crop and as a source of cash income. Coconut is especially important for poverty alleviation, as it is often the only source of income for smallholders in island and coastal communities. Coconut also contributes to the stability of farming systems in these often fragile ecosystems. Coconut is the dominant crop for many resource poor, island countries and coastal zones which have benefitted little from CGIAR-sponsored research to date.

   Coconut germplasm, collection, conservation and evaluation is especially suited to the CGIAR mode of operation.

2. Of the existing CGIAR centres, only IBPGR is sponsoring a small amount of research on coconut, in the area of embryo culture, and cryopreservation. This research is being undertaken in France on a contract basis. IBPGR has also supported the collection of coconut germplasm in Asia.

3. None of the existing, non-associated international agricultural research centres are conducting research on coconut.

4. The identified research needs on coconut concern:

   - germplasm conservation, evaluation and improvement
   - disease and pest control
   - sustainability of coconut-based farming system
   - post-harvest handling and utilization

   None of these needs are being met either by the existing CGIAR centres nor by the non-associated centres.

5. The proposed activities on coconut research would be international in character. The modes of operation in the preferred option would include in-house research capacity in regard to germplasm improvement, contract research capability and related subject-specific research networks, and regional networks. The proposed contract research would be able to be undertaken by national agricultural research systems, either on their own, or in collaboration with advance laboratories in some instances.

INSTITUTIONAL OPTIONS

52. Although there are many bilaterally and multilaterally funded coconut research and development projects, all currently operate for relatively short periods (usually 3 to 5 years), and are rarely linked to one another. This system of discontinuity of funding, provided primarily on a bilateral basis, is not conducive to achieving a quantum leap in coconut productivity in many countries. If an increase in productivity in coconut is to be achieved, it requires a critical mass of funds and research capacity to be brought to bear on coconut for a sustained period of time.

53. There are several institutional mechanisms by which an international research program on coconut could be established. These institutional options include ones which could be incorporated into the CGIAR system and ones which could be conducted under international auspices but outside the CGIAR system. The key elements are to establish inter- national auspices for the program, especially in regard to germplasm conservation, evaluation and improvement, and to provide a mechanism for continuity of funding for coconut research.

54. Nine institutional options by which an international program on coconut could be established and conducted are outlined below. The relative features of the options are summarized in Table 3.

Option 1. CGIAR International Coconut Research Council

55. Establish an independent International Coconut Research Council, as an international agricultural research centre (IARC), under the auspices of the CGIAR. The research program and mode of operation would be as outlined in this paper.

Advantages

- Establishes a critical mass of expertise and resources focussed on coconut research needs.
- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific networks.
- Provides in-house research capacity, especially in relation to germplasm conservation, evaluation and utilization.
- Provides international auspices for a multi-site germplasm collection and an inter-country coconut improvement program.
- Provides a mechanism for continuity of funding for coconut research.
- Enables research to be contracted to national agricultural research systems (NARS) and other advanced laboratories for specific problems of international significance.

- Global coverage of activities, via regional and subject-specific research networks.

- Visibility of effort by the CGIAR on a perrenial tree crop.

Disadvantages

- Establishes a new IARC, with associated overhead costs.

- Requires a new IARC to obtain international legal status (often a lengthy process).

- give too high a priority to coconut relative to other commodities within the CGIAR system.

Option 2. Non-CGIAR International Coconut Research Council

56. Establish the International Coconut Research Council in a manner analogous to the current non-associated IARCs such as the International Council for Agro-Forestry (ICRAF) or the Asian Vegetable Research and Development Centre (AVRDC). This would require sponsorship by a Donor Support Group.

Advantages

- Establishes a critical mass of expertise and resources focussed on coconut research needs.

- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific research networks.

- Provides in-house research capacity, especially in relation to germplasm conservation, evaluation and utilization.

- Enables research to be contracted to NARS and other advanced laboratories on specific problems of international significance.

- Global coverage of activities via regional and subject-specific networks.

- May be attractive to development agencies with special interests in the Asia/Pacific region.

Disadvantages

- Establishes a new IARC, with associated overhead costs.

- Requires a new IARC to obtain international legal status.

- Does not provide immediate international auspices for a multi-site germplasm collection and an inter-country germplasm improvement program.

- Does not provide continuity in funding.

Option 3. IBPGR Crop Genetic Resources Network on Coconut

57. Establish an IBPGR-sponsored Crop Genetic Resources Network on Coconut, with a Steering Committee to guide its research strategy. The international R and D program outlined in this paper contains a large element of work concerned with the long-term support of coconut germplasm collections to be held under international auspices; breeding and inter-country evaluation of germplasm; and related research on tissue culture and disease control. These activities could be conducted within a crop genetic resources network on coconut, sponsored by IBPGR and supported by additional funds provided to IBPGR by interested development agencies, and possibly industry sources.

Advantages

- Establishes a critical mass of expertise and resources focussed on coconut research needs.

- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific research networks.

- Provides in-house research capacity, especially in relation to germplasm conservation, evaluation and utilization.

- Provides international auspices for a multi-site germplasm collection, and inter-country coconut improvement program.

- Provides a mechanism for continuity of funding.

- Enables research to be contracted to NARS and other advanced laboratories on specific problems of international significance.

- Global coverage of activities via regional and subject-specific research networks.

- Reduced overhead costs, due to sharing of common services such as administration, information, training, and governance.

- May be attractive to bilateral and multilateral development agencies with special interests in the Asia/Pacific region.

Disadvantages

- Requires IBPGR to expand its usual mode of operation to incorporate research on germplasm utilization, as well as provide additional support for coconut collection and conservation.

- Greater emphasis on the germplasm improvement aspects of the program (including disease and pest control) and less on sustainability of coconut-based farming systems and post-harvest handling and processing.

- International status may be affected by IBPGR's own negotiations on its future.

Option 4. International Council on Agroforestry: Coconut Network

58. Incorporate a coconut R and D network within the activities of the International Council on Agroforestry (ICRAF). This would require ICRAF (with its headquarters in Kenya) to sponsor a research network with its primary site of activities in Asia and the Pacific.

Advantages

- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific research networks.
- Provides in-house research capacity, especially in relation to germplasm conservation, evaluation and utilization.
- Enables research to be contracted to NARS and other advanced laboratories.
- Establishes linkages with research on other tree species.
- Some common services possible, thereby reducing costs.

Disadvantages

- May not bring a critical mass of expertise and resources focussed on coconut.
- May not provide early international auspices for a multi-site germplasm collection and an inter-country coconut improvement program.
- May not provide continuity in funding.
- ICRAF is itself considering its own future, in relation to the CGIAR and its forestry initiative. Coconut may not receive high priority from ICRAF, at least not initially.
- ICRAF is primarily focussed on Africa, whereas the proposed coconut research initiative would have a substantial program in Asia/Pacific as well as regional activities in Africa, Latin America and the Caribbean.
- May not give global coverage of activities.
- Implementation may be

Option 5. CGIAR Forestry Research Initiative: Coconut Network

59. Incorporate a coconut research network within the proposed CGIAR initiative on forestry.

Advantages

- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific research networks.

- Provides in-house research capacity, especially in relation to germplasm conservation, evaluation and utilization.

- Enables research to be contracted to NARS and other advanced laboratories on specific problems of international significance.

- Global coverage of activities.

- Would provide international auspices of a multi-site germplasm collection and an inter-country improvement program in the medium to long term.

- May provide continuity in funding.

- Establish linkages to other CGIAR efforts on tree species.

Disadvantages

- May not bring a critical mass of expertise and resources focussed on coconut research needs.

- The preferred institutional mechanisms for the proposed CGIAR initiative on forestry are not yet finalized. The implementation of a coconut research network under this option may be delayed until these mechanisms are decided, and the future role of ICRAF is clarified.

- Slow implementation likely.

- Lack of visibility for a CGIAR-sponsored coconut initiative.

Option 6. International Rice Research Institute: Coconut Research Unit

60. The major coconut producing and exporting country is the Philippines. The International Rice Research Institute (IRRI) in the Philippines could host an international coconut research network, and provide logistical support for its activities in Asia/Pacific, Africa, Latin America and the Caribbean.

Advantages

- Establishes a critical mass of expertise and resources focussed on coconut research needs.

- Flexibility in modes of operation with in-house research capacity, contract research responsibilities, and regional and subject-specific networks.

- Provides in-house research capacity, especially in relation to germplasm conservation, evaluation and utilization.

- Enables research to be contracted to NARS and other advanced laboratories.

- Global coverage of activities.

- May provide international auspices for a multi-site germplasm collection and an inter-country coconut improvement program, if IRRI's mandate is modified.

- Provides a mechanism for continuity of funding.

- Reduced overhead costs, due to sharing of common services and governance.

- Access to other research expertise at IRRI (e.g. agronomy, plant nutrition, pathology, farming systems).

Disadvantages

- Requires IRRI to provide an international umbrella for a new commodity.

- The Philippines is the typhoon zone, and has at least one lethal disease of coconut. It is therefore not the ideal location for the primary site of an international germplasm collection. The primary site of the germplasm should be located elsewhere in Asia, preferably in Indonesia, to facilitate germplasm exchanges.

Option 7. International Network for the Improvement of Banana and Coconut (INIBAC)

61. The proposed modes of operation of an international coconut research network are somewhat similar to those for the existing International Network on Banana and Plantain (INIBAP) which has its headquarters in Montpellier, France. The differences are that the proposed international coconut research council would have an in-house research capacity in the form of a germplasm research unit located in Asia and be responsible for a multi-site germplasm collection sponsored under international auspices. The coconut network would also have a significant contractual research budget with which to contract research to national programs and advanced laboratories on specific problems of international significance.

62. There is strong French interest and research capacity in both commodities. Coconuts and bananas both have their centres of origin in the Asia/Pacific region, and are often intercropped in the field. It may be possible to intercrop the two research networks, and obtain a synergistic effect to stimulate research on both crops.

Advantages

- Establishes a critical mass of expertise and resources focussed on coconut research needs.

- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific research networks.

- Provides in-house research capacity, especially in regard to germplasm conservation, evaluation and utilization.

- Enables research to be contracted to NARS and other advanced laboratories.

- Global coverage of activities.

- Some cost-savings by sharing of common services (e.g. information, administration, governance).

- Linkage with INIBAP Headquarters in France may facilitate access to European oil crops research.

Disadvantages

- Does not provide international auspices for a multi-site coconut germplasm collection and an inter-country coconut improvement program (but may do so if INIBAP agreements are modified).

- Does not provide continuity of funding.

- Institutional difficulties in merging an existing network (banana) with an emerging network (coconut).

Option 8. BUROTROP (European Initiative on Oilpalm and Coconut Research and Development)

63. BUROTROP is a newly established, inter-governmental European Initiative on Oilpalm and Coconut, supported by a small secretariat in Paris. It aims to stimulate and coordinate R and D projects on oilpalm and coconut supported by European development agencies, or other bilateral and multilateral agencies. Its main focus is on establishing collaborative research among European institutes and regional or national institutions. BUROTROP's initial foci are on oilpalm, and Africa, for its first year of operation.

64. The Board of BUROTROP presently comprises:

- an executive committee with 15 members from producing countries, European development agencies, and research organizations.

- a program committee with six members, three of whom are from producing countries.

65. It may be possible for BUROTROP to expand its character and activities to enable it to sponsor an international coconut research network, including a multi-site germplasm collection and an inter-country coconut improve- ment program. This would require BUROTROP to conduct as well as to coordinate research.

Advantages

- Flexibility in modes of operation, but with limited in-house research capacity.
- Enables research to be contracted to NARS and other advanced laboratories.
- Access to European research institutions.
- Access to European bilateral and multilateral development agencies.

Disadvantages

- Would not provide international auspices for a multi-location germplasm collection and an inter-country coconut improvement program.
- Does not provide continuity of funding.
- BUROTROP is presently a European-based coordinating mechanism, without in-house research capacity. It would need to amend its charter to manage a coconut research program as proposed here.
- BUROTROP is currently perceived to be a European initiative, rather than an international research initiative. It may be possible to merge the European initiative with one of the other options proposed in this paper, in order to achieve an international coconut research program.
- BUROTROP's current comparative advantage is in contract research with European institutions. A mechanism needs to be found to link this advantage with a body which has an in-house research capacity in coconut, and a responsibility for international coconut germplasm conservation and utilization.

Option 9. FAO/UNDP Coconut Genetic Resources Program

66. FAO could implement an international coconut research program, as described in this paper. This would require close cooperation between FAO and IBPGR in regard to the collection, conservation and utilization of coconut germplasm. UNDP could be approached to seek its interest in being the lead sponsoring agency for such a program, with other bilateral and multilateral development agencies joining as cosponsors.

Advantages

- Establishes a critical mass of expertise and resources focussed on coconut research needs.

- Flexibility in modes of operation, with in-house research capacity, contract research responsibilities, and regional and subject-specific research networks.

- Provides in-house research capacity in regard to germplasm conservation, evaluation and utilization.

- Provides international auspices for a multi-site germplasm collection and a multi-country coconut improvement program.

- Should provide a mechanism continuity of funding, if UNDP and other bilateral and multilateral agencies support the program.

- Enables research to be contracted to NARS and other advanced laboratories.

- Global coverage of activities via regional and subject-specific research networks.

- May reduce cost of implementation, if common services are provided by FAO/UNDP.

- Low overhead costs.

Disadvantages

- Requires close collaboration between FAO and IBPGR in regard to germplasm collection and conservation.

- Implementation may be slow.

CONCLUSION

67. A case has been presented for establishing an international research initiative on coconut. This subject has been examined since the early 1970's by several bodies interested in improving the productivity of coconut, and increasing the incomes of millions of smallholders dependent on the crop. Although the needs have been demonstrated, and the potential returns from research appreciated, all these efforts have failed.

68. In the intervening period, research workers have shown the potential for substantial increases in yield, the development of new technologies for pest and disease control, and the improvement in processing of coconut products. The management of the coconut lands to ensure their long-term productivity is also of increasing concern. Investment in research in these priority areas would benefit directly smallholder producers and coconut consumers in many countries. Coconut research is commended to TAC for its consideration as an international research initiative appropriate for support by the CGIAR.

Collaborators

Region	Country	Research Institutes	Programs	External Collaboration Past/Present*
Asia	China	Chinese Academy of Agricultural Sciences Hainan Island	Hybrid production	
	India	All-India Coordinated Coconut and Arecanut Improvement Project		
		Central Plantation Crops Research Institute, Kasaragod (plus 11 other research centres)	Pest and disease control Tissue culture Germplasm collection, conservation, and evaluation Hybrid breeding	
	Indonesia	Agency for Agricultural Research and Development (AARD)		
		Coordinating Research Institute for Industrial Crops, Research Institute for Coconuts. Main stations at Manado, Pakaiwon, Bone-Bone	Germplasm collection Hybrid breeding	IBPGR FAO World Bank
		Industrial Plantations (PTP/PNP) Coconut Research Program, Medan, North Sumatra	Hybrid breeding	France (IRHO)*
	Malaysia	Malaysian Agricultural Research and Development Institute (MARDI)	Smallholder planting and rehabilitation	
		Private Sector Research Programs	Hybrid seed production Intercropping	
		Universities	Processing Food technology	
	The Philippines	Philippines Coconut Authority	PCA	World Bank* France (IRHO)*
		Albay Research Centre	Cadang-cadang disease Tissue culture Entomology (disease transmission)	FAO/UNDP Australia (ACIAR)* Germany (GTZ)
		Davao Research Centre	Agronomy, nutrition entomology Post-harvest	FAO/UNDP Potash Institute France (IRHO) ODA*/GTZ*
		Zamboanga Research Centre	Germplasm conservation Hybrid breeding Coconut wood utilization	IBPGR FAO/UNDP New Zealand

Region	Country	Research Institutes	Programs	External Collaboration Past/Present*
		Philippine Universities		
		University of the Philippines, Los Banos (UPLB)	Embryo culture Tissue culture	
		Visayas State College of Agriculture (VISCA)	Hybrid breeding Intercropping Village level processing Product development	
	Sri Lanka	Coconut Research Institute	Breeding and selection Soils and plant nutrition Agronomy Pest and disease control Coconut information service	
		Coconut Board	Post-harvest processing	U.K.*
	Thailand	Department of Agriculture, Horticultural Research Institute, Sawi Research Centre	Hybrid breeding	ODA
		Kasetsaart University	Food technology	
	Vietnam	Oil Crops Research Institute	Hybrid production	FAO France
South Pacific	Fiji	Ministry of Forestry	Hybrid breeding Pest control (biological control of rhinoceros beetle)	France (IRHO)*
	French Polynesia	Coconut Research Institute	Hybrid breeding	France (IRHO)*
	Papua New Guinea	Cocoa and Coconut Research Institute	Germplasm collection and conservation Hybrid breeding Pest control (Scapanes)	Australia (ACIAR)*
	Solomon Is.	Levers Research Yandina	Hybrid breeding Intercropping (cocoa/coconut) Tissue culture	Unilever* Unifield*
		Department of Agriculture	Disease surveys (viroid diseases)	Australia (ACIAR)*
	Vanatu	Oil Crops Research Saraoutou	Hybrid breeding Disease control (foliar decay)	France (IRHO)* Australia (ACIAR)*

Region	Country	Research Institutes	Programs	External Collaboration Past/Present*
	Western Samoa	Department of Agriculture	Hybrid breeding Pest control (biological control of rhinocerous beetle)	FAO* World Bank ADB*
Latin America	Brazil	Coconut Research Institute, Aracaju	Germplasm collection Food processing	
	Mexico	National Coconut Research Program		
Caribbean	Jamaica	Coconut Industry Board	Germplasm collection and evaluation Lethal yellowing disease	U.K. FAO International Council on Lethal Yellowing
	Trinidad	National Coconut Research Program	Red ring disease	
Africa	Cote d'Ivoire	Marc Delorme Coconut Development Centre	Germplasm collection Hybrid breeding	France (IRHO)*
	Mozambique	National Coconut Development Program	Germplasm evaluation	Portugal
	Tanzania	National Coconut Development Program	Hybrid breeding Agronomy Disease control (mycoplasmas) Biological control of insect pests Socioeconomic	World Bank* Germany (GTZ)* France (IRHO)* U.K. (Imperial College)*

* Existing research project supported by technical assistance, or collaborative research grants.

Table 3. Summary of Institutional Options for an International Coconut Research Initiative

TIONAL N	CRITICAL MASS[a]	IN-HOUSE RESEARCH CAPABILITY[b]	CONTRACT/ RESEARCH CAPACITY[c]	GLOBAL COVERAGE[d]	LIKELY CONTINUITY OF FUNDING[e]	INTER-NATIONAL AUSPICES FOR GERMPLASM[f]	LEGAL STATUS	ADMIN. COSTS[h]	OTHER FACTORS
R/IARC	+	+	+	+	+	+	-	High	Establishment and governance costs high
CG/IARC	+	+	+	+	-	-	-	High	Establishment and governance costs high
R ork	+	+	+	+	+	+	+	Low	IBPGR mode of operation would require modification
F ork[i]	?	+	+	?	?	?	?	Medium	Possibly slow implementation
R stry iative[i]	+	+	+	+	+	+	?	Medium	Possibly slow implementation
-based	+	+	+	?	+	+	?	Low	IRRI mandate would require modfication
AP	+	(+)	+	+	-	-	-	Medium	INIBAP charter would require modification
TROP	?	-	+	+	-	-	-	Medium	BUROTROP charter would require modification to enable in-house research, conduct of field programs and responsibility for a germplasm collection
UNDP ram	+	+	+	+	+	-	-	Low	Possibly slow implementation
gro- stry/ stry	+	+	+	+	+	+	?	Medium	New mechanism needs to be accepted for agroforestry/forestry by the CGIAR, and by ICRAF and other IARCs involved Possibly slow implementation

nt; (+) possible; - absent; ? unknown.

anism would enable critical mass of expertise and resources to be directed at coconut research needs; b) In-house research capacity in proposal; c) Mechanism would enable research to be contracted to NARS and advanced institutions; d) Global coverage of coconut h possible; e) Likely continuity of funding; f) Availability of international auspices for germplasm collections and inter-country in the short term; g) Need for new legal status; h) Administrative costs (including costs of establishment and governance); on 10 - merging options 4 and 5. Some of the limitations with ICRAF (option 4) and CG forestry (option 5) may be overcome if ICRAF part of a new CGIAR agroforestry/forestry initiative as recommended by TAC.

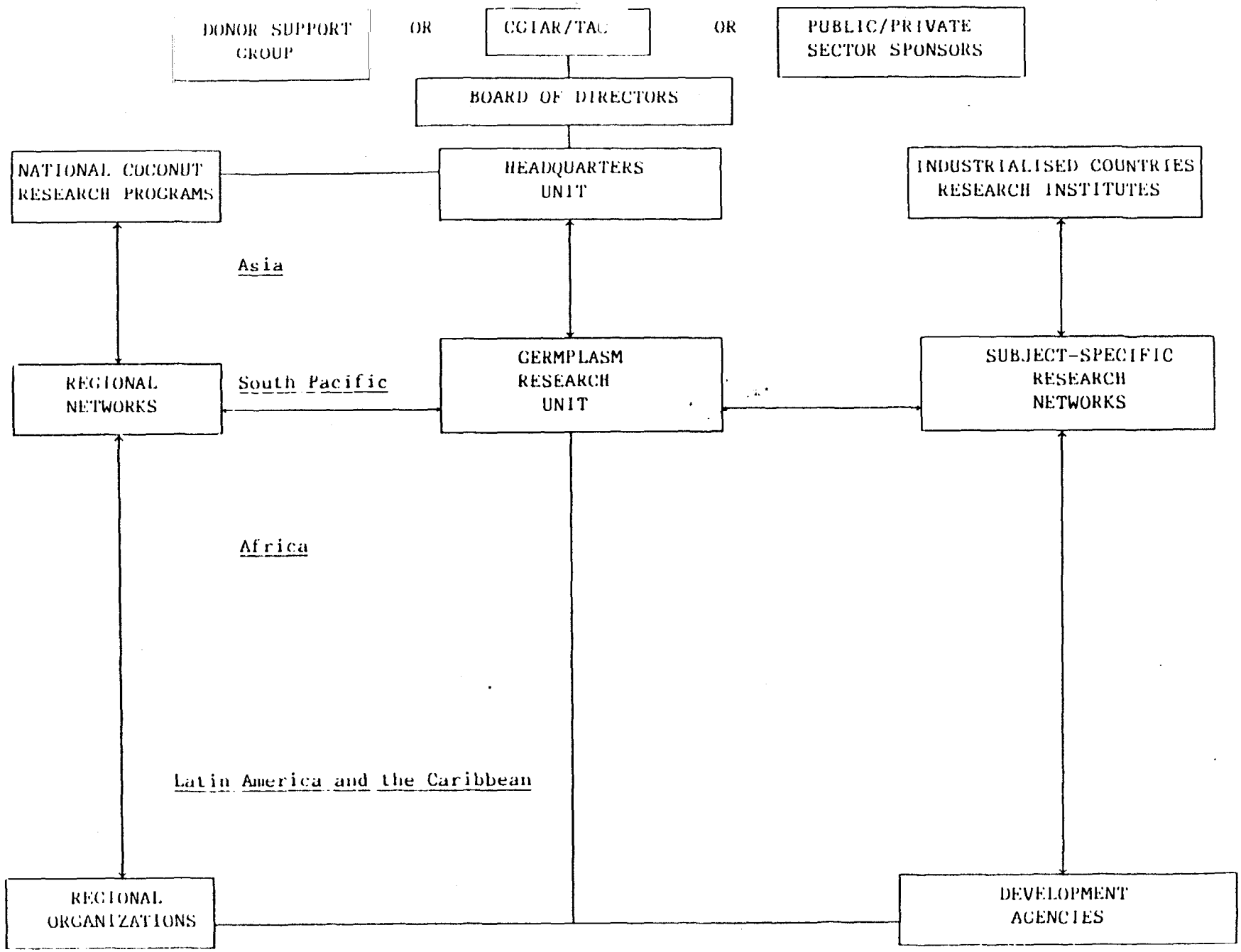

Figure 1. Proposed International Coconut Research Initiative