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Fiber Crops Program Area Research Planning and Prioritization

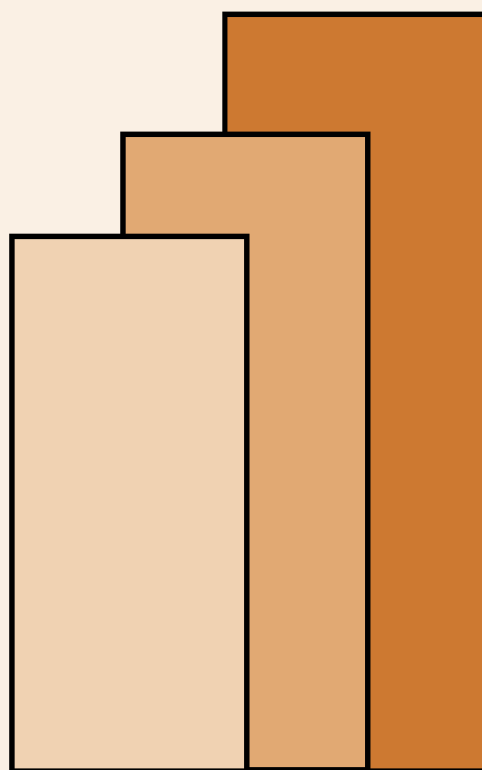
Corazon T. Aragon

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FIBER CROPS PROGRAM AREA RESEARCH PLANNING AND PRIORITIZATION

CORAZON T. ARAGON

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TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
1.0 Introduction	1
2.0 Industry Profile	2
2.1 Domestic Production	2
2.2 Domestic Consumption	11
2.3 External Trade	17
2.3.1 Exports	17
2.3.2 Imports	32
2.4 Problems/Constraints Affecting the Fiber Crops Industry	40
2.4.1 Production-related Problems	40
2.4.2 Marketing Problems	42
2.5 Market Prospects	43
3.0 Status of Research and Development (R&D) for Fiber Crops	46
3.1 Profile of the National Research System for Fiber Crops	46
3.2 Funding, Manpower, and Research Facilities	49
3.2.1 Funding	49
3.2.2 Manpower and Research Facilities	55
3.3 Review of Researches on Fiber Crops	59
3.3.1 Past and Current Researches by Research Area, and Agency	59
3.3.2 Technologies Generated/Adopted Including Constraints To and Consequences of Adoption	69
3.4 Strengths and Weaknesses of the Institutional Structure of	79

Research and Extension Linkage

4.0 Conclusion and Recommendations	80
References	83
Appendices	85

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
1	Production of fiber crops, Philippines, 1990-1997	3
2	Area planted to fiber crops, Philippines	4
3.	Yield of selected fiber crops, Philippines, 1990-1997	7
4	Cotton production, Philippines, 1990-1997	9
5.	Domestic fiber consumption, Philippines, 1991-1997	12
6	Domestic consumption of abaca fiber by sector, Philippines, 1991-1997	14
7	Export value of Philippine agricultural products, 1990-1997	18
8	Export earnings from raw fibers and manufactures of Philippine fiber crops, 1990-1997	19
9	Export earnings from manufactures of Philippine fiber Crops, 1990-1997	20
10	Export earnings from raw fibers produced from Philippine Fiber crops, 1990-1997	22
11	Export earnings from abaca fiber and manufactures, 1990-1997	23
12	Quantity of export of abaca fiber and manufactures, 1990-1997	24
13	Number of importing countries, top 3 foreign buyers, and corresponding market shares in terms of export volume, Philippine abaca fiber and manufactures, 1990 and 1997	26
14	Value of exports of Philippine silk products, 1990-1997	28
15	Volume of exports of Philippine silk products, 1990-1997	29
16	Total value of imports of fibers and manufactures, 1990-	33

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
	1997	
17	Philippine quantity of imports of raw fibers, 1990-1997	34
18	Cotton demand and supply sources (imports and local production) in the Philippines, 1990-1997	36
19	Value of Philippine imports of silk products, 1990-1997	37
20	Quantity of Philippine imports of silk products, 1990-1997	38
21	Research expenditure of DOST on fiber crops by type and by agency/institution based on the 1996 financial plan	50
22	Public expenditure for research and development of FIDA and CRDI (now CODA), 1992-1997	52
23	Public expenditures (in million pesos) for research and development of FIDA, CRDI, and selected SCUs engaged in fiber crops R&D activities, 1992-1997	53
24	Distribution of average (in %) direct budgetary support for agriculture R & D across selected DA-attached agencies and selected SCUs engaged in fiber crops R & D activities, 1992-1996	54
25	Minimum manpower requirements for R & D in crops research	56
26	Number (in FTE) of technical manpower resources for agriculture and natural resources research and development in selected DA-attached agencies and SCUs involved in fiber crops R & D activities, 1998	57
27	Land area of FIDA research centers/offices	58
28	Completed researches on fiber crops by agency and research area, 1988-1998	60

<u>Table No.</u>	<u>Title</u>	<u>Page</u>
29	Completed researches on major fiber crops by type and and research area, 1988-1998	61
30	Number of on-going researches on fiber crops by agency and research area as of January 1999	63
31	Number of completed researches on fiber crops by FIDA by type and research area, 1988-1998	64
32	Number of on-going researches on fiber crops conducted by FIDA by type of crop and research area as of January 1999	66
33	Number of completed researches on fiber crops conducted by UPLB by type of crop and research area, 1988-1998	66
34	Number of on-going researches on fiber crops conducted by UPLB by type and research area as of January 1999	67
35	Number of completed M.S. thesis and Ph.D. dissertation on fiber crops at UPLB by type and research area, 1988- 1998	57

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>	<u>Page</u>
1	World abaca production by country, 1997	2
2	Production of major fibers by type, Philippines, 1990-1997	5
3	Area devoted to major fiber crops by type,	5
4	Yield of major fiber crops by type, Philippines, 1990-1997	5
5	Domestic consumption of fibers by type of fiber crop, Philippines, 1991-1997	13
6	Distribution of domestic consumption of abaca fiber by sector, Philippines, 1991-1997	13
7	Trend in domestic consumption of abaca fiber by sector, Philippines, 1991-1997	15
8	Average export revenue shares by type of fiber crop, 1990-1997	17
9	Average export revenue shares by type of Philippine abaca manufactures, 1990-1997	21
10	Trend in export revenue by type of Philippine abaca manufactures, 1990-1997	21
11	Trend in the value of Philippine imports of raw fibers and manufactures, 1990-1997	32
12	Trend in the volume of Philippine imports of raw fibers and manufactures, 1990-1997	35

LIST OF APPENDIX TABLES

<u>Appendix Table No.</u>	<u>Title</u>	<u>Page</u>
1	Total world production of abaca	85
2	Abaca fiber production by region, Philippines, 1991-1997	86
3	Area planted to abaca by region, Philippines, 1991-1997	87
4	Abaca fiber yield by region, Philippines, 1991-1997	88
5	Average world cotton lint production, area, and yield, 1990-1997	89
6	Cotton hectareage by region and by province, Philippines, 1993-1997	90
7	Annual baling of salago fiber by district of Production, Philippines, 1990-1996	91
8	Ramie production by region, Philippines, 1990-1997	92
9	Area planted to ramie by region, Philippines, 1990-1997	93
10	Area planted to maguey by region, Philippines, 1990-1996	94
11	Area planted to mulberry by region, Philippines, 1991-1997	95
12	Philippine production of cocoon, raw silk, and Fabrics, 1990-1997	96
13	Production of dried cocoons by region, Philippines, 1990-1997	97

<u>Appendix Table No.</u>	<u>Title</u>	<u>Page</u>
14	Production of piña fiber and fabrics, Philippines, 1990-1997	98
15	World export of abaca, fiber, 1990-1997	99
16	Quantity of exports of Philippine abaca fibercrafts, 1990-1997	100
17	Export earnings from Philippine abaca fibercrafts, 1990-1997	101
18	Quantity of Philippine exports of silkworm cocoons and silk products, 1990-1997	102
19	Quantity of exports of Philippine fibers from fiber crops, 1990-1997	103
20	Quantity of exports of Philippine salago fiber by country of destination, 1990 and 1997	104
21	Philippine volume and value of imported ramie products by country of origin, 1990 and 1997	105
22	Philippine volume and value of imported raw silk and silk products by county of origin, 1990 and 1997	106
23	Philippine volume and value of imported sisal fiber and sisal products by county of origin, 1990-1997	107
24	Responsibilities of selected government agencies and SCUs in Fiber Crops R & D as part of the National Commodity Research and Development Centers (NMCRDCs)	108
25	Prioritization of commodities based on selected Parameters (developed by the Science and Technology Coordinating Council,STCC,1989)	109
26	PCARRD listing of priority commodities including their rank and percent share in the total research	110

<u>Appendix Table No.</u>	<u>Title</u>	<u>Page</u>
	budget	
27	Regional priority commodities under NAREA of BAR	111
28	List of completed cotton researches conducted by CRDI/CODA, 1988-1998	112
29	List of on-going cotton researches being conducted by the CRDI/CODA as of 1999	120
30	List of completed researches on multi-commodity/ fiber crops conducted by FIDA, 1988-1999	123
31	List of on-going researches on multi-commodity/ fiber crops conducted by FIDA	128
32	List of completed researches on abaca conducted by the UPLB, 1988-1998	129
33	List of completed researches on cotton conducted by the UPLB, 1988-1998	131
34	List of completed researches on ramie conducted by the UPLB, 1988-1998	132
35	List of completed researches on other fiber crops conducted by the UPLB, 1988-1998	132
36	List of completed researches on silk conducted by the UPLB, 1988-1998	133
37	List of on-going researches on other fiber crops conducted by the UPLB	133
38	List of on-going researches on cotton conducted by the UPLB	134
39	List of on-going researches on abaca conducted by the UPLB	134
40	List of completed MS and PhD thesis on fiber crops	135

<u>Appendix Table No.</u>	<u>Title</u>	<u>Page</u>
	conducted at UPLB, 1988-1998	
41	List of completed abaca researches conducted by the VISCA-National Abaca Research Center, 1988-1998	137
42	List of on-going abaca researches being conducted by the VISCA-National Abaca Research Center as of 1999	139
43	List of completed researches on silk conducted by the DMMSU, 1988-1998	141
44	List of on-going researches on silk conducted by the DMMSU	144
45	List of completed researches on multi-commodity/fiber crops conducted by various institutions, 1988-1998	145
46	List of on-going researches on multi-commodity/fiber crops conducted by various institutions	146
47	Technologies generated for abaca and commercialized by NARC-VISCA, 1988-1998	147
48	FIDA-generated technologies generally adopted by farmers by region, Philippines, August-December, 1998	154
49	CRDI generated technologies	156

ABSTRACT

FIBER CROPS PROGRAM AREA RESEARCH PLANNING AND PRIORITIZATION

CORAZON T. ARAGON

The fiber crops industry is one of the country's major pillars in employment generation and foreign exchange earnings. However, recent trade developments and local production problems in the fiber crops industry might affect its long-term sustainability and viability. The reduction of trade barriers under the GATT-WTO implies that in order for the Philippines to be globally competitive, the country must exert all efforts to increase the productivity of Philippine fiber crops, lower the cost of production, and improve the quality of fiber and fiber products through technological developments.

In recent years, the Philippines' position as the top producer of abaca is being threatened by the increasing share of Ecuador in the world market. Abaca farmers in Ecuador are mechanizing and producing consistent quality fibers. Unless the weaknesses and threats in the abaca industry are faced, the country's market share in the world market for abaca fiber will continue to diminish.

This paper, therefore, aims to present an industry profile with focus on domestic production, consumption, external trade, problems/constraints, and market potentials; review past researches on fiber crops, technologies generated, and the extent of participation of the private and public sectors; identify research and technology gaps for the fiber crops industry; identify strengths and weaknesses in the institutional structure of research and extension interface, as well as research complementation efforts; and suggest recommendations and R & D agenda for the fiber crops industry.

FIBER CROPS PROGRAM AREA RESEARCH PLANNING AND PRIORITIZATION

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1.0 INTRODUCTION

The fiber crops industry is one of the country's major pillars in employment generation and foreign exchange earnings. However, recent trade developments and local production problems in the fiber crops industry might affect its long-term sustainability and viability. The reduction of trade barriers under the GATT-WTO implies that in order for the Philippines to be globally competitive, the country must exert all efforts to increase the productivity of Philippine fiber crops, lower the cost of production, and improve the quality of fiber and fiber products through technological developments.

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To address the issue on the global competitiveness of the country's fiber and fiber products and in line with the objective of modernizing agriculture as stipulated under AFMA, there is a need to review past research efforts and formulate a research plan for the fiber crops industry which will be used as basis by the Department of Agriculture-Bureau of Research (DA-BAR) in properly allocating research resources among fiber crops and in setting priorities among research program areas.

This paper, therefore, has the following objectives:

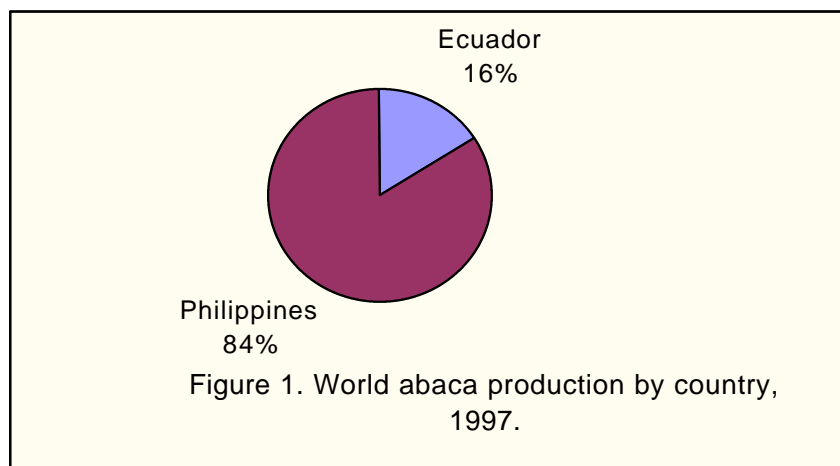
1. Present an industry profile with focus on domestic production, consumption, external trade, problems/constraints, and market potentials;
2. Review past researches on fiber crops, technologies generated, and the extent of participation of the private and public sectors;
3. Identify research and technology gaps for the fiber crops industry;
4. Identify strengths and weaknesses in the institutional structure of research and extension interface, as well as research complementation efforts; and
5. Suggest recommendations and R & D agenda for the fiber crops industry.

2.0 INDUSTRY PROFILE

2.1 Domestic Production

The country's major fibers include abaca, cotton, and silk while the minor fibers are salago, ramie, maguey, piña, buntal, buri, and raffia. Buri, raffia, and buntal fibers are obtained from the buri palm.

On the average, fiber crops production which averaged 79,621 metric tons (mt) accounted for a measly 0.12% of the country's total production of agricultural crops during the period 1990-1997 (Table 1). It exhibited a negative growth in production (-1.4%/year), area (-0.3%/year), and yield (-1.4%/year) from 1991 to 1997.



The Philippines is the top world producer and supplier of abaca fiber. In 1997, world abaca fiber production totaled 80,195 mt, 84% of which was produced by the Philippines while only 16% was produced by Ecuador, its major competitor (Appendix Table 1 and Figure 1). However, Ecuador posted a higher annual growth rate in abaca production at 4.7% compared to only 2% for the Philippines during the period 1990-97. Abaca contributed almost 95% of the country's fiber production, or 66,258 mt in the same year (Table 1). This could be attributed to the fact that abaca occupied the largest hectareage (112,284 hectares or 94%) of the total area planted to fiber crops (Tables 1 and 2). Abaca production had risen from 58,490 mt in 1990 to 66,258 mt in 1997 (Figure 2). The growth in abaca fiber crop production could be attributed to both area expansion (1.4%/year) and yield improvement (0.55%/year) (Figures 3 and 4). The expansion in abaca hectareage is due to the implementation of the Abakaunlaran 2000 Project since 1993. Under this flagship project of the Fiber Industry Development Authority (FIDA), about 13,000 hectares of new abaca areas will be developed and 8,700 hectares of old and diseased abaca plantations will be rehabilitated by the year 2000.

Table 1. Production of fibercrops, Philippines, 1990-1997.

YEAR	PRODUCTION (MT)							AGRICULTURAL PRODUCTION (MT)	PROPORTION OF FIBER CROPS PRODN TO AGRIC. PRODN (%)
	Abaca	Salago	Ramie	Maguey	Cotton	Others ^a	Total		
1990	58,490	853	2,776	323	8,684	713	71,839	61,566,500	0.12
1991	62,931	739	2,012	159	15,146	808	81,795	64,109,300	0.13
1992	62,159	901	763	133	37,895	1,127	102,978	63,837,400	0.16
1993	58,633	812	153	144	18,855	1,034	79,631	65,766,500	0.12
1994	65,220	915	152	54	6,496	948	73,785	68,525,600	0.11
1995	63,821	819	86	49	11,944	727	77,446	62,164,800	0.12
1996	69,462	943	12	23	8,529	614	79,583	69,128,500	0.12
1997	66,258	830	10	60	2,193	559	69,910	68,301,400	0.10
Average (MT)	63,372	852	746	118	13,718	816	79,621	65,425,000	0.12
% Share									
1990	81.42	1.19	3.86	0.45	12.09	0.99	100.00		
1997	94.77	1.19	0.01	0.09	3.14	0.80	100.00		
1990-1997	79.59	1.07	0.94	0.15	17.23	1.03	100.00		
Annual Growth									
Rate (%)	2.0	^b	-45.2	-3.3	^b	-1.7	0.76 ^c (1.4) ^d	1.7	

^a Includes buntal, raffia, silk, piña, and musa species

^b Highly erratic

^c 1990-1997

^d 1991-1997

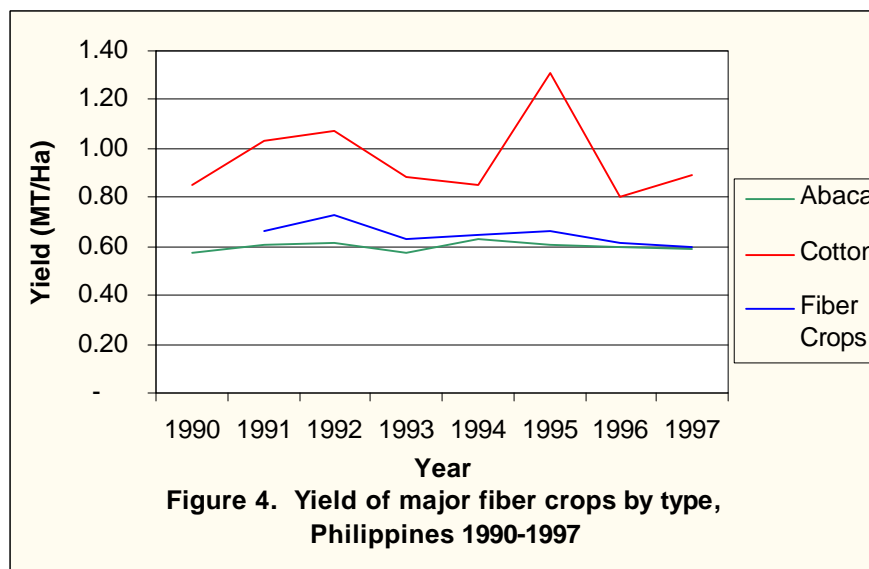
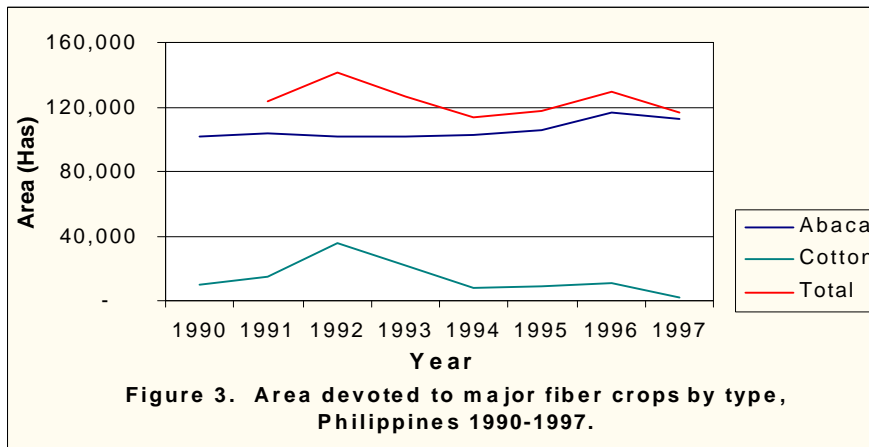
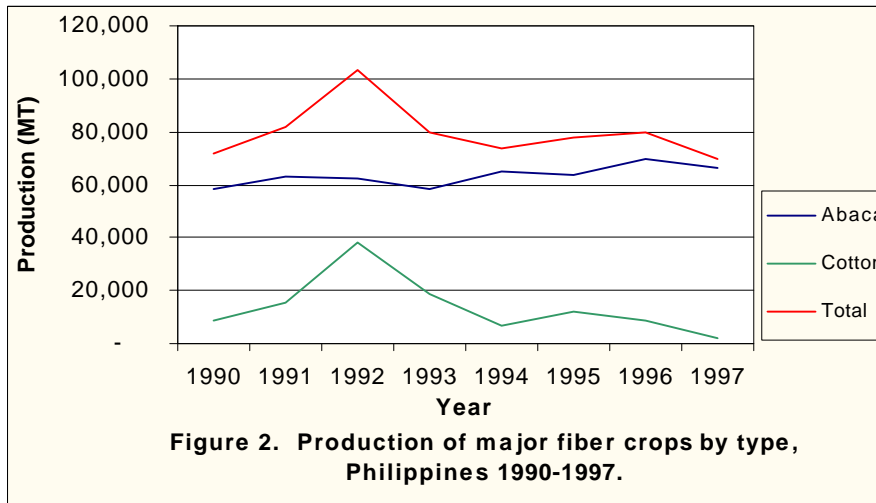
Sources of basic data: FIDA, BAS, and CODA

Table 2. Area planted to fibercrops, Philippines, 1990-1997

YEAR	AREA PLANTED (HA.)								All Agricultural Crops	PROPORTION OF AREA PLANTED TO FIBER CROPS TO TOTAL AGRICULTURAL AREA (%)
	Fiber Crops									
	Abaca	Salago	Ramie	Maguey	Mulberry	Pineapplea	Cotton	Total		
1990	102,055	na	2,182	1,436	na	na	10,169			
1991	103,953	1,739	1,047	1,207	371	27	14,719	123,064	13,096,300	0.94
1992	101,700	1,739	544	1,222	396	28	35,284	140,912	12,983,700	1.09
1993	101,753	1,308	427	1,152	555	33	21,305	126,533	12,520,400	1.01
1994	102,925	1,320	84	868	598	35	7,642	113,472	12,549,000	0.90
1995	105,444	1,267	55	870	584	37	9,104	117,361	12,786,900	0.92
1996	116,658	996	20	527	308	38	10,621	129,169	12,574,800	1.03
1997	112,284	849	15	535	278	71	2,447	116,479	13,015,600	0.89
Average (Ha.)										
1990-97	105,847		547	977			13,911			
1991-97	106,388	1,317	313	912	441	39	14,446	123,856	12,789,529	0.97
% Share										
1991	84.47	1.41	0.85	0.98	0.30	0.02	11.96	100.00		
1997	96.40	0.73	0.01	0.46	0.24	0.06	2.10	100.00		
1991-1997	85.90	1.06	0.25	0.74	0.36	0.03	11.66	100.00		
Annual Growth										
Rate (%)	1.4	-10.7	-46.4	-11.1	-0.1	20.2	-0.9	-0.3	-0.1	

Sources of basic data: FIDA, BAS, and CODA

As of 1996, FIDA was able to establish 3,165.6 hectares of new plantations and rehabilitate 2,371 hectares of old and diseased areas (FIDA, 1997).



Eastern Visayas posted the highest abaca fiber production of 27,263 mt or 41.1% of the country's production in 1997 (Appendix Table 2). The Bicol Region ranked second to Eastern Visayas in terms of abaca fiber production (18,651 mt or 28.1% share) despite the fact that it had the largest abaca hectareage in the country (Appendix Tables 2 and 3). The whole of Mindanao contributed 29% of the country's abaca fiber production in the same year.

Abaca hectareage in the Bicol Region posted a negative trend (-1.9%/year) during the period 1991-97 due to disease infestation (Appendix Table 3). Southern Tagalog, Central Mindanao, and Western Mindanao also exhibited a declining trend in abaca hectareage at -10.1%, -2.2%, and -1.5% per year, respectively from 1991 to 1997. In contrast, expansion of area devoted to abaca production in Eastern Visayas and Western Visayas was remarkable as evident from their annual positive growth rates of 60.2% and 53.2%, respectively, in the same period. Other regions which recorded positive growth rates in abaca hectareage were Southern Mindanao (8.6%/year), CARAGA (7.1%/year), and Central Visayas (1.9%/year).

National abaca yield level has remained low averaging 0.6 mt per hectare during the period 1991-97 (Table 3). This is comparatively much lower than the country's potential abaca yield of 2.0 mt per hectare and Ecuador's average abaca yield which ranges from 1.0-1.5 mt per hectare (Teotico, 1998). The country's low abaca productivity is caused by the following: 1) the infestation of abaca plantations by bunchy top and mosaic diseases, especially the Bicol Region; 2) the destructive typhoons and long drought; 3) low-yielding abaca varieties planted; and 4) lack of skills and financial capability of abaca farmers to efficiently manage their farms (FIDA, 1997). The highest yield level of 0.63 mt per hectare was recorded in 1994.

Abaca productivity varied considerably among abaca-producing regions. Eastern Visayas posted the highest yield averaging 0.98 mt per hectare, followed by Southern Mindanao with 0.79 mt per hectare from 1991 to 1997 (Appendix Table 4). However, both regions showed a declining trend in abaca productivity (-2.4%/year and -3.3%/year, respectively) in the same period. On the average, abaca yield in the Bicol Region was 0.45 mt per hectare, which was approximately 46% lower than the yield level in Eastern Visayas. Abaca yield in the Bicol region exhibited a highly fluctuating trend. The highest yield level was recorded in 1994 (0.54 m ton per hectare) due to favorable weather condition. On the other hand, Southern Tagalog, which is one of the regions with low abaca productivity in the country, posted the highest growth rate in abaca yield at 28.6% per year during the period 1991-97, followed by Northern Mindanao at 26.3% per year. Other regions which showed an improvement in abaca productivity were Central Mindanao (6.1%/year), CARAGA (3.8%/year), and Western Mindanao (0.6%/year). In contrast, abaca productivity in Central Visayas, which was already very low in 1991 (0.20 mt per hectare) further decreased to 0.11 mt per hectare in 1997.

Cotton ranked second to abaca with its production averaging 13,718 mt during the period 1990-97 (Table 1). In 1997, cotton production in the country declined to 2,193 mt

Table 3. Yield of selected fiber crops, Philippines, 1990-1997.

YEAR	YIELD (MT/HA)					
	Abaca	Salago	Ramie	Maguey	Cotton ^a	Fiber Crops
1990	0.57		1.27	0.22	0.85	
1991	0.61	0.42	1.92	0.13	1.03	0.66
1992	0.61	0.52	1.40	0.11	1.07	0.73
1993	0.58	0.62	0.36	0.13	0.89	0.63
1994	0.63	0.69	1.81	0.06	0.85	0.65
1995	0.61	0.65	1.56	0.06	1.31	0.66
1996	0.60	0.95	0.60	0.04	0.80	0.62
1997	0.59	0.98	0.67	0.11	0.90	0.60
Average (MT)	0.60	0.69	1.20	0.11	0.96	0.65
Annual Growth						
Rate (%)	0.6	16.1	^c	^c	4.4	-1.4

^a Based on CODA statistics

^b Based on BAS statistics

^c Highly erratic

Sources of basic data: FIDA, BAS and CODA

compared to 8,684 mt in 1990 (Table 1 and Figure 2). This could be attributed to the significant reduction in cotton hectareage in 1997 caused by the downward trend in the domestic and world prices of cotton and the farmers' shifting to more profitable crops (Table 2 and Figure 3). From an area of 10,169 hectares involving 8,766 farmers in 1990, area planted to cotton by commercial farms tapered to 2,447 hectares involving only about 2,272 farmers (Table 4). Despite the contraction in area planted to cotton, cotton productivity at the national level modestly improved from 0.85 mt in 1990 to 0.90 mt in 1997 as a result of the release of locally developed high-yielding cotton varieties (Table 3 and Figure 4). The highest cotton yield was attained in 1995 at 1.31 mt per hectare. However, this is 37% lower than the potential cotton yield of 3.5 mt per hectare using improved technology under irrigated condition (CODA, 1998).

World statistics also show that the Philippines had the lowest cotton lint production which averaged 5,211 mt during the period 1990-97 (Appendix Table 5). This is primarily because of the country's relatively low cotton yield and small hectareage compared to the large cotton-producing countries. The Philippines ranks 7th among the countries with the lowest cotton yield.

With production contraction, the national importance of the cotton industry, likewise, dwindled. Hence, its economic contribution substantially declined from PHP199.57 million in 1990 to PHP58.24 million in 1997, or by 71% (Table 4).

Cotton is grown in seven regions of the country particularly in Ilocos Norte, Ilocos Sur, La Union, and Pangasinan in Region I, Tarlac in Region III, Iloilo in Region VI, Negros Oriental in Region VII, Zamboanga del Sur in Region IX, Davao del Sur, Sarangani and South Cotobato in Region XI, and in North Cotobato, Sultan Kudarat and Maguindanao in Region XII (Appendix Table 6). Except for Ilocos Sur, La Union, Zamboanga del Sur, and Sarangani, negative growth rates in cotton hectareage were posted by most cotton-producing provinces.

With regard to salago, its fiber production exhibited a fluctuating trend during the period 1990-97 owing to its two-year harvesting cycle (Table 1). Baling of salago fiber averaged 852 mt per year during this period. The peak production level was attained in 1996 at 943 mt while the lowest was recorded in 1991 at 739 mt. Central Visayas was the major salago-producing region contributing 94.7% of the total salago production (892 mt) in 1996 (Appendix Table 7). Bicol (5.3%) and Southern Tagalog (0.1%) trailed behind.

Despite the large contraction in salago hectareage from 1,739 hectares in 1990 to 849 hectares in 1997, or by 10.67% annually, productivity of this crop increased markedly by 16.07% per annum (Tables 2 and 3).

As regards to ramie, local production declined markedly by 45.2% owing to a large extent to reduction in area planted (-46.44%) as a result of conversion to more profitable crops during the period under study (Tables 1 and 2). Furthermore,

Table 4. Cotton Production, Philippines, 1990-1997.

YEAR	NO. OF FARMERS	AREA PLANTED (Ha.)	TOTAL PRODUCTION (MT)	TOTAL PRODUCTION (MT Lint)	VALUE OF LINT (Million Pesos)	VALUE OF SEEDS (Million Pesos)	TOTAL REVENUE (Million Pesos)
1990	8,766	10,169	8,684	3,300	173.52	26.05	199.57
1991	16,610	14,719	15,146	5,755	326.39	45.44	371.83
1992	24,868	35,284	37,895	14,400	566.93	113.69	680.62
1993	14,438	21,305	18,855	7,155	297.34	56.56	353.90
1994	6,060	7,642	6,496	2,468	132.85	19.49	152.34
1995	8,666	9,104	11,944	4,539	272.33	35.83	308.16
1996	8,498	10,621	8,529	3,241	178.25	25.59	203.84
1997	2,272	2,447	2,193	833	51.66	6.58	58.24
Average	11,272	13,911	13,718	5,211	250	41	291

Source of basic data: CODA

ramie productivity significantly declined by 94.72% from 1.27 mt in 1990 to only 0.67 mt in 1997 (Table 3). Southern Mindanao was the only producer of ramie in 1997 (Appendix Tables 8 and 9).

Like ramie, maguey exhibited a negative growth in production (-3.3%/year) and hectarage (-11.14%/year) (Tables 1 and 2). Maguey fiber production level (60 mt) in 1997 was in fact 1/5 lower than that in 1990 (323 mt). The decline in maguey fiber production could be attributed to the inefficient extraction method, the prohibition of retting, which is a polluting method/procedure, in sea water due to resort development, area contraction due to lack of interest among farmers to continue growing this crop because of the low price offered by buyers, and the decrease in maguey productivity from 0.22 mt in 1990 to 0.11 mt in 1997 as a result of the existence of old plantations which need rehabilitation (FIDA, 1997). Maguey fibers are mainly produced in Central Visayas (Bohol and Cebu) and the Ilocos Region (Pangasinan) (Appendix Table 10).

In 1997, a total of 278.1 hectares were planted to mulberry, the sole food of silkworm (Appendix Table 11). This was 1.3 times lower than the total area planted to this crop in 1990 (370.8 hectares). Western Visayas had the largest area accounting for 36.1% of the total area planted to this crop in 1997, followed by Southern Mindanao with approximately 33%. Other mulberry-producing regions were Southern Tagalog, Western Mindanao, CAR, Northern Mindanao, Central Luzon, and Ilocos.

Production of silk products in the Philippines takes various forms from cocoon production to raw silk/silk yarns, fabrics, and garments. Considering that the Philippine sericulture industry is still in its developmental phase, silkworm rearing for cocoon production is mostly done by small farmers' groups or cooperatives under the close supervision and support of government agencies like FIDA, the Philippine Textile Research Institute (PTRI), Don Mariano Marcos Memorial State University - Sericulture Research and Development Institute (DMMMSU-SRDI) and other state universities and colleges (SCUs) (FIDA, 1997).. As of 1997, there were 38 cooperatives engaged in cocoon production in Luzon, Visayas, and Mindanao. Some farmers are currently into commercial cocoon production, but on a limited scale.

The volume of cocoon production averaged 2.29 mt and exhibited a negative trend during the period 1990-97 (Appendix Table 12). The declining trend in cocoon production from 1990 to 1993 could be attributed to the low production of the Silk Mountain Corporation. It stopped operating in 1993 because of the withdrawal of its foreign partner partly due to disagreements in price and quality (FIDA, 1997). Cocoon production in 1997 was concentrated in Western Visayas (29.5%), Northern Mindanao (21%), Ilocos (19%), Western Mindanao (11.1%) (Appendix Table 13). Other cocoon-producing regions include Southern Mindanao and Southern Tagalog.

On the other hand, raw silk production increased substantially from 0.31 mt in 1990 to 23.2 mt in 1992 and decreased thereafter. According to FIDA (1997), local production of raw silk is presently hampered and limited by the absence of a private filature (reeling plant) owing to the closure of APSI, the only commercial filature plant in

the country, in 1997. The operation of APSI was an on-and-off operation due to low and irregular domestic supply of cocoons. Its closure in 1997 was inevitable due to its non-optimum level of operation. Owing to the closure of APSI, conversion of cocoons into raw silk and silk yarn through reeling is presently being done locally by PTRI and DMMMSU-SRDI. However, production of these institutes is primarily for research and development purposes. During the last quarter of 1998, DMMMSU-SRDI established the Regional Silk Processing Center in Sta. Maria, Ilocos Sur to partially meet the demand for raw silk by local weavers in Aklan, Manila.

As regards to local production of silk fabrics, these are produced largely by local handloom weavers using either pure silk or silk blended with other fibers such as abaca and piña because of the closure of Phil-Fibers in Marikina, the country's only powerloom weaver and the handloom operations of Phi-Silk in Binalbagan, Negros Occidental due largely to lack of raw materials (FIDA, 1997).

The Red Spanish pineapple variety, which is used for fiber and cloth production, is presently grown in Aklan, La Union, and Negros. As of 1997, there were 38.4 hectares of pineapple cultivated in Aklan solely for its fiber (FIDA, 1997). Moreover, Negros had 26.55 hectares of piña farm while La Union had only 1,777 square meters planted to piña plants in the same year. The revival of the piña cloth industry could be attributed to the implementation of the following FIDA projects: "Pilot Production of Fiber and Cloth" in Aklan in 1989; "Integrated Native Pineapple Project" in Negros in 1993; and "Piña Production and Weaving" in La Union in 1995. Under these projects, continuous trainings on scraping, weaving, and knotting were conducted. As a result of these projects, loose and knotted piña fiber production substantially increased from 1990 to 1997 at 54.9% and 57.5% per year, respectively (Appendix Table 14). Likewise, production of handwoven piña cloth posted a positive growth at 23.9% per annum in the same period.

2.2 Domestic Consumption

Domestic consumption of raw fibers averaged 112,897 mt and posted an annual growth rate of 2.6% during the period 1991-97 (Table 5 and Figure 5). Among the fiber crops, domestic consumption was highest for cotton accounting for 59.94%, followed by abaca (38.23%). Raw silk, buntal/raffia, salago, maguey, ramie, piña, and musa species collectively accounted for only 1.83% of the total domestic consumption of raw fibers.

On the average, domestic processors consumed 43,159 mt or about 67.4% of the country's total abaca fiber production (64,069 mt) for the period 1991-97 (Table 5). A steady increase of about 1.1% per year in the consumption of abaca fiber by local processors resulted to the production of high-value added products (Figure 5).

Table 5. Domestic fiber consumption, Philippines, 1991-1997.

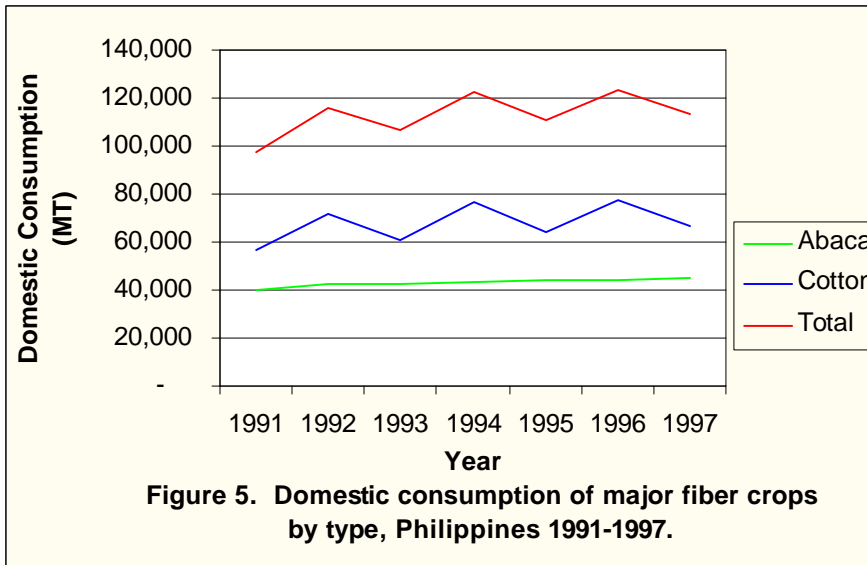
YEAR	DOMESTIC CONSUMPTION (MT)							Total ^c
	Abaca	Salago	Ramie	Buntal/ Raffia	Maguey	Cotton ^a	Other Fibers ^b	
1991	40,190	32	106	21	133	56,605	717	97,804
1992	42,279	60	6	60	137	71,394	1,515	115,451
1993	42,871	36	-	69	142	61,038	2,684	106,840
1994	43,700	37	-	106	85	76,570	2,124	122,622
1995	44,240	63	31	65	122	63,839	2,585	110,945
1996	43,900	173	100	34	22	77,387	1,476	123,092
1997	44,935	76	-	31	60	66,823	1,601	113,526
Average	43,159	68	35	55	100	67,665	1,815	112,897
% Share								
1991	41.09	0.03	0.11	0.02	0.14	57.88	0.73	100.00
1997	39.58	0.07	0.00	0.03	0.05	58.86	1.41	100.00
1991-1997	38.23	0.06	0.03	0.05	0.09	59.94	1.61	100.00
Annual Growth Rate (%)	1.1	32.7		34.0	24.0	4.2	24.0	2.6

a In lint

b Includes silk, piña and musa species

c Excludes coco coir

Sources of basic data: FIDA and CODA



Of the total domestic abaca fiber consumption during this period, 57.7% was absorbed by the pulp sector (Table 6 and Figure 6). The pulp sector is considered the growth area of the abaca industry due to favorable developments in the world market for its end-products such as meat casings, tea bags, cigarette papers and other specialty paper products (FIDA, 1997). Abaca fiber consumption by this sector grew by 3.4% annually from 1991 to 1997 (Table 6 and Figure 7).

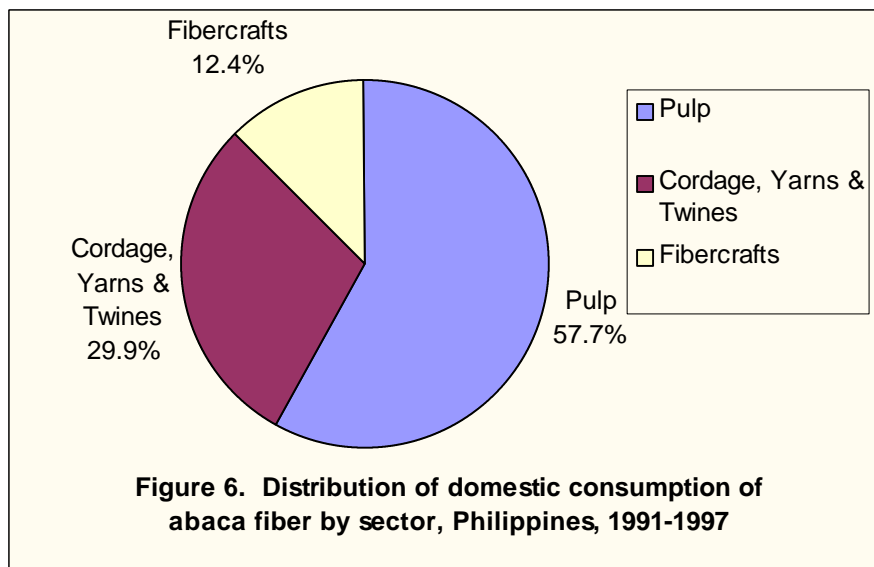
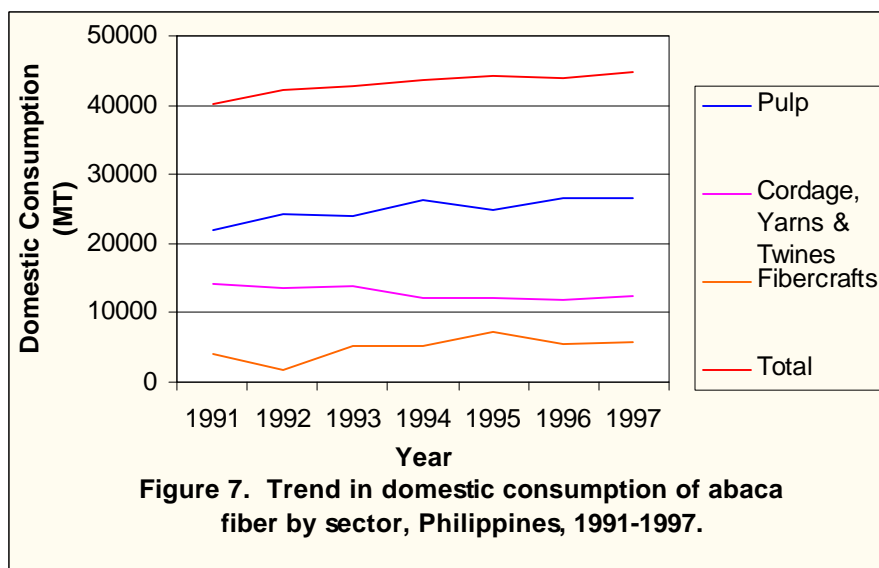


Table 6. Domestic consumption of abaca fiber by sector, Philippines, 1991-1997.

YEAR	DOMESTIC CONSUMPTION (MT)			
	Pulp	Cordage, Yarns & Twines	Fibercrafts	Total
1991	21971	14205	4014	40190
1992	24168	13495	1616	42279
1993	23926	13846	5099	42871
1994	26200	12270	5230	43700
1995	24870	12100	7270	44240
1996	26482	11808	5610	43900
1997	26650	12520	5765	44935
Average (mt)	24895	12892	5372	43159
% share	57.7	29.9	12.4	100.0
Annual Growth Rate (%)	3.4	-1.9	7.8	1.9

Sources of basic data: FIDA



The cordage sector, on the other hand, accounted for about 29.9% of the total fiber usage by the domestic manufacturers during the period 1991-97 (Table 6 and Figure 6). The volume of abaca fibers utilized by the local cordage industry posted a decreasing trend (-1.9%/year) in the same period (Table 6 and Figure 7). This might be attributed to the declining trend in export demand for ropes and twines as a result of stiff competition posed by synthetic cordage.

Among the domestic abaca fiber users, the fibercrafts sector exhibited the highest growth rate in consumption of abaca fiber at 7.8% in the same period (Table 7). This sector accounted for only 12.4% of the total abaca fiber usage during the period 1991-97 (Table 6 and Figure 6).

As regards to cotton lint, its domestic demand averaged 65,616 mt during the period under review (Table 5 and Figure 6). The demand for cotton lint by the local textile industry showed an increasing trend at 4.2% per year during this period. Relatively higher domestic demand for cotton lint was recorded in 1992 and in 1996 at 71,394 and 77,387 mt, respectively. Cotton lint produced in the country is only geared to the domestic market.

With regard to minor crops, salago is used mainly by local handmade papermakers in the country (FIDA, 1997). As of 1997, there were about 200 handmade papermakers in the country. Salago is considered the Philippines' counterpart of the Japanese "kozo" or paper mulberry, the main material used in Japan for handmade papermaking. From 1991 to 1997, annual domestic consumption of salago fiber which averaged 68 mt showed a fluctuating pattern following the harvesting cycle of the plant which happens every two years (Table 5). Nevertheless, domestic consumption of salago

fiber generally posted an upward trend (32.7%/year) during this period. The highest consumption level was recorded in 1996 at 173 mt.

As regards maguey fibers, total domestic production is consumed locally by the cordage (rope/twine), carpet and fibercraft manufacturers, as well as the handmade paper sector (FIDA, 1997). As of 1997, there were three licensed cordage/twine processors and a carpet maker using maguey in their production. Owing to dwindling maguey fiber supply, domestic consumption of maguey fiber declined from 133 mt in 1991 to 60 mt in 1997 (Table 5). Thus, the requirements of the domestic processing sector for maguey fiber have remained unmet (FIDA, 1997). For instance, two cordage companies need 72 mt of maguey fibers monthly to sustain their operations. In 1997, maguey fiber production reached only 60 mt which was insufficient to meet the total monthly requirement of these two companies. Due to the shortage of supply of maguey fibers, industrial manufacturers had to compete with cordage/twine makers and fibercraft manufacturers operating in the Ilocos Region and Central Visayas.

The bulk of the buntal fiber production was consumed locally while most of the raffia fibers were geared to the export market (FIDA, 1997). From 1991 to 1997, domestic consumption of buntal and raffia fibers averaged 55 mt and showed an erratic trend during the period 1991-97 (Table 5). Consumption was at its highest in 1994 with a volume of 106 mt while the lowest level was recorded in 1991 at 21 mt. Nevertheless, the average annual growth in consumption of these fibers was positive at 34%. Buntal fiber is used in the manufacture of buntal hats while raffia fiber which is commercially traded in unbleached and bleached form is loom woven into fabrics for use in wall coverings and upholstery materials (FIDA, 1997). It is also made into hats, bags, placemats, mats, folders, portfolios, shoes, slippers, motifs/accents, and as tying, décor and wrapping materials in department stores, boutiques, and specialty shops.

Being one of the strongest and most durable vegetable fibers, ramie's uses are in textile fabrics, furnishings, fishing nets, and sewing threads (FIDA, 1991). However, domestic consumption of ramie fiber was highly erratic owing to unstable fiber supply during the period 1991-97 (Table 5). From 106 mt in 1991, domestic consumption of ramie fiber decreased drastically to only 6 mt in 1992. There was no recorded domestic consumption of ramie fiber in 1993 and 1994. In 1993, domestic consumption of ramie fiber was 31 mt which increased to 100 mt in 1996. Again, there was no registered local consumption of ramie fiber in 1997.

The aggregate domestic consumption of raw silk, piña and musa species fibers averaged 1,815 mt from 1991 to 1997 (Table 5). Domestic consumption of these fibers grew markedly from 717 mt in 1991 to 1,601 mt in 1997 or by 24% annually.

Owing to its excellent properties such as striking luster and soft handle, silk has various applications and uses. In the Philippines, it is chiefly used for Barong Tagalog, wedding gowns, evening dresses, ladies' blouses, other novelty items, high-fashion garments, and accessories (e.g., hosiery, laces, gloves, purses, decorative boxes,

umbrellas, handbags, handkerchiefs, silk flowers, covers of books and albums, scarves, veils, fabrics belts, etc.).

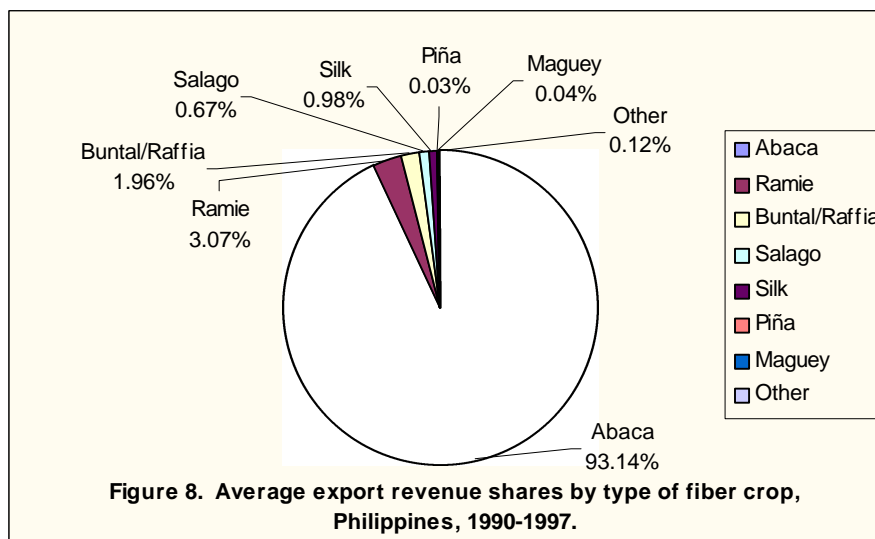
According to FIDA (1997), practically all handscraped piña fiber produced in Aklan and Negros are absorbed by the weavers in their respective provinces. In recent years, however, knotted fibers from Negros are delivered to Manila-based handloom weavers. As regards to piña cloth, the bulk is sold in the domestic market which is comprised of cloth traders in Aklan and Manila, local fashion designers, department stores, fashion houses/boutiques, and embroiderers in Lumban, Laguna and Taal, Batangas.

2.3 External Trade

2.3.1 Exports

Fibers and manufactures are among the top ten agricultural export products in the country. In 1997, raw fiber and fiber products ranked third in terms of generating export earnings from agricultural products (Table 7). Exports of fiber and fiber products generated an aggregate value of US\$90.5 million in the same year. This accounted for approximately 10.42% of the total export earnings generated from agricultural products. Philippine fibers except cotton are produced and exported in its raw and processed form.

Of the fiber crops export mix, abaca fiber and manufactures traditionally have the biggest share, accounting for 93.14% of the total foreign exchange earnings generated by the fiber crops industry during the eight-year period under review (Table 8 and Figure 8).



From 1990 to 1997, the Philippines generated an average of U.S.\$78.65 million a year from exports of abaca fiber and manufactures (e.g., abaca pulp, fabric, yarn, fibercraft, cordage and allied products) (Table 8). The largest contribution (75.5%) came from abaca manufactures with an average of U.S.\$59.34 million per year (Table 9).

Table 7. Export value of Philippine agricultural products, 1997.

AGRICULTURAL PRODUCTS	EXPORT VALUE F.O.B. US \$	PERCENT SHARE
Vegetables, fruits & nuts excluding		
oil nuts	520,370,662	59.93
Sugars & molasses	98,730,481	11.37
Fiber & fiber products from fibercrops	90,507,369	10.42
Fiber & fiber products from coco coir	1,424,557	0.16
Coconuts: fresh, young & matured, dried coconut meat & dessicated coconut	89,941,866	10.36
Tobacco and tobacco manufactures	40,002,685	4.61
Cocoa	19,218,987	2.21
Coffee and coffee substitutes	4,423,661	0.51
Corn	3,500,795	0.40
Spices	118,649	0.01
Total	868,239,712	100.00

Sources of basic data: National Statistics Office

Table 8. Export earnings from raw fibers and manufactures of Philippine fiber crops, 1990-1997.

YEAR	VALUE OF EXPORTS (FOB US\$) ^a								
	Abaca	Ramie	Buntal/Raffia	Salago	Silk	Piña	Maguey	Other Fibers ^b	Total
1990	61,560,107	9,265,860	2,384,401	765,150	532,052	14,431	252,469	2,105	74,776,575
1991	62,591,692	5,706,938	1,555,860	540,771	88,929	26,125	8,645	51,220	70,570,180
1992	74,454,751	2,427,241	1,311,284	622,936	105,806	4,487	-	70,025	78,996,530
1993	77,768,004	814,020	1,406,322	523,224	878,818	30,244	-	97,607	81,518,239
1994	82,425,551	1,410,562	2,000,312	558,225	1,083,760	38,604	-	76,722	87,593,736
1995	94,598,944	798,514	1,535,952	486,757	1,317,006	43,890	-	76,306	98,857,369
1996	88,125,984	336,637	2,081,851	506,027	1,503,969	9,519	-	142,362	92,706,349
1997	87,666,280	296	944,699	492,977	1,106,366	7,006	-	289,745	90,507,369
Average	78,648,914	2,595,009	1,652,585	562,008	827,088	21,788	32,639	100,762	84,440,793
% Share, 1990	82.33	12.39		3.19	1.02	0.71	0.02	0.34	100.00
% Share, 1997	96.86	0.00		1.04	0.54	1.22	0.01	0.32	100.00
% Share, 1990-1997	93.14	3.07		1.96	0.67	0.98	0.03	0.12	100.00
Ave. Annual Growth Rate (%)	5.5	-41.46		-6.18	-4.98	99.84	72.7	368.22	3.03

^a Excludes coco coir

^b Includes banana, musa factory wastes, canton, kozo, jute and sisal

Source of basic data: NSO

Table 9. Export earnings from manufactures of Philippine fiber crops, 1990-1997.

YEAR	VALUE OF EXPORTS (FOB US\$) ^a							
	Abaca	Ramie	Buntal/Raffia	Silk	Piña	Maguey	Other Fibers ^b	Total
1990	44,365,141	6,682,640	2,297,500	435,827	9,371	252,469	-	54,042,948
1991	45,374,361	3,920,008	1,540,375	11,938	-	-	4,112	50,850,794
1992	55,523,723	1,686,226	1,242,048	29,475	4,487	-	33,925	58,519,884
1993	60,676,356	487,414	1,248,036	821,353	28,444	-	5,149	63,266,752
1994	63,272,762	1,209,989	1,871,830	1,083,760	38,604	-	16,850	67,493,795
1995	71,938,377	701,014	1,439,838	1,314,856	43,890	-	13,615	75,451,590
1996	66,004,363	315,517	1,967,380	1,493,179	9,519	-	109,253	69,899,211
1997	67,590,460		832,349	1,106,366	7,006	-	226,445	69,762,626
Average	59,343,193	2,143,258	1,554,920	787,094	17,665	31,559	51,169	63,660,950
% Share, 1990	82.09	12.37		4.25	0.81	0.02	0.47	100.00
% Share, 1997	96.89			1.19	1.59	0.01	0.32	100.00
% Share, 1990-1997	93.22	3.37		2.44	1.24	0.03	0.08	100.00
Ave. Annual Growth Rate (%)	6.58	-31.18		-6.57	396.74			4.03

^a Excludes coco coir

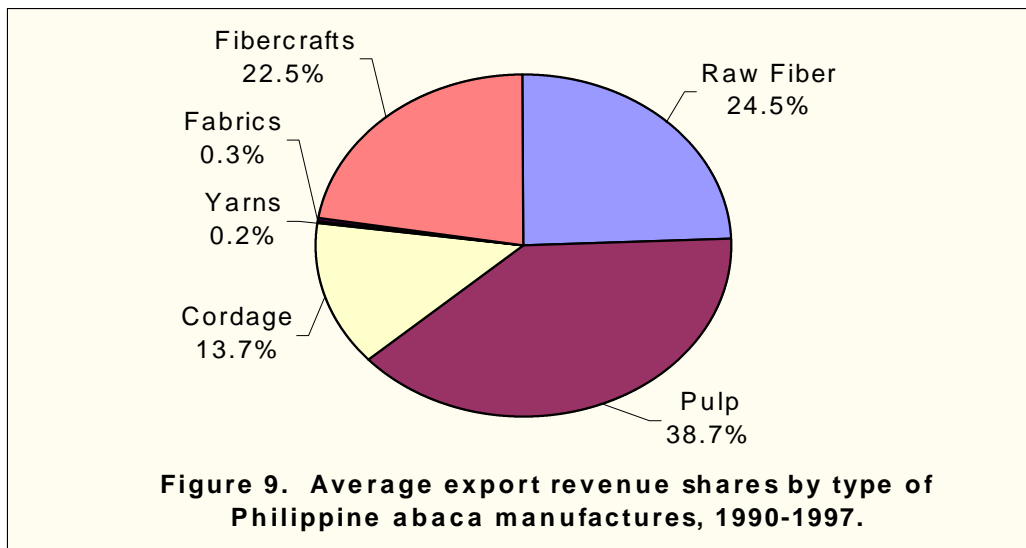
^b Includes jute and sisal

Source of basic data: NSO

Annual export earnings from abaca fiber averaged U.S.\$19.3 million, which accounted for approximately 24.5 % of the total export earnings generated by the abaca industry (Table 10). Total export revenue generated from abaca fiber and manufactures registered a growth rate of 5.5% per year in the same period (Table 8)..

Among the abaca manufactures, pulp contributed the highest average export earnings with U.S.\$30.54 million per year (38.7%), followed by fibercrafts with U.S.\$17.73 million (22.5%) (Table 11 and Figure 9).. Exports of cordage and allied products contributed U.S.\$ 10.77 million (13.7%) and yarns and fabrics, U.S.\$385,807 (0.5%).

The abaca pulp sector is considered the growth area of the Philippine abaca



industry due to favorable developments in the world market for its end-products like currency notes, meat casings, tea bags, cigarette paper, other specialty paper, and non-woven disposables (e.g., disposable medical gowns, globes, diapers, and sanitary napkins (FIDA, 1997). Pulp exports have been improving significantly at an average of 9.6% in value terms from 1990 to 1997 (Table 11 and Figure 10). From 9,475 mt valued at U.S. 20.68 million in 1990, the volume of abaca pulp exports markedly increased to 13,458 mt worth U.S.\$37.89 million in 1997 (Tables 11 and 12).

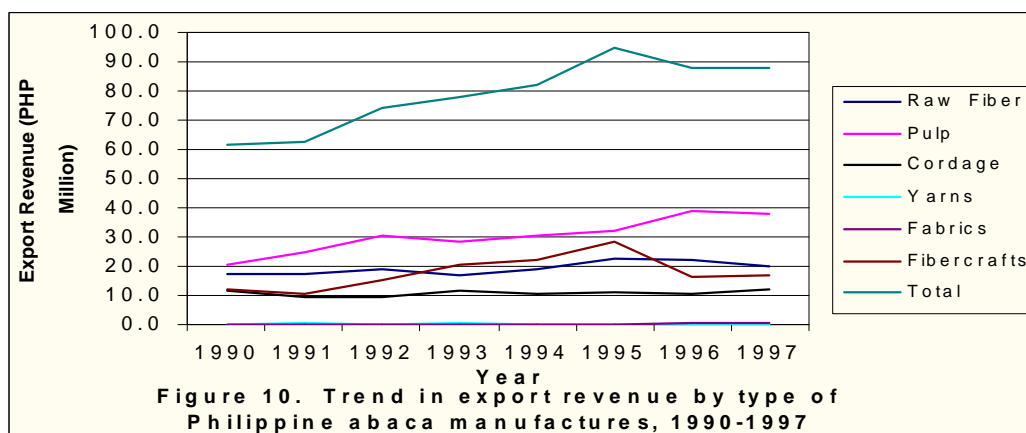


Table 10. Export earnings from raw fibers produced from Philippine fiber crops, 1990-1997.

YEAR	VALUE OF EXPORTS (FOB US\$) ^a								
	Abaca	Ramie	Buntal/Raffia	Salago	Silk	Piña	Maguey	Other Fibers ^b	Total
1990	17,194,966	2,583,220	86,901	765,150	96,225	5,060	-	2,105	20,733,627
1991	17,217,331	1,786,930	15,485	540,771	76,991	26,125	8,645	47,108	19,719,386
1992	18,931,028	741,015	69,236	622,936	76,331	-	-	36,100	20,476,646
1993	17,091,648	326,606	158,286	523,224	57,460	1,800	-	92,458	18,251,482
1994	19,152,789	200,573	128,482	558,225	-	-	-	59,872	20,099,941
1995	22,660,567	97,500	96,114	486,757	2,150	-	-	62,691	23,405,779
1996	22,121,621	21,120	114,471	506,027	10,790	-	-	33,109	22,807,138
1997	20,075,819	296	112,350	492,977	11,059	-	-	63,300	20,755,801
Average	19,305,721	719,658	97,666	562,008	41,376	4,123	1,081	49,593	20,781,225
% Share, 1990	82.94	12.46		0.42	3.69	0.46	0.02	0.01	100.00
% Share, 1997	96.72	0.00		0.54	2.38	0.05	0.00	0.30	100.00
% Share, 1990-1997	92.90	3.46		0.47	2.70	0.20	0.02	0.24	100.00
Ave. Annual Growth Rate (%)	2.73	-58.89		52.4	-4.98			326.30	0.44

^a Excludes coco coir

^b Includes banana, musa factory wastes, canton and kozo.

Source of basic data: NSO

Table 11. Export earnings from abaca fiber and manufactures, 1990-1997.

YEAR	EXPORT EARNINGS (FOB US \$)						
	Raw Fiber	Pulp	Cordage	Yarns	Fabrics	Fibercrafts	Total
1990	17,194,966	20,684,515	11,703,593	64,561	24,791	11,936,681	61,609,107
1991	17,217,331	24,690,755	9,562,723	412,507	39,320	10,669,056	62,591,692
1992	18,931,028	30,743,159	9,330,811	222,960	149,997	15,076,796	74,454,751
1993	17,091,648	28,345,224	11,456,449	367,237	71,264	20,436,182	77,768,004
1994	19,152,789	30,362,325	10,288,047	137,014	186,213	22,229,163	82,355,551
1995	22,660,567	32,077,319	11,157,524	175,373	185,927	28,342,234	94,598,944
1996	22,121,621	38,838,582	10,555,557	55,484	452,451	16,102,289	88,125,984
1997	20,075,819	37,893,934	12,095,791	72,882	468,477	17,059,376	87,666,279
Average	19,305,721	30,454,477	10,768,812	188,502	197,305	17,731,472	78,646,289
% Share	24.5	38.7	13.7	0.2	0.3	22.5	100.0
Ave. Annual Growth Rate (%)	2.7	9.6	1.4	69.4	85.1	9.3	5.5

Source: NSO

Table 12. Quantity of export of abaca fiber and manufactures, 1990-1997.

YEAR	QUANTITY OF EXPORT				
	Raw Fiber (mt)	Pulp (mt)	Cordage (mt)	Yarns (mt)	Fabrics (sq m)
1990	22,979	9,475	10,213	442	23,887
1991	19,662	10,616	9,172	311	21,268
1992	17,617	11,907	8,131	127	138,902
1993	15,403	10,794	8,546	195	42,934
1994	18,140	11,947	7,798	41	156,774
1995	19,338	11,506	8,061	102	66,496
1996	17,947	13,227	7,419	15	81,230
1997	17,791	13,458	8,408	4	213,336
Average	18,610	11,616	8,469	155	93,103
Ave. Annual Growth Rate (%)	-3.0	5.5	-2.4	-17.7	123.6

Source: NSO

In 1997, Germany absorbed the bulk of abaca pulp exports (44.3%), followed closely by Japan (40.1%) (Table 13). Other buyers of this product include France with 8.1% market share, the United States (3.3%), and China (1.9%). Increasing quantities of abaca pulp were also exported to Taiwan and Korea during the period under review.

During the period 1990-97, total world exports of abaca fiber averaged 30,507 mt per year, the bulk (61%) of which was contributed by the Philippines while Ecuador contributed 39 % (Appendix Table 15). An average of 18,610 mt of abaca fiber was exported every year during the period 1990-97 (Table 12). The volume of abaca fiber exports, however, declined by 3% annually from 1990 to 1997. Nevertheless, this was offset by an increasing trend in the domestic consumption and export of abaca manufactures in the form of pulp and fibercraft (FIDA, 1997). Despite the reduction in the volume of abaca fiber exports, revenue generated from its export increased at 2.73% per year during this period owing to favorable prices of abaca fiber (Table 10). The number of countries which imported abaca fiber from the Philippines decreased from 16 in 1990 to 13 in 1997 (Table 13). The bulk of abaca fiber exports in 1997 went to the United Kingdom (38.0%), Korea (33.6%) and the United States (24.5%).

Export earnings from abaca fibercraft products have been improving significantly from 1990 to 1997 as evident from its average annual growth rate of 9.3% despite the negative trend in export quantity at 0.6% per year (Tables 11 and Appendix Table 16). The major markets include the United States, Germany, Japan and Australia (FIDA, 1997). Among the abaca fibercraft products which have bright export markets are handbags (plaited and fabrics), doormats, and rugs considering that exports of these fibercraft products have been increasing tremendously over the years (Appendix Table 16). Handbags (fabrics and plaited) also exhibited the biggest demand with 81.73% market share in 1997. The combined market share of other exported fibercraft products such as doormats, rugs, coasters, and hot pads was miniscule at 1.25%. In terms of export revenue, handbags also posted the largest contribution among abaca fibercraft products (92.58%) (Appendix Table 17).

As regards to the export performance of the Philippine abaca cordage and allied products sector, the total volume of exports of these products declined from 10,213 mt in 1990 to 8,408 mt in 1997 (Table 12). Nevertheless, export earnings generated from cordage and allied products rose from U.S\$11.7 million in 1990 to U.S.\$12.1 million in 1997 due to rising prices of these abaca products (Table 11). The number of countries importing these products increased from 34 in 1990 to 38 in 1997 (Table 13). The United States remains as the biggest market for Philippine abaca cordage and allied products with 71.1% market share in 1997. Other foreign buyers of these products in the same year were Singapore (4.7%), Canada (3.2%), Netherlands (3.0%), and the United Kingdom (2.7%).

The abaca fabric sector exhibited the highest growth rate at 85.1% per year in terms of export revenue from 1990 to 1997 (Table 11). Likewise, the volume of exports of Philippine abaca fabrics increased tremendously from 23,887 square meters in 1990 to

Table 13. Number of importing countries, top 3 foreign buyers, and corresponding market shares in terms of export volume, Philippine abaca fiber and manufactures, 1990 and 1997.

FIBER						CORDAGE, ROPES, TWINE					
1990			1997			1990			1997		
No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)
16	UK	30.9	13	UK	38.0	34	USA	69.2	38	USA	71.1
	USA	30.7		Korea	33.6		Singapore	6.2		Singapore	4.7
	Japan	25.7		USA	24.5		Malaysia	2.5		Canada	3.2

PULP						CORDAGE, ROPES, TWINE					
1990			1997			1990			1997		
No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)
10	Japan	64.6	10	Germany	44.3	5	Japan	64.4	9	Italy	65.1
	Germany	27.0		Japan	40.1		Korea	24.8		UK	14.5
	Korea	2.2		France	8.1		Taiwan	6.3		USA	9.8

YARNS					
1990			1997		
No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)	No. of Importing Countries	Top 3 Foreign Buyers	Market Share (%)
8	Germany	27.3	3	Japan	95.2
	USA	14.1		UK	1.7
	UK	13.9		Italy	0.1

213,336 square meters in 1997 (Table 12). The increase in demand for abaca fabrics could be attributed to the growing awareness and interest in this product for décor and wrapping purposes as well as for fashion (FIDA, 1997). There is a high demand for natural fibers including those made of abaca because of their growing popularity as textile materials both in the international and local fashion scenes. The demand for abaca ribbonettes as decorative and packaging materials particularly in Taiwan, South Korea, Hong Kong, Italy, and the United Kingdom is also growing (FIDA, 1997). The increase in the number of foreign buyers of abaca fabrics from only five in 1990 to nine in 1997 is also a good indicator of the growing demand for this product (Table 13). In 1997, the top five buyers of Philippine abaca fabrics were Italy, the United Kingdom, the United States, Switzerland, and Japan. Italy was the biggest buyer of Philippine abaca fabrics with 65.1% market share. Export earnings from abaca fabrics averaged U.S.\$197,305 during the period 1990-97 (Table 11).

With regard to Philippine abaca yarn, the export market for this product is not promising since the volume of exports of this abaca product fell significantly from 442 mt in 1990 to only 4 mt in 1997 (Table 12). Moreover, the number of countries importing Philippine abaca yarn decreased to only three in 1997 compared to eight in 1997. Germany was the major foreign buyer in 1990. The United States which was the second major foreign buyer of abaca yarn in 1990 ceased importing from the Philippines in 1997. The bulk of Philippine exports of abaca yarn in 1997 was absorbed by Japan (95.2%) (Table 13). Other foreign buyers of this product were the United Kingdom (4.7%) and Italy (0.1%). On the average, the Philippines generated U.S.\$188,502 annually from exporting abaca yarn during the period 1990-97 (Table 11). The highest export earning (U.S.\$367,237) was attained in 1993.

In 1997, the silk industry ranked second to the abaca industry in terms of generating foreign exchange earnings among the fibercrops (Table 8 and Figure 8). It dislodged the ramie industry as the second top foreign exchange earner in the fibercrops industry. Compared to export revenue from abaca fiber and manufactures, export earnings generated from cocoons and silk products posted a remarkably faster growth at 99.8% per year during the period under review. The Philippines earned an average of US \$ 827,088 annually from exports of cocoons, wastes, raw silk, silk yarn, and fabrics from 1990 to 1997. Of this amount, approximately 95% was contributed by silk fabrics (Table 14). However, the bulk of Philippine silk exports was merely re-exports considering that the country's production of silk fabrics is presently limited to hand-woven fabrics (FIDA, 1997). The highest export revenue (US\$ 1.5 million) was recorded in 1996.

Philippine exports of silk fabrics averaged 141,268 square meters worth U.S.\$785,105 annually from 1990 to 1997 (Table 15). The volume of exports of silk fabrics was erratic during the 1990-97 period. Exports dropped from 1990 to 1992, then increased tremendously in 1993 until 1994, but decreased thereafter. The improvement in the country's exportation of silk fabrics in 1993 could be attributed to the marketing tie-up or exclusive market contract of a local handloom weaver with a foreign buyer (FIDA, 1997). Due to quality problems, however, this marketing contract terminated in 1995.

Table 14. Value of exports of Philippine silk products, 1990-1997.

YEAR	VALUE OF EXPORTS (FOB US \$)					
	Cocoons	Raw Silk	Yarns	Fabrics	Wastes ^a	Total
1990	96225	-	-	435,827	-	532,052
1991	76991	-	-	11,936	-	88,927
1992	3315	72096	-	29,475	920	105,806
1993	-	57,460	3,900	816,703	750	878,813
1994	-	-	-	1,083,760	-	1,083,760
1995	-	-	-	1,314,858	2150	1,317,008
1996	10,790	-	-	1,493,179	-	1,503,969
1997	-	7,260	208	1,095,099	3799	1,106,366
Average	23,415	17,102	587	785,105	952	827,088
% Share in 1997	0	0.66	0.02	98.98	0.34	100.00
% Share, 1990-1997	2.83	2.07	0.07	94.92	0.12	100.00
Ave. Annual Growth Rate (%)				394.5		99.8

Source of basic data: NSO

Table 15. Volume of exports of Philippine silk products, 1990-1997.

YEAR	VOLUME OF EXPORTS			
	Cocoons (Kgs.)	Raw Silk (Kgs.)	Yarns (Kgs.)	Fabrics (Sq. m.)
1990	4,880	-	-	33,053
1991	42,322	-	-	1,203
1992	161	2,340	-	6,247
1993	-	2,166	190	163,018
1994	-	-	-	323,744
1995	-	-	-	275,715
1996	1,300	-	-	192,757
1997	-	5,700	-	134,409
Average	6,083	1,276	24	141,268
Ave. Annual Growth Rate (%)				481

Source of basic data: NSO

The decline in the export volume of silk fabrics since 1994 was also caused by the reduction in importation of Japan, the country's major regular buyer of silk fabrics. It is interesting to note, however, that both the export volume and value of silk fabrics in 1997 were remarkably higher than the 1990 figures (Tables 14 and 15). From an export volume of 33,409 square meters valued at U.S.\$435,827 in 1990, silk fabrics exports soared to 134,409 square meters worth U.S.\$1.095 million in 1997. Japan was the sole foreign buyer of silk fabrics in 1990 and was the major buyer in 1997, absorbing 63% of the total volume of exports of this product in 1997 (Appendix Table 18). The country was able to expand its foreign buyers of silk fabrics consisting of Singapore, Hong Kong, Micronesia, United Kingdom, Belgium, France, South Korea, Spain, United Arab Emirates, and Indonesia in 1997.

On the other hand, exports of cocoons was on-and-off during the period 1990-97 (Table 14). No export of cocoons was made during the period 1993-94 due to the closure of SMC (FIDA, 1997). The country did not also export cocoons in 1997 because cocoon production of small farmers' cooperatives was all consumed locally. Japan, Hong Kong, and Korea used to import cocoons from the Philippines on an irregular basis (Appendix Table 18).

The country did not export raw silk and silk yarn annually from 1990 to 1997. Raw silk was only exported in three years (i.e., 1992, 1993, and 1997) during this period while silk yarn was exported in 1993 and 1997 (Tables 14 and 15). Export earnings from raw silk decreased markedly from US \$ 72,096 in 1992 to only US \$7,260 in 1997 while that of silk yarn declined to US \$3,900 in 1993 to US\$208 in 1997. Exports of raw silk and yarns were irregular because domestic production was mainly absorbed by local weavers (FIDA, 1997). Furthermore, lack of domestic supply of cocoons caused the irregular production of raw silk and silk yarn. In 1997, Greece was the only foreign buyer of Philippine raw silk (Appendix Table 18). The country used to export raw silk to Japan, Korea, and Sri Lanka during the period 1992-93.

Minor fiber crops consisting of buri, salago, pineapple, maguey, jute, sisal, banana and musa species had a measly contribution of 6.86% to total export earnings generated by the fiber crops industry during the 1990-97 period (Table 8).

Export earnings from the buri industry averaged U.S.\$1.65 million, which accounted for almost 2% of the total export earnings generated by the fiber crops industry during the period 1990-97 (Table 8). The bulk of the export earnings generated by the buri industry came from buntal, buri, and raffia manufactures (94 % or U.S.\$1.55 million) since export receipts from buntal and raffia fibers only averaged U.S.\$97,666 (6%). From U.S.\$2.38 million in 1990, export earnings generated by the buri industry, fell to U.S.\$0.94 million in 1997, or by 6.18% annually. This could be attributed to the decrease in export earnings from buntal, buri, and raffia manufactures which more than offset the increase in the export revenue from buntal and raffia fibers (Tables 9 and 10). Exports of buntal and raffia fibers which averaged 33 mt grew at a rate of 71.7 % per year from 1990 to 1997 (Appendix Table 19). Hence, export revenue from these fibers rose from U.S.\$86,901 in 1990 to U.S.\$112,350 in 1997 or by 52.4% annually (Table

10). The country exported a limited volume of buntal fiber to Japan while Philippine raffia fiber was purchased by the United States, Hong Kong, Japan, Taiwan, and Canada (FIDA, 1997). In contrast, export earnings from buntal, buri, and raffia manufactures posted a decreasing trend at 6.57% annually from approximately U.S.\$2.30 million in 1990 to U.S.\$0.83 million in 1997. This is due to the sharp decline in the export revenue generated from buri and buntal hats as well as buri placemats which together accounted for 87.5% of the total export earnings from buntal, buri, and raffia manufactures as a result of stiff competition with other countries particularly China (FIDA, 1997). Raffia hats and buri braids, however, have good market prospects abroad considering that foreign shipments of these products have been improving during the period under review. The main export markets of raffia and buri hats were the United States, Japan, Germany, and Australia while the United States, Japan, and Hong Kong were the primary foreign markets for buri braids. For buntal hats, the major importing countries include Australia, the United Kingdom, Spain, Japan, the United States, and Germany. Buri placemats were exported to the United States, France, the United Kingdom, and Germany.

Despite the fact that the bulk (91 %) of salago produced in the country was geared to the export market, the salago industry contributed merely 1% to total export earnings generated by the fiber crops industry during the period 1990-97 (Table 8). Due to limited application of salago fiber in pulp and paper production and the availability of cheaper substitutes, export earnings from salago fiber exhibited a decreasing trend at approximately 5% per year from 1990 to 1997. During the eight-year period, the highest export volume was recorded in 1992 at 828 mt while the lowest was registered in 1995 at 683 mt (Appendix 19). The average export volume of salago fiber was 752 mt worth U.S.\$562,008 annually during the period under review. Taiwan was the biggest buyer in 1997, contributing 48.3% of the total export volume in 1997 (Appendix Table 20). Other regular foreign buyers of salago fiber included Thailand, Japan, and China, absorbing 27%, 14.8%, and 9.9% of the total export volume of salago fiber in the same year. China was the newest market of salago fiber having started importing only in 1993 (FIDA, 1997).

Minimal export earnings were also generated from piña and maguey fibers and manufactures as well as from musa factory wastes, banana, canton, kozo, jute, and sisal fibers (Table 9). Their aggregate contribution to total export revenue generated by the fiber crops industry was measly at 0.19%.

During the period under review, the Philippines exported piña fiber only in 1990, 1991, and 1993 (Table 10). The highest export earnings from piña fiber amounting to U.S.\$26,125 was recorded in 1991. With regard to Philippine export of piña fabrics, export earnings showed a very irregular pattern (Table 9). The country exported piña cloth from 1990 to 1997 except in 1991. The highest export earnings from piña fabrics (U.S.\$43,890) was registered in 1995, but decreased thereafter because other importing countries ceased or slowed down their purchases (FIDA, 1997). Japan and the United Kingdom were the principal foreign buyers of piña fabrics, but their buying pattern was irregular or inconsistent.

The Philippines exported maguey fiber only in 1991 at 18.2 mt worth U.S.\$8,645. (Table 10). This could be attributed to the limited and unreliable supply of maguey fiber which practically went to the local market (FIDA, 1997). The Philippines started exporting maguey pulp in 1987, but stopped exporting in 1990 because the only maguey pulp plant in the country shut down partly due to insufficient supply of maguey fiber. The foreign buyers of maguey pulp were Japan, Taiwan, Germany, and Belgium with Japan as the major export market. Export earnings from maguey pulp in 1990 amounted to U.S.\$252,469 (Table 9).

In 1997, the ramie industry had the least contribution to export revenue generated by the fiber crops industry due to diminishing supply resulting from area contraction (Table 8). It used to be the second major contributor to export earnings in 1990. From U.S.\$9.27 million in 1990, export revenue generated by the ramie industry fell drastically to only U.S.\$296, or by 58.9% per year. Ramie fiber and manufactures were exported from 1990 to 1996. In 1997, the only source of export revenue was ramie fiber (Table 10).

2.3.2 Imports

From 1990 to 1997, the value of imports of raw fibers and manufactures grew by an average of 6.1% per year (Table 16 and Figure 11). The Philippines spent an average of U.S. \$99.7 million annually for the importation of these products during this period. Of this amount, cotton lint imports accounted for 91.9% with ramie (5.1%), silk (1.7%), sisal (0.6%), abaca (0.5%), and jute (0.4%) trailing behind. Likewise, the volume of imported raw fibers increased by 329.3% per year in the same period with cotton lint accounting for the largest chunk (97.53%) (Table 17 and Figure 12).

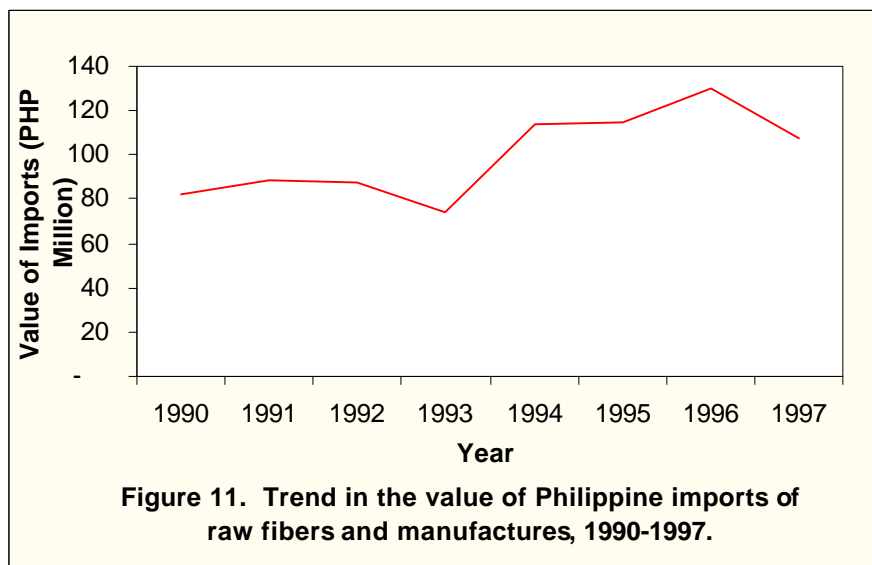


Table 16. Total value of imports of fibers and manufactures, 1990-1997.

YEAR	VALUE OF IMPORTS (FOB US\$)							
	Jute	Ramie	Silk	Abaca ^a	Sisal	Cotton Lint	Other Fibers	Total
1990	947,717	5,330,439	1,271,632			74,207,077		81,756,865
1991	696,468	8,709,650	1,206,273	15,750		77,695,491		88,323,632
1992	219,457	8,603,956	1,750,224		206,138	76,579,193		87,358,968
1993	486,728	6,031,542	1,870,854	346,127	739,466	64,392,758		73,867,475
1994	307,384	5,590,675	2,063,123	364,404	528,534	105,087,222		113,941,342
1995	298,007	3,509,340	2,152,494	1,087,871	879,144	106,763,047	45,147	114,735,050
1996	482,570	1,688,831	1,582,293	1,771,171	563,236	123,716,836		129,804,937
1997		948,944	1,263,875	281,940	815,354	104,499,748		107,809,861
Average	429,791	5,051,672	1,645,096	483,408	621,979	91,617,672	5,643	99,699,766
% Share								
1990	1.2	6.5	1.6			90.8		100.0
1997		0.9	1.2	0.3	0.8	96.9		100.0
1990-1997	0.4	5.1	1.7	0.5	0.6	91.9		100.0
Ave. Annual Growth Rate (%)	-7.3	-15.4	2.1		61.1	7.5		6.1

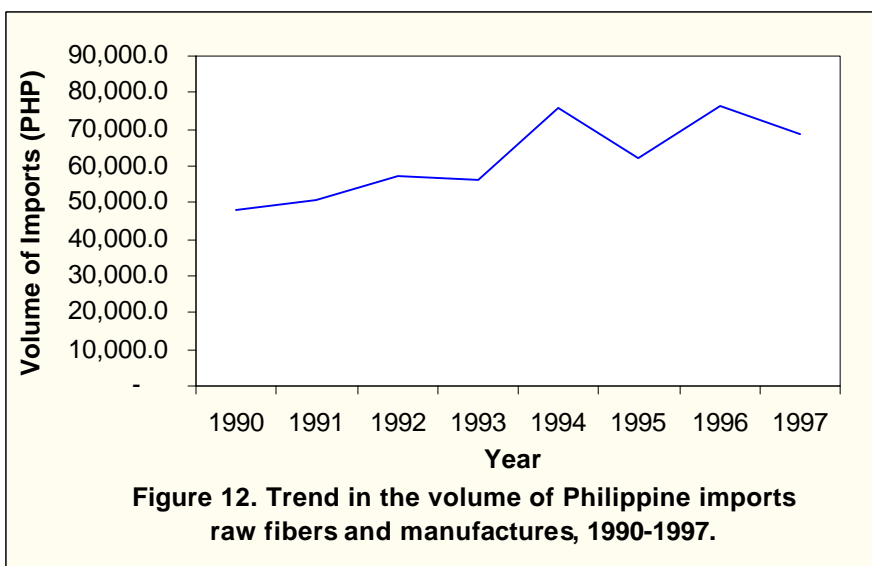
^a Raw fibers only imported from Ecuador.

Source of basic data: NSO

Table 17. Philippine quantity of imports of raw fibers, 1990-1997.

YEAR	QUANTITY OF IMPORTS (MT)							Total
	Jute	Ramie	Silk	Abaca	Sisal	Cotton Lint	Other Fibers	
1990			4.7			47,968		47,972.7
1991	26.4		0.3	22.5		50,850		50,899.2
1992	18.8		180.5		346.4	56,994		57,539.7
1993	30.9		9.0	303.8	1,939.4	53,883		56,166.1
1994	124.8		23.6	337.5	1,360.5	74,102		75,948.4
1995	184.5	0.5	132.5	634.3	1,844.1	59,300	79	62,174.9
1996	101.8		28.1	1,057.1	898.8	74,146		76,231.8
1997			16.5	1,361.0	1,162.1	65,990		68,529.6
Average	60.9	0.06	49.4	464.5	943.9	60,404	9.9	61,932.8
% Share								
1990			0.01			99.99		100.0
1997			0.02	1.99	1.70	96.29		100.0
1990-1997	0.10		0.08	0.75	1.52	97.53		100.0
Ave. Annual Growth Rate (%)	40.4		8625.9		88.7	6.3		329.3

Source of basic data: NSO



Owing to insufficient local production, the country's supply of cotton lint largely comes from imports (91.9%) (Table 18). During the period 1990-97, domestic demand for cotton lint by the local textile industry averaged 65,616 mt which exceeded average domestic production (5,211 mt). Thus, the Philippines imported an average of 60,404 mt of cotton lint during this period. Imports of cotton lint rose from 47,968 mt in 1990 to 65,990 mt in 1997 posting an average annual growth rate of 6.3%. The United States, Pakistan, India, Egypt, and Africa are the important suppliers of cotton lint imported to the country.

On the average, expenditures for the importation of ramie fiber and manufactures totaled to U.S.\$5.05 million per year during the period 1990-97 (Table 16). The bulk of imports during this period consisted of ramie fabrics and yarn (Appendix Table 21). Ramie fiber was imported only in 1995 at a minimal quantity (0.5 mt) (Appendix Table 19). Korea (63.7%) and China (20.5%) were the major sources of imported ramie yarn in 1997 while the bulk of imported ramie fabrics came from Taiwan (67.4%) and Vietnam (28%) (Appendix Table 21).

The Philippines also spent an average of approximately U.S.\$1.645 million annually for the importation of various semi-processed and manufactured silk from 1990 to 1997, the bulk of which was contributed by silk fabrics (71.4%) (Table 19). The value of imported silk fabrics, however, declined by 2.9%/year during this period. This could be largely attributed to the decreasing trend in its import price considering that the volume of imports of silk fabrics registered an annual growth rate of 12.6% during the eight-year period (Table 20). In 1997, the bulk of imported silk fabrics which are the basic raw materials for manufacturing garments and lingerie came from Korea (63%). Other suppliers of silk fabrics were Singapore (13%), Italy (7.2%), Hong Kong (6.4%), and India (4.4%), among other countries (Appendix Table 22). Most of their manufactured goods are bound for the export market practically making the Philippines

Table 18. Cotton lint demand and supply sources (imports and local production) in the Philippines, 1990-1997.

YEAR	DEMAND (mt lint)	SUPPLY			PROPORTION OF IMPORTS TO TOTAL SUPPLY (%)
		Import (mt lint)	Local Production (mt lint)	Total (mt lint)	
1990	51,268	47,968	3,300	51,268	93.6
1991	56,605	50,850	5,755	56,605	89.8
1992	71,394	56,994	14,400	71,394	79.8
1993	61,038	53,883	7,155	61,038	88.3
1994	76,570	74,102	2,468	76,570	96.8
1995	63,839	59,300	4,539	63,839	92.9
1996	77,387	74,146	3,241	77,387	95.8
1997	66,823	65,990	833	66,823	98.8
Average	65,616	60,404	5,211	65,616	92.0

Source of basic data: CODA and NSO

Table 19. Value of Philippine imports of silk products, 1990-1997.

YEAR	VALUE OF IMPORTS (US \$)					
	Cocoons	Silk Wastes ^a	Raw Silk	Yarns & Threads	Fabrics	Total
1990	-	-	49,262	4,184	1,218,186	1,271,632
1991	-	-	8,762	22,091	1,175,420	1,206,273
1992	-	126,892	99,570	12,301	1,475,461	1,714,224
1993	35,500	30,058	-	2,735	1,802,561	1,870,854
1994	-	23,800	544,587	168,707	1,326,029	2,063,123
1995	-	97,156	1,109,431	206,271	739,636	2,152,494
1996	-	2,880	652,316	73,518	853,579	1,582,293
1997	-	42,495	437,330	7,086	776,964	1,263,875
Average	4,438	40,410	362,657	62,112	1,170,980	1,640,596
% Share in 1990	-	-	3.9	0.3	95.8	100.0
% Share in 1997		3.4		0.6	61.5	100.0
% Share in 1990-97	0.3	2.5		3.8	71.4	100.0
Ave. Annual Growth Rate (%)				891.7	-2.9	2

Source of basic data: NSO

Table 20. Quantity of Philippine imports of silk products, 1990-1997.

YEAR	QUANTITY OF IMPORTS		
	Raw Silk & Silk Wastes ^a (Kgs.)	Yarns & Threads (Kgs.)	Fabrics (Sq. m.)
1990	4,733	650	194,063
1991	307	3,453	161,443
1992	172,532	5,458	287,983
1993	-	177	238,314
1994	23,578	9,545	343,239
1995	132,517	12,355	264,921
1996	28,142	8,342	212,103
1997	26,600	2,200	302,806
Average	48,551	5,273	250,609
Ave. Annual Growth Rate (%)		801.2	12.6

Source of basic data: NSO

just an assembly point (FIDA, 1997).

On the other hand, importation of cocoons valued at U.S.\$35,500 was made only in 1993 to sustain the operation of APSI (FIDA, 1997). However, APSI opted to stop importing from 1994 to 1997 and instead accumulated and used whatever local supply was available (Table 19).

In view of the limited local production, the country also resorted to importation of raw silk and silk wastes to meet the demand of local weavers from 1990 to 1997, except in 1993 when the country did not import these products (Table 20). Imports of raw silk and silk wastes showed a very erratic trend during this period, but the largest volume of importation (172.5 mt) was registered in 1992. Bulk of imports of raw silk in 1997 was sourced from China (76.4%) (Appendix Table 22). Other sources of imported raw silk were Singapore (10.3%), Vietnam (9.7%), and Hong Kong (3.6%). Likewise, China (99%) was the major supplier of imported silk wastes. Taiwan supplied only 1% of the total volume of silk waste imports in the same year.

On the other hand, the country's importation of silk yarns and threads exhibited a fluctuating pattern. Nevertheless, an average annual growth rate of 801.2% in terms of import volume was registered during the period 1990-97 (Table 20). In terms of import value, imports of silk yarn increased at an average of 891.7% per year in the same period (Table 19). More than 86% of imported silk yarn in 1997 came from Korea (Appendix Table 22). Other suppliers of imported silk yarn were Germany and Japan.

Similarly, due to the limited and unstable supply of maguey fibers, domestic requirements were supplemented by imports of sisal fiber (FIDA, 1997). Being of the same Agave family, sisal approximates the qualities and characteristics of maguey and is considered as its closest substitute. The Philippines started importing raw sisal fibers and manufactures in 1992 (Table 16). The value of imports of raw sisal and sisal manufactures increased from U.S.\$206,138 in 1992 to U.S.\$815,354 in 1997, or by 296%. Likewise, the volume of imported raw sisal fiber rose from 346.4 mt in 1992 to 1,162.1 mt in 1997 (Table 17). Kenya (63.5%), and China (26.1%) were the biggest suppliers of sisal fiber to the Philippines in 1997 (Appendix Table 23). The Philippines spent U.S.\$746,340 for importing raw sisal fiber in 1997. In addition, about 48 mt of sisal yarn worth U.S.\$31,680 were imported from China in the same year. The country also imported sisal binder/baler (15.2 mt) and sisal twine/cordage (2.88 mt) in minimal quantities. Sisal cordage/twine was mainly sourced from Switzerland (69.8%) and the United Kingdom (13.2%) (Appendix Table 23). The rest was supplied by Taiwan, Japan, Hong Kong, the United States, and Netherlands. On the other hand, Hong Kong accounted for 96.7% of sisal binder/baler imports in 1997. The other suppliers were Taiwan (3.3%) and Japan (0.1%).

Despite being the world's major exporter of abaca fiber, the Philippines started importing abaca fiber from Ecuador in 1991 (Table 16). Imports of abaca fiber reached 1,361 mt, worth U.S.\$281,940 in 1997 compared to only 22.5 mt (U.S.\$15,750) in 1991.

This could be attributed to lack of good quality abaca fiber in the Bicol Region due to pest and disease infestation.

The Philippines imported raw jute fiber and manufactures from 1990 to 1996 (Table 16). The country ceased importing these products in 1997. Imported jute manufactures were comprised of yarn and fabrics. Between 1990 and 1996, the value of imported jute fiber and manufactures showed a decreasing trend (-7.3%/year) due to the significant reduction in the volume of jute manufactures. Only jute manufactures were imported in 1990. Although the Philippines imported jute fiber in the 1980's, the country stopped importing in 1990. In 1991, the country resumed importing jute fiber which grew significantly and peaked in 1996 (184.5 mt) (Table 17). Imports of jute fiber dropped to 101.8 mt in 1996 and stopped thereafter. Taiwan, China, Japan, and the United Kingdom were suppliers of jute fabrics while China was the major source of imported jute fiber.

2.4 Problems/Constraints Affecting the Fiber Crops Industry

The continuous growth and development of the Philippine fiber crops industry is hampered by production and marketing-related problems.

2.4.1 Production-related Problems

The major production-related problems which plague the abaca industry are low farm productivity, limited supply of high quality fibers, pest and disease infestation, lack of capital for the establishment of plantations, and lack of field technicians (PCARRD, 1997). As mentioned earlier, low yield is caused by indiscriminate use of poor abaca varieties, use of antiquated production practices due to limited capital and the farmers' reluctance to adopt new technologies, lack of planting materials of high-yielding and disease-resistant varieties, the destructive typhoons and long drought, and lack of entrepreneurial skills of many abaca farmers to efficiently manage their farms. Low fiber quality, on the other hand, may be attributed to the use of mixed varieties, pest and disease infestation, harvesting of over mature abaca by some farmers due to lack of knowledge of the proper schedule for harvesting abaca, lack of drying facilities, and the use of knives of 14 and 17 serration/inch for hand stripping. According to FIDA (1997), harvesting of over mature abaca would result to low fiber recovery and the production of fiber of inferior quality. The use of knives with 14 and 17 serration/inch also results in the production of coarse and fair quality of abaca fibers, respectively. FIDA recommends the use of 0-24 serration/inch to produce high quality fibers. As regards abaca processing problems, "pinukpok" makers complained that although there is a high demand for "pinulpok" cloth in the local and international markets, they could not meet volume orders since each worker can weave only one to three meters of cloth per day using a handloom and the manual process of knotting the abaca threads. Presently, knotting machines have not yet been developed in the country to increase the production efficiency of the "pinukpok" weavers.

Similarly, the cotton industry is faced with several production-related problems. The most pressing problem confronting the industry is low cotton productivity caused by

low level of technology adoption, which in turn, is due to the cotton growers' limited access to credit, the high cost of farm inputs, lower priority given by agricultural technicians to cotton compared to food crops, and the inadequate number of municipal extension workers whose field of specialization is cotton production (CODA, 1997). Pest build-up due to disregard for recommended technology and the indiscriminate use of pesticides is the second major problem of the cotton industry. The third most critical problem is the diminishing area planted to cotton due to conversion of cotton lands to food crops and industrial/commercial uses and the instability of domestic cotton prices which are highly dependent on world market prices considering that the Philippines is a net importer of cotton.

With regard to the production-related problems confronting the sericulture industry, the foremost problem is lack of funds on the part of the farmers and prospective processors to sustain production (FIDA, 1997). The long period of time to develop skills and know-how and attain optimum productivity levels on moriculture/sericulture considering that it is a relatively new undertaking is another constraint to the growth of the sericulture industry. The third major problem of the industry is the poor quality of silkworm eggs and non-uniformity of hatching. Lack of processing facilities to convert cocoons into yarns also constrain the full-scale development of the sericulture industry. As mentioned earlier, there is no commercial private filature or reeling plant at present owing to the closure of APSI in 1997 (FIDA, 1997). On the other hand, some powerloom weavers ceased operating due to obsolete equipment and machinery, labor problem, and difficulty in sourcing raw materials such as silk yarns and threads.

On the other hand, the limited application of salago, the availability of cheaper substitutes, the two-year production cycle of the crop, and the low prices offered to farmers/gatherers vis-à-vis the time-consuming and laborious process of fiber extraction are the factors which limit the growth and development of the salago industry.

As regards to the major production-related problems confronting the Philippine piña fiber industry, these include the following: (1) lack of planting materials and the high price of suckers; and (2) limited working capital to sustain knotting and weaving activities (FIDA, 1997). Moreover, plain weaves generally comprise the bulk of the piña cloth currently produced because weavers generally lack the initiative to update or introduce innovations in their designs.

The most important problem of the maguey industry is the limited and unstable maguey fiber supply caused by the inefficient fiber extraction method, the existence of many old, abandoned, or sparsely planted maguey plantations, and the reduction in area devoted to maguey as a result of conversion to other more profitable agricultural crops (FIDA, 1997). The long gestation period before harvest (four years from planting) and the relatively low returns from maguey farming compared to other crops also contributed to the farmers' losing interest in venturing into maguey fiber production. At present, the traditional method of sea retting to extract fibers is still commonly practiced by maguey farmers despite the fact that this is now prohibited because of the conversion and development of most beaches into resorts. Although some farmers are now using

decorticating machines, adjustments still have to be done to increase productivity or fiber yield/recovery. Moreover, the farmers need further training on mechanized extraction.

For the buntal sector, the major problem of the processors is the high price of raw fibers (FIDA, 1997). In addition, buntal processors and extractors complained of delayed payments which adversely affected their operating capital. For the raffia sector, the farmers complained of the low price of raffia fibers that was offered to them which made their business operation unprofitable considering that the fiber extraction process is too laborious. Owing to the low price of raffia fibers, they were discouraged to increase their production. This could be the reason why some local fibercraft manufacturers have difficulty in sourcing raffia fibers.

2.4.2 Marketing Problems

One of the marketing problems mentioned by abaca farmers is the low farm gate price of fibers due to lack of market information and inefficient marketing system (PCARRD, 1997). Another marketing problem is the rising competition in the world market for abaca fiber due to abaca area expansion in Ecuador which produces more consistent fiber quality.

The foremost marketing problem which adversely affects the growth of the Philippine sericulture industry is the stiff competition posed by China which, being the world's biggest producer of silk, strongly influences silk supply and pricing in the global market to the detriment of small producers (FIDA, 1997). The second marketing problem is the low domestic demand for silk fabric. Moreover, delayed payment for cocoon deliveries and low prices offered by buyers are the marketing problems of cocoon producers.

With regard to piña cloth weavers, their main problem is the delayed payments or issuance of bouncing checks by piña cloth buyers (FIDA, 1997). Another marketing problem which adversely affects the piña cloth industry is the cut-throat competition among embroiderers. In addition, its being a high-priced fabric has practically limited the domestic market for piña cloth to the upper segment of society. The export demand for piña cloth is also erratic considering that the major foreign buyers have not been consistent in their buying pattern.

One of the major marketing problems of the buntal industry is the decreasing and erratic trend in the demand for buntal and buri products (FIDA, 1997). Due to the high price of buntal fibers, the prices of buntal and buri products have become uncompetitive, thus limiting expansion of local and export markets for these products. Similarly, the market demand for raffia fibers and products made of raffia fibers is also a problem. This is due to the fact that the demand for raffia fibers is dictated by ever-changing fashion trends and consumers' tastes and preferences considering that it is a material for fashion and novelty items. Hence, product development and improved processing technologies (e.g., drying, knotting, twisting, and dyeing) are needed to cope with the changing demand trends and consumers' preferences. It was also mentioned earlier in section 2.3.1

that stiff competition with similar products of different raw materials have adversely affected the export demand of raffia, buntal, and buri manufactures.

2.5 Market Prospects

Among the fiber crops, abaca has the greatest prospect in both the domestic and international markets. The Food and Agriculture Organization (FAO) of the United Nations projects that global consumption of abaca will increase further to about 82,000 mt by the year 2000 (FIDA, 1997). This translates to total global demand of at least 71,500 mt for Philippine abaca, including domestic consumption.

In the Philippines, current supply of good quality fibers is still insufficient to meet the soaring demand. Majority of the abaca traders from the Bicol Region and Southern Luzon, for instance, come all the way to Eastern Visayas to buy good quality fibers for their handicraft and pulping needs. Local demand for abaca fibers will further increase once the proposed plan for the establishment of a pulping plant in the Eastern Visayas will materialize. The increasing local demand for abaca fibers is a good indication of great market prospects for the industry.

Moreover, the growing concern for environmental protection and forest conservation the world over will provide vast opportunities to natural raw fiber like abaca. Being natural and considering its superior qualities over other fiber crops, the utilization of abaca especially for industrial applications is expected to increase. The development of abaca fiber in the United Kingdom as replacement for asbestos, which was found to be carcinogenic and banned in many countries, is also a big boost in the demand for the fiber (FIDA, 1996). It has reportedly captured about 80% of the U.K. market for asbestos-based boards and are also being exported with shipments increasing at the rate of about 5-19% per year.

The abaca pulp sector will also remain strong and is expected to grow further considering that the technology and formulations developed and used by the specialty paper manufacturers are principally abaca-based. Likewise, the demand for specialty papers such as currency notes, tea bags, meat and sausage casings, cigarette papers and the like will continue to grow as economies of the major consuming countries improve and new markets open up (FIDA, 1997).

There is also a future for abaca as a replacement for coniferous pulp. It is estimated that the world's pulp industry relies on wood for some 80% of its raw material supply. Supply of conifer timber will fall short by at least 200 million cubic meters short of demand by the year 2010 (International Papermaker Magazine, 1996).

According to Engr. Arturo Gorrez, Vice-President of the Canlubang Pulp Manufacturing Co. and President of the Natural Fiber Processors Association of the Philippines (1995), the country's consumption of coniferous pulp is estimated at 300,000 mt by the year 2000, while worldwide annual requirement is estimated at about 200,000 million mt. The Tropical Timber Institute of London claims that one part abaca pulp can

replace four parts of coniferous in most paper products which means that one unit of abaca pulp can impart the same characteristics to the consumer's product as against that of four units of coniferous pulp. This was confirmed by the Canlubang Pulp Manufacturing Co. and the Forest Products Research and Development Institute (FPRDI).

If Philippine imports of coniferous pulp are translated to abaca pulp at a conservative ratio of 2:1, this implies that 150,000 mt of abaca pulp will be needed as an import substitute for coniferous pulp. Furthermore, if the world requirement for coniferous pulp is translated to its equivalent in abaca pulp, this is about 100 million mt. Hence, 200 million hectares of abaca plantation need to be established to support the world requirement for abaca pulp.

Likewise, the demand for abaca fiber for the cordage industry is also growing as evident from the increased importation of North America and Europe. Based on NSO statistics, a 14.3% growth in abaca cordage export was obtained generating US\$8.89 million for the economy during the third quarter of 1997. Abaca cordage is highly preferred in oil dredging/exploration, navies and merchant shipping as well as in the construction business because of its non-slippage characteristics (FIDA, 1997).

Abaca fibercraft products have bright market prospects not only in the local market, but also abroad. Among the abaca fibercraft products which have the biggest export demand are handbags and placemats. The export demand for doormats and rugs has also been increasing tremendously over the years. To sustain the increasing demand for Philippine fibercrafts, however, functional and innovative designs should continuously be introduced in the market (FIDA, 1997).

Owing to the growing interest in abaca fabrics for decor and wrapping purposes as well as for fashion, the demand for this product has also risen substantially. For instance, the demand for abaca ribbonettes as decorative and packaging materials particularly in Taiwan, South Korea, Hongkong, Italy, and the United Kingdom increased (FIDA, 1997). As discussed earlier, the sector registered a remarkable growth of 77% per year in value terms from 1993 to 1997. It is expected that demand would be long term due to the growing popularity of environment friendly materials especially in developed countries.

With regard to silk and silk products, the export market prospect of these products is constrained by lack of supply of cocoons and raw silk. Although these may not help address the problem immediately, other alternatives are the introduction and operation of cottage-level reeling facilities and the operation of the FIDA-established Municipal Sericulture Center (MSC) in Benguet and La Union as well as the other two processing facilities to be put up in Zamboanga and Iloilo (FIDA, 1997). Another company, the Philitalia Silk Inc. is planning to put up a spun silk processing plant in South Cotabato with a production capacity of 360 tons per year. In the long run, these could help in developing the export market for raw silk/silk yarn considering that the Neilino Silk Inc., which produces hand-woven silk, has successfully developed world-class materials using 100% Philippine silk (FIDA, 1997). The hand-woven fabrics are marketed internationally

either as pure silk or blended with abaca, piña, and locally sourced natural fibers. Neilino Silk Inc. has established a marketing tie-up with a local fashion designer who transforms the fabrics into high fashion silk garments which have likewise created a niche in both the local and export markets. Silk produced locally by this partnership took center stage during the APEC meeting in 1996 when 18 APEC leaders wore specially-designed Barong Tagalog made of this material. A Korean fashion designer has also introduced Filipino silk and silk blends for her collection. Moreover, noted local fashion designers like Inno Sotto and Renee Salud have included Neilino's Filipino silk among their collections for presentation in both the local and international fashion world, thus creating awareness for Philippine silk.

In the international scene, the International Silk Association (ISA), a conglomeration of the major and the newly-emerging silk producing and consuming countries, reports that the world will be facing a shortage of supply of raw silk (FIDA, 1997). This can be attributed to the reduction in raw silk production in China, Japan, and India and the opening of the Japanese market to increased import of raw thrown silk. The shortage of supply is expected to result to a price increase, making raw silk production once again an attractive investment venture. According to ISA, global demand for silk can be expected to increase as China's consumers become affluent and European economies gradually gather strength. Considering that the U.S. economy is thriving, American consumers might renew their interest in silk. In Japan, young people have acquired taste for western-style silk goods and will probably continue to buy silk goods.

Cotton has also a great domestic market prospect as evident from the growing demand for cotton lint by the local textile industry. However, it is projected that local production of medium staple cotton lint will still be insufficient to meet local demand for the period 2000-2004 because local demand will grow much faster (65.5%/year) than local production (7.7%/year) (DA, 1999). Currently, AgriSwiss, a branch of Primatex which is a foreign-owned company engaged in the cotton lint importation business, is conducting a feasibility study on a wide-scale/commercial mechanical cotton production in the country. If the commercial mechanical production of cotton will be found feasible, then this will contribute to a large extent in meeting the future raw material requirements of the local textile and garment industries. The Philippines could also explore using biotechnology-assisted cotton breeding and pest management (CODA, 1999). Major cotton growing countries like the United States, Australia, China, and South Africa are now starting to commercially use genetically-engineered cotton.

Piña fabrics, on the other hand, has a greater prospect in the domestic market than in foreign markets considering that the local fashion designers are continuously using piña fabrics in their haute couture business (FIDA, 1997). Demand for piña fabrics is expanding especially as a clothing material for *Barong Tagalog* which is popularly worn during official and social functions especially weddings. The interest for piña fabrics in the fashion world has increased due to the inclusion of handwoven piña collections as a regular feature during fashion shows in the Philippines and abroad.

With regard to other minor fibers, limited and unreliability of supply due to land conversion to other more profitable crops adversely affected their market prospects.

3.0 STATUS OF RESEARCH AND DEVELOPMENT (R & D) FOR FIBER CROPS

3.1 Profile of the National Research System for Fiber Crops

The Philippine National Agricultural Research System (NARS) is comprised of two basic structures: PCARRD, a planning and coordinating body, and the National Agriculture and Resources Research and Development Network (NARRDN) (Dar, 1997). The NARRDN has for its members line agencies and R &D institutions, state colleges and universities (SCUs), local government units (LGUs), and private institutions.

The SCUS actively involved in conducting researches on fiber crops are the University of the Philippines Los Baños (UPLB), the Visayas State University - National Abaca Research Center (VISCA-NARC) and DMMMSU-SRDI. To a limited extent, other SCUs like the Central Luzon State University (CLSU), the University of Southern Mindanao (USM), Pampanga State University (PSU), and the Western Mindanao State University (WMSU) also conducted researches on fiber crops..

As part of the National Commodity Research and Development Centers (NMCRDCs), CLSU is given the national responsibility of undertaking researches on sericulture while the national responsibility of VISCA-NARC is on abaca (Appendix Table 24). On the other hand, USM's national responsibility is on basic fiber plantation crops. As regards UPLB, it is given the regional responsibility to undertake researches on fiber crops whereas DMMSU is given the responsibility to conduct researches on sericulture.

UPLB focuses on varietal/strain improvement including collection, hybridization, screening for disease resistance and fiber yields and quality especially for abaca and silk.

As the national abaca research center, VISCA-NARC is involved in varietal improvement, production, utilization, and extension work. Its current research thrusts are as follows: (1) development of new uses of fibers and waste products and improvement of existing ones to increase the market value of abaca; (2) breeding of high-yielding, pest, disease and stress resistant abaca varieties with high quality fibers; (3) generation of appropriate production management technologies and integrated pest management systems for sustained abaca production particularly in disease-infested areas; (4) development of village-level postharvest processing technologies; (5) enhanced access of producers and processors to mature abaca technologies; and (6) establishment of a National Abaca Information Service.

The research and extension program of DMMMSU-SRDI underscores the three goals of Republic Act (RA) 7359, which are to : (1) conduct researches; (2) extend technologies; and (3) educate or train sericulturists. Specifically, the institute has four

major research program thrusts, namely: Mulberry Research and Development, Silkworm Research and Development, Post Cocoon Research and Development, and Socio-economic and Marketing Research and Development. Mandated to undertake silk research and development in Region I, DMMMSU-SRDI does silkworm strain/hybrid improvement, production, utilization, and extension functions.

As regards to the line agencies primarily engaged in R & D activities on fiber crops, these consist of the Cotton Development Administration (CODA), PTRI, and FIDA. Other line agencies like the Forest Products Research and Development Institute (FPRDI) sometimes conducted researches on fiber crop utilization/processing. CODA was recently created from merging the Philippine Cotton Corporation (PCC) and the Cotton Research and Development Institute (CRDI).

The R & D program thrusts of CODA are on: varietal development, Integrated Pest Management, cultural management of new varieties, farm tools development, by-product utilization/development, and technology demonstration and piloting of seed multiplication that is cooperative-based and LGU-linked. In addition to basic and applied research and development activities, CODA carries out pilot projects to improve existing technology. This agency continuously develops and refines packages of technology suited to the specific agro-climatic requirements of different cotton producing areas in the country.

On the other hand, PTRI is engaged in research and development activities dealing with silkworm breeding/strain improvement and utilization for abaca, silk, and other indigenous fibers such as banana, kenaf, and maguey..

With the exception of cotton, FIDA covers all natural fibers both of major and minor commercial importance in its R, D, & E programs. As mandated, FIDA aims to promote the growth and development of the Philippine fiber industry in all aspects including research. Among the crops included in FIDA's R & D/E programs are abaca, silk, piña, salago, banana, maguey, ramie, and coir. For abaca, its research efforts are focused on production, product standards, marketing, extension, utilization, and mechanization. For silk, FIDA is involved in production, extension, development, utilization/processing, and financial support. For fiber crops of minor importance, FIDA supports production and development efforts for salago, mechanization and utilization of piña fiber, and mechanization and development efforts for banana and maguey.

Although these agencies are independent of PCARRD, their R & D activities on fiber crops are coordinated, monitored, and evaluated by PCARRD (Dar, 1997).

Based on the scoring approach using selected statistical parameters which was adopted by the Science and Technology Coordinating Council (STCC) in 1989 to prioritize commodities, fiber crops ranked only ninth under level 1 (Appendix Table 25).

In the late 1980's PCARRD, on the other hand, grouped commodities into three research priority areas. Fiber crops were classified under Priority I and shared with other

18 priority commodities in the research budget of 80% allotted by PCARRD (Appendix Table 26). It ranked third among the priority crops. The research budget allocation was arbitrarily decided upon by PCARRD.

For better integration of R & D programs, PCARRD restructured its priority commodities by trimming down the number of priority commodities from 29 to 21 in 1996 (Dar, 1997). Due to this new scheme of realignment of commodities, the National Fiber Crops R & D Committee, which was created by PCARRD to set research priority areas for fiber crops and evaluate research proposals, was dissolved. The functions of this committee were then transferred to the newly created National Industrial Crops R & D Committee which covered fiber crops, tobacco, and other industrial crops. Presently, this committee is composed of a chair and seven (7) members. However, there are no social scientists/economists among the committee members. Of the seven members, three represent the fiber crops sector consisting of the following: the Director of VISCA-NARC; a researcher from CODA; and the President of the Philippine Fiber Exporters Association as the representative from the private sector. This committee only meets once or twice a year. Whenever the committee met in the past, the members were not furnished by PCARRD a summarized copy of completed and on-going researches which could guide them in identifying research gaps. The latter could have been used as basis in setting research priority areas.

To effectively coordinate and monitor R & D activities in the country, PCARRD also manages 14 R & D consortia in the regions (Dar, 1998). The consortium arrangement is designed to optimize the use of limited resources among many agencies at the regional level. It involves a series of satellite institutions orbiting around a strong base agency, tasked to conduct research priority setting, planning, monitoring, and evaluation of R & D; technology promotion; and information sharing. Of the 14 R & D consortia, only ViCARP chose abaca its flagship commodity. ViCARP's implementation of its flagship program, the Abaca Industry Integrated Program (AIIP), further strengthened research and development collaboration among the member-agencies (DAR, 1997). Since its inception in 1978, ViCARP's membership expanded from five (5) to 20. VISCA-NARC is one of the members of this consortium.

Apart from PCARRD, the DA-BAR, which was created in 1987, also plans, integrates, coordinates, monitors, evaluates, and sources funds for the department's various research efforts (Dar, 1998). Although BAR duplicates the functions of PCARRD, it closely coordinates with PCARRD, being the unit in charge of the overall coordination of the entire agricultural system. BAR's priority setting under each commodity grouping like fiber crops takes into consideration the following research program areas or themes: 1) improving productivity; 2) protecting the environment; 3) saving bio-diversity; 4) sustaining knowledge; and 5) improving policy. Recently, the criteria used in determining high impact projects are as follows: 1) potential contribution to food security (productivity and income); 2) potential impact to the reduction of poverty (employment generation and income); 3) potential impact to the competitiveness of the sector or industry (improved product quality, cost reduction, and increased productivity or volume); 4) insures sustainable production system; 5) potential contribution to

development or enhancement of democratic processes (capacity-building or people empowerment); and 6) extent of utilization of earlier scientific works.

BAR's R & D priorities are embodied in the National Agricultural Research and Extension Agenda (NAREA) (Dar, 1998). Cotton is a regional priority commodity in Region 1 under BAR's NAREA while abaca is a regional priority commodity in Regions 4, 8, 9, and 11 (Appendix Table 27). Like the PCARRD approach, NAREA priorities are determined through multi-sectoral and multi-disciplinary consultations up to the regional level. The National Fiber Crops R & D Committee created by BAR conducted such consultations with various stakeholders in the fiber crops industry to identify the major problems and issues confronting the industry as well as the immediate R & D needs of the industry. The committee is currently chaired by the Deputy Administrator of FIDA and has six (6) members (two from UPLB; one from CODA; one from DMMSU-SRDI; one from VISCA-NARC who is also a member of the PCARRD committee; and one from PTRI). This committee has an economist as member including a Socio-economics consultant unlike the PCARRD Industrial Crops R & D Committee.

3.2 Funding, Manpower, and Research Facilities

3.2.1 Funding

Public expenditures for agricultural research in the 1990s increased rapidly in real terms by an average annual growth rate of 8-9% (David, et al., 1998). However, despite this growth, Philippine public expenditure for agricultural research from 1992 to 1996 was still underfunded.

An attempt was made in this report to compare research expenditures among fiber crops. Except for CRDI/CODA and VISCA-NARC, there is a dearth of time-series data on public expenditures spent on fiber crops research by type of fiber crop and by agency/institution. According to David *et. al.* (1998), it was not possible to compile a complete database on annual research budgets by commodity because the accounting system of multi-commodity research institutions such as FIDA and the various SCUs like UPLB do not record research expenditure by commodity. Nevertheless, the 1996 work and financial plans of a number of institutions involved in fiber crops research would provide cross-section data on the pattern of allocation of research budget from DOST-PCARRD across fiber crops. As shown in Table 21, silk received the biggest share (P26.27 million or 59%) of the research budget granted by DOST-PCARRD for fiber crops in 1996, followed by cotton (P9.21 million or 21%). In contrast to cotton and silk, research budget from DOST-PCARRD for abaca was relatively lower at P7.88 million or 18% of the total research budget spent on fiber crops in the same period.

Table 21. Research expenditure of DOST on fiber crops by type and by agency/institution
based on the 1996 financial
plan.

TYPE OF CROP	IMPLEMENTIN G AGENCY	TOTAL BUDGET (Million Pesos)	PERCENT SHARE
Abaca	FPRDI	0.40	
	UPLB	5.32	
	VISCA	2.09	
	ESSC	0.07	
Sub-total		7.88	18
Cotton	CRDI	5.4	
	DA-R.1	0.02	
	UPLB	0.79	
	UPLB - CRDI	3.00	
Sub-total		9.21	21
Ramie	UPLB	0.42	
	USM	0.10	
Sub-total		0.52	1
Salago	PSU	0.02	
	UPLB	0.38	
	USM	0.09	
		0.49	1
Silk	CLSU	0.10	
	DA-FIDA	13.84	
	DMMS-SRDI	8.89	
	MMSU	0.08	
	NVSIT	0.13	
	PTRI	3.12	
	RSC	0.05	
	WMSU	0.06	
		26.27	59
Total		44.37	100

Source of data: DOST-PCARRD

Apart from the afore-mentioned research grants obtained from PCARRD, FIDA and CRDI have direct appropriations for research from their own budget. It can be noted in Table 22 that the average annual research budget for cotton allocated to the CRDI during the period 1992 to 1997 amounted to P22.5 million which was higher than the average annual research budget allocation to FIDA of about P14.13 million. The study conducted by David *et. al.* (1998) revealed that higher budgetary allocations are spent on fiber crops that the country has no inherent comparative advantage as evidenced by their insignificant level of production and limited market potential. For example, research intensity of cotton was found to be extremely high at 25%. This was significantly much higher than the 1% research intensity of abaca and other fiber crops. Despite the fact that abaca had the greatest economic contribution to the Philippine economy among the fiber crops, it received less direct research budget allocation compared to cotton. David *et. al.* added that silk has also a relatively higher research intensity than abaca. The research budget of the research institute for sericulture in DMMSU is more than P5 million, but local silk production is very low.

The sources of research funds of FIDA, CRDI/CODA, and the SCUs are direct budgetary support (i.e., regular allotment) and project funds obtained from other government agencies, foreign donors and to a minimum extent, private companies. FIDA's direct budgetary support accounted for 87.60% of its research budget during the period 1992-97 (Table 23). Its total research budget grew by an average of 33.52% in the same period mainly because of its direct budgetary support which drastically rose from P6.31 million to P22.94 million in 1997, or by 29.95%. The Congressional Initiative Allotment for tissue culture research was the only source of external funding of FIDA during this period.

Although higher in absolute terms than that of FIDA, CRDI's total research budget grew at a slower rate (18.90%/year) during the period 1992-97 (Table 23). The agency's main source of research funds was its regular allotment which accounted for 98.47% of its total research budget (Table 23). CRDI had more sources of external funds than FIDA. Its external funds came from other local public agencies (e.g., Naphire, PCARRD, DA-BAR, PhilRice, and DOST-PCIERD) and private companies (e.g., Transworld, Zuellig, CIBA-Geigy, Bayer, and Hoechst).

As regards to the SCUs, it was mentioned earlier that it was difficult to obtain a complete database on the annual research budget for each type of fiber crop because they did not record research expenditure by commodity. Nevertheless, the research budgets of five selected SCUs engaged in fiber crops R & D activities are presented in Table 23 to show the disparity in research budget allocation among these SCUs. On the average, UPLB's annual research budget (P212.45 million) was almost 2.6 times higher than the combined research budget of VISCA, DMMSU, MMSU, and CLSU (P82.91 million). In terms of sources of research funds, UPLB received the largest regular research budget allotment and external research grants while MMSU obtained the lowest budget (P15.47 million/year). The capacity of an institution to generate a large chunk of funding for

Table 22. Public expenditure for research and development of FIDA and CRDI (now CODA), 1992-1997.

AGENCY	DIRECT BUDGETARY RESEARCH ALLOCATION (MILLION PESOS)							PERCENT SHARE (1992-97)
	1992	1993	1994	1995	1996	1997	Annual Average	
FIDA	6.31	9.05	11.40	16.31	18.76	22.94	14.13	38.21
CRD	14.80	18.37	19.99	23.80	25.61	34.55	22.85	61.80
TOTAL	21.11	27.42	31.39	40.11	44.37	57.49	36.80	100.00

Source: FIDA and CRDI

Table 23. Public expenditures (in million pesos) for research and development of FIDA, CRDI and selected SCUs engaged in fiber crops R&D activities, 1992-1997.

YEAR	PCA CLSU			UPLB			VISCA			USM DMMSU			MMSU		
	General	External	Total	Regular	External	Total	Regular	External	Total	Regular	External	Total	Regular	External	Total
	Funds ^a	Funds ^b		Allot.	Funds		Allot.	Funds		Allot.	Funds		Allot.	Funds	
1992	6.61	1.96	8.57	87.32	74.25	161.57	17.33	11.09	28.42	12.36	0.07	12.43	6.77		6.77
1993	10.64	2.69	13.33	90.69	105.78	196.47	19.93	9.77	29.70	14.46	0.99	15.45	8.17	3.01	11.18
1994	12.18	2.39	14.57	76.73	142.03	218.76	19.25	7.05	26.30	12.47	1.02	13.49	6.49	5.62	12.11
1995	14.21	7.64	21.85	108.88	141.79	250.67	19.54	8.45	27.99	18.10	1.27	19.37	10.01	4.97	14.98
1996	14.64	2.45	17.09	123.69	99.30	222.99	23.81	7.50	31.31	28.25	3.75	32.00	12.19	8.08	20.27
1997	17.49	5.35	22.84	120.36	103.86	224.22	24.18	9.61	33.79	34.94	1.25	36.19	13.50	14.03	27.53
Average	12.63	3.74	16.37	101.28	111.17	212.45	20.67	8.91	29.59	20.09	1.39	21.48	9.52	5.95	15.47
% Share	77.14	22.86	100.00	47.67	52.33	100.00	69.85	30.15	100.00	93.53	6.47	100.00	61.54	35.71	100.00
Growth															
Rate (%)	22.92	59.26	25.35	8.26	10.24	7.41	7.30	-0.60	3.85	25.63	289.74	26.7	17.38		33.66
YEAR	PCA FIDA			UPLB CRDI											
	General	External	Total	Regular	External	Total									
	Funds ^a	Funds ^b		Allot.	Funds										
1992	6.31		6.31	14.80		14.80									
1993	9.05	3.50	12.55	18.37		18.37									
1994	11.40	2.72	14.12	19.99		19.99									
1995	16.31	3.83	20.14	23.77	0.03	23.80									
1996	18.76	1.96	20.72	25.23	0.38	25.61									
1997	22.94		22.94	32.81	1.74	34.55									
Average	14.13	2.00	16.13	22.50	0.35	22.85									
% Share	87.60	12.40	100.00	98.47	1.53	100.00									
Growth															
Rate (%)	29.95		33.52	17.61		18.90									

Source: David, et. al., 1998.

research regardless of source depends to a large extent on the availability and quality of its manpower and infrastructure facilities. Considering that UPLB has the strongest manpower and infrastructure capacities among the five SCUs, this might account for its having attracted the largest research budget.

In contrast to the other four SCUs, external grants accounted for a higher share (52.33%) of UPLB's total research budget (Table 23). Although it has the highest direct budgetary allocation, UPLB's regular research budget allotment, however, grew less rapidly (8.26%/year) than that of DMMSU (25.63%/year), CLSU (22.92%/year) and MMSU (17.38%/year).

The allocation of government funding for agricultural research across types of expenditures (i.e., personnel, operations, and maintenance, and capital outlay) also partly affects the returns to agricultural research (David, et al., 1998). As shown in Table 24, the proportion of FIDA's and CRDI's research expenditure for personnel services (69% and 70%, respectively) tended to be higher than that for its maintenance and operating expenses (31% and 23%, respectively) as well as for its capital outlay (7% for CRDI only). The same pattern of research expenditure allocation was observed for all the SCUs with personnel services accounting for 54-71% of their total research budget,. According to David, et al. (1998), the agencies' response to the Salary Standardization Law resulted to the disparity in funds for salary against operational budget, which in turn, left research facilities underutilized and forced these agencies to attract external donors' support. Due to more reliance on external donor support, research projects that were conducted especially at UPLB were based on the research priority areas of the external donors.

Table 24. Distribution of average (in %) direct budgetary support for agriculture R & D across selected DA-attached agencies and selected SCUs engaged in fiber crops R & D activities, 1992-1996.

AGENCY/SCU	PERSONNEL SERVICES	MAINTENANCE AND OPERATING EXPENSES	CAPITAL OUTLAY	TOTAL
DA-Attached Agencies				
FIDA	69	31		100
CRDI	70	23	7	100
SCUs				
UPLB	71	29		100
VISCA	58	42		100
DMMSU	61	39		100
CLSU	54	46		100
MMSU	65	35		100

Source: David, et al., 1998

3.2.2 Manpower Resources and Research Facilities

The quality and the number of research outputs depend to a large extent on the availability and quality of human resources in various research institutions and SCUs.

The minimum manpower requirements for R & D capability in crops research which were set by PCARRD are shown in Table 25. For a multi-commodity research agency, the minimum manpower requirement is eight Ph.D. degree holders and 11 M.S. degree holders. Currently, FIDA has a total of 99 technical manpower resources engaged in fiber crops R & D (Table 26). FIDA's technical manpower is beefed up by one Ph.D. degree holder and nine M.S. degree holders with specialization in various fields. It is apparent from Table 26 that FIDA has not met the minimum number of researchers with M.S. degree and Ph.D. degree. FIDA needs seven Ph.D. degree holders and two M.S. degree holders to meet the minimum number of research staff holding a Ph.D. degree and M.S. degree, respectively.

On the other hand, CRDI/CODA has a total of 95 technical manpower resources, 11 of whom are Ph.D. degree holders while 40 hold an M.S. degree (Table 26). For a single-commodity research agency, the minimum number of research personnel with advanced degrees is seven Ph.D. degree holders and ten M.S. degree holders. Hence, it is apparent that CRDI/CODA has more than met the minimum number of technical manpower resources with advanced degrees.

As mentioned earlier, the SCUs which are actively engaged in R & D activities on fiber crops are UPLB, VISCA, and DMMSU. A PCARRD-commissioned study conducted by the Research Management Center (1997) reported that among the SCUs, UPLB has the most number of technical experts and has exceeded the minimum research personnel requirement (Table 26). In full-time equivalent, UPLB has 462 highly competent staff (188 M.S. and 145 Ph.D. degree holders) compared to 79 for VISCA (33 M.S. and 31 Ph.D. degree holders) and 115 for DMMSU (40 M.S. and 18 Ph.D. degree holders). Nevertheless, VISCA and DMMSU as well as CLSU and MMSU also met the minimum human resource requirement for research institutions. It is noteworthy to mention, however, that generally, technical experts in the SCUs conduct researches on more than one commodity.

The availability and the condition of research facilities also influence the operation of the R & D system or the conduct of research in various research institutions and SCUs. To determine the adequacy of research facilities, PCARRD established a set of minimum infrastructure requirements for its research network members. These are published in Book Series (BS) No. 11/1993. Existing research facilities especially laboratories in the DA-attached agencies and the SCUs need upgrading. Due to lack of time, however, an inventory of the research facilities that require upgrading was not prepared.

Table 25. Minimum manpower requirements for R&D in crops and research.

R & D CENTER/DISCIPLINE	MULTI-COMMODITY				SINGLE-COMMODITY			
	Ph.D.	M.S.	B.S.	Total	Ph.D.	M.S.	B.S.	Total
A. National Research Center	8	11	11	30	7	10	10	27
Post Production or Seed Technology	2	3	3	8	2	3	3	8
Propagation/Production or Improvement or Plant Nutrition	2	3	3	8	2	3	3	8
Processing/Product Development	2	2	2	6	1	1	1	3
Crop Protection	2	3	3	8	2	3	3	8
B. Regional Research Center	6	3	3	12	1	3	3	7
Nutrition								
Crop Protection	2	1	1	4		1	1	2
C. Cooperating Station	4	6	6	16		3	3	6
Post Production or Seed Technology	2	2	2	6		1	1	2
Propagation/Production or Improvement or Plant Nutrition	1	2	2	5		1	1	2
Crop Protection	1	2	2	5		1	1	2

Source: PCCARD, 1992

Table 26. Number (in FTE^a) of technical manpower resources for agriculture and natural resources research and development in selected DA-attached agencies and SCUs involved in fiber crops R&D activities, 1998.

AGENCY	NUMBER OF TECHNICAL MANPOWER				
	Pre-BS	B.S.	M.S./MBA	Ph.D.	Total
DA-Attached Agencies:					
CRDI		44	40	11	95
FIDA	24	65	9	1	99
SCUs					
UPLB		129	188	145	462
DMMSU		57	40	18	115
VISCA		15	33	31	79
MMSU		32	23	6	61
CLSU		21	26	17	64
Total	24	363	359	229	975

^aFull-time equivalent
Source: David, et al., 1998

RMC's study (1997) on the assessment of research facilities of the national and regional R & D centers engaged either in multi-commodity or specialized studies revealed that not even one of the research centers met the standard provision of 144- sq. m. per researcher. With the exception of IPB, experimental fields of all the research agencies were below the minimum standard; laboratory and communication equipment were inadequate; and greenhouses and storage rooms were in dire need of repairs. The study, however, did not cover research centers dealing with studies on a single commodity (e.g., CRDI/CODA) and on plantation crops such as abaca (e.g., FIDA). The land area of the FIDA research centers/regional offices is shown in Table 27.

Table 27. Land area of FIDA research centers/offices.

AGENCY	AREA (Ha)
FIDA	272.37
Crops Res. Division	<u>272.17</u>
Sericulture Centers/Lab	<u>10.33</u>
Municipal Sericulture Centers at Benguet	1.75
Municipal Sericulture Centers at Agoo, La Union	1.75
Silkworm Breeding Center, UPLB	5.00
Silkworm Egg Multip. Center & Silk Proc. Center,	0.08
Iloilo	
Silkworm Egg Multiplication Center, Davao	1.75
Tissue Culture Lab	<u>0.60</u>
Legaspi	0.20
Sorsogon	0.20
Catanduanes	0.20
Fiber Seedbanks & Exp. Stations	<u>261.24</u>
Oriental Mindoro, Region IV	31.06
Camarines Sur, Region V	30.60
Sorsogon, Region V	31.70
Bohol, Region VII	20.00
Leyte, Region VIII	6.00
Zamboanga, Region IX	100.00
Agusan del Sur, Region XI	22.80
Davao del Norte, Region XI	9.08
Davao City, Region XI	10.00
Fiber Tech Utilization Div.	<u>0.20</u>
Fiber Processing & Utilization Lab Bldg.	0.18
Silk Processing Center, Zamboanga	0.02

Source: FIDA

3.3 Review of Researches on Fiber Crops

3.3.1 Past and Current Researches By Research Area and Agency

For the period 1988-98, a total of 566 research studies on fiber crops had been completed (Table 28). Most of these studies dealt on crop production (i.e., cultural management practices including Integrated Pest Management) numbering 250, followed by varietal development/crop improvement and with 134 and 110 studies, respectively. In contrast, there were only 68 completed sociological, marketing and socio-economic studies while two were policy studies, indicating that these research areas had the least priority in the past.

Bulk of the completed researches were concentrated on the major fiber crops such as cotton (268), sericulture (120), and abaca (112) (Table 29). This could be explained by the fact that cotton received the highest research budgetary allocation among the fiber crops. Researches on cotton were undertaken by CRDI/CODA (229) and UPLB (38) while researches on abaca were conducted by FIDA (45), VISCA-NARC (30), UPLB (29), PTRI (5), and FPRDI (3). Sericulture researches, on the other hand, were concentrated in DMMSU-SRDI (67), PTRI (20), FIDA (7), UPLB (11), and other agencies such as CLSU, NVSIT, DA-R1, WMSU, and MMSU with one study each.

Considering that cotton received the highest research budget relative to the other fiber crops, it is not surprising, therefore, that CRDI/CODA had the highest number of completed researches among the agencies undertaking researches on fiber crops. Crop production was accorded the topmost priority by this agency as evident from the fact that more than half of its completed researches (i.e., 149) focused on this research area (Table 28). Other research areas trailed behind as follows: socio-economics and marketing, 35; and varietal development/crop improvement, 19. Among the research agencies involved in conducting researches on fiber crops, CRDI/CODA had the highest number of socio-economic and marketing studies for the past 10 years. These studies dealt with the assessment of the adoption of cotton production technologies; evaluation of the CRDI RCPT in demo-pilot projects, cotton training programs, and the PGCP technology booklets on cotton production; technology assessment in demo-pilot farms; assessment of farmer leaders and DA technicians as cotton extensionists; training and communication needs analysis of cotton technicians; evaluation of cotton farmers' cooperatives; economic evaluation of the financing schemes for cotton production in Western Visayas; socio-economic evaluation and profitability analysis of cotton-based cropping systems; profitability analysis of cotton growing in Luzon; acceptability of cotton as a crop by Ilocano farmers; resource productivity analysis of cotton farms; social returns to cotton research and extension; gender analysis of participation in the rice-cotton cropping project; supply response of cotton farmers; structure, conduct, and performance of cotton markets in Luzon; and cotton price monitoring and analysis, among others.

Table 28. Completed researches on fiber crops by agency and research area, 1988-1998.

AGENCY	TOTAL NUMBER OF COMPLETED RESEARCHES CONDUCTED						Total
	Varietal Development/Improvement	Crop Production ^a	Postharvest/Processing Waste Utilization	Socio-economics and Marketing	Policy Studies	General ^c	
VISCA-NARC	9	9	8	4	-	-	30
FIDA	12	29	32	12	2	-	87
CODA/CRDI	19	149	26	35	-	-	229
UPLB	64	22	4	1	-	-	91
UPLB-MS PhD	4	11	-	6	-	-	21
DMMSU-SRDI	14	20 ^b	23	10	-	-	47
FPRDI	-	1	3	-	-	-	4
USM	1	-	-	-	-	-	1
PSU	-	2	-	-	-	-	2
ESSC	1	-	-	-	-	-	1
PTRI	10	4	14	-	-	-	28
MMSU	-	-	-	-	-	1	1
WMSU	-	1	-	-	-	-	1
NVSIT	-	-	-	-	-	1	1
CLSU	-	1	-	-	-	-	1
DA-R1	-	1	-	-	-	-	1
Total	134	250	110	68	2	2	566

^aIncludes Integrated Pest Management

^bIncludes mulberry and cocoon production

^cMore than one research area

Table 29. Completed researches on major fiber crops by type and research area, 1988-1998.

AGENCY	TOTAL NUMBER OF COMPLETED RESEARCHES CONDUCTED			Total
	Cotton	Abaca	Sericulture	
VISCA-NARC	-	30	-	30
FIDA	-	45	18	63
CODA/CRDI	229	-	-	229
UPLB	22	27	11	60
UPLB-MS PhD	16	2	-	18
DMMSU-SRDI	-	-	67	67
FPRDI	-	3	-	3
PTRI	-	5	20	25
MMSU	-	-	1	1
WMSU	-	-	1	1
NVSIT	-	-	1	1
CLSU	-	-	1	1
DA-R1	1	-	-	1
ESSC	-	1	-	1
Total	268	112	120	500

Presently, CODA has 73 on-going studies distributed as follows: crop production, 34; varietal development/crop improvement, 22; postharvest/processing/waste utilization, 7; and socio-economics, 10 (Table 30). Its on-going socio-economic studies are concerned with the profitability analysis of cotton growing; socio-economic profile of the cotton industry; and cotton farmers' and loom weavers' business capability enhancement.

From 1988 to 1998, FIDA conducted a total of 87 researches, 45 of which were on abaca (Tables 31). Moreover, of the total number of completed researches on fiber crops conducted by this agency, 12 researches were on varietal/crop improvement with emphasis on the collection, characterization and evaluation of abaca as well as on yield trials on the different varieties of mulberry, salago, and jute. FIDA's past researches mainly focused on crop production and postharvest/processing/waste utilization with 29 and 32 completed studies, respectively. Researches on crop production dealt with cultural management practices for abaca, salago, maguey, mulberry, and pandan including crop protection and water management. On the other hand, researches on postharvest/processing/waste utilization were on product diversification of pulp and paper; waste utilization of abaca and ramie; fiber extraction specifically on the design, fabrication, and modification of denting, serrating, and abaca spindle stripping machines; and fiber pre-treatment on the dyeing method for tinalak. Adaptation researches on silk particularly on equipment/devices (e.g., modified reeling, re-reeling, twisting, and degumming) and cocoon and silk processing were also conducted. Regarding FIDA's researches on product standard, these focused on the impact evaluation of the standard stripping knives and the use of the abaca dryer on fiber quality. On the other hand, only 12 studies were on marketing while two were policy studies. Most of the marketing studies were conducted in the Bicol Region and were, therefore, location-specific or had limited area coverage. The marketing researches focused on an analysis of the non-woven firms' demand for abaca and natural fibers; abaca wallcover industry in Albay; handmade paper industry and pinukpok livelihood project in the Bicol Region; raw material requirements of handmade papermakers in Metro Manila and Laguna areas; hand embroidery industry in Region IV; and market study on different weaves. Other marketing researches conducted by FIDA focused on case studies on the marketing cooperative system for abaca and ramie and supply-demand analysis of "bitool" knotted hemp in Valencia, Negros Oriental and piña cloth. The two policy studies were concerned with the review of the existing abaca grading system and the sanitary and phytosanitary measures for abaca and other fibers.

With regard to the 32 on-going studies of FIDA, these are distributed as follows: five (5) studies on varietal /crop improvement for abaca, 26 on crop production with emphasis on crop protection (5 for abaca and 21 for sericulture), one marketing study, and one socio-economic study (Tables 30 and 32). The marketing study aims to provide basic investment information on handmade papermaking, sinamay weaving, and piña cloth weaving. On the other hand, the socio-economic study deals with the socio-economic assessment of abaca rehabilitation projects and the Land Bank-assisted cooperatives.

Table 30. Number of on-going researches on-going researches on fiber crops by agency and research area as of January 1999.

AGENCY	TOTAL NUMBER OF COMPLETED RESEARCHES CONDUCTED					Total
	Varietal Development/Improvement	Crop Production ^a	Postharvest/Processing Waste Utilization	Socio-economics and Marketing	Policy Studies	
UPLB	29	10	3	-	-	42
VISCA-NARC	10	12	5	7	-	34
FIDA	5	26	-	1	-	32
CODA/CRDI	22	34	7	10	-	73
USM	1	1	-	-	-	2
DMMSU-SRDI	-	1	19	4	-	24
RSC	-	-	-	1	-	1
Total	67	84	34	23	-	208

^aIncludes Integrated Pest Management

Table 31. Number of completed researches on fiber crops conducted by FIDA by type and research area, 1988-1998.

RESEARCH AREA	NUMBER OF COMPLETED RESEARCHES						Total
	Abaca	Sericulture	Maguey	Salago	Jute	Fibercrops	
Varietal Development/ Improvement	8	1	-	2	1	-	12
Crop Production	10	4	1	5	-	9	29
Postharvest/Processing Utilization	16	13	-	-	-	3	32
Socio-Economics and Marketing	9	-	-	-	-	3	12
Policy Studies	2	-	-	-	-	-	2
Total	45	18	1	7	1	15	87

Source of Basic Data: FIDA

For the 10-year period under review, UPLB undertook a total of 91 researches on fiber crops particularly abaca, cotton, and sericulture and to a limited extent, ramie, salago, kenaf, jute, ramie, and pineapple (Table 33). By research area, these studies were distributed as follows: varietal development/crop improvement, 64; crop production, 22; postharvest/processing/waste utilization, 4; and sociological studies on cotton and ramie, 1. It is interesting to note that no official socio-economic and marketing studies on fiber crops were conducted at UPLB. Nevertheless, UPLB faculty members undertook socio-economic and marketing researches outside the university as part of their consultancy assignments, but these are not credited as official research outputs by the university. It can be gleaned from these figures that UPLB's past researches focused on varietal improvement or plant breeding. UPLB collaborated with FIDA and CRDI in some of its abaca and cotton research projects, respectively.

UPLB's completed researches in the area of varietal development/crop improvement were concentrated on salago, kenaf, ramie, cotton, and jute breeding; tissue culture of abaca, salago, maguey, and pineapple; silkworm breeding and egg production; varietal improvement of mulberry and abaca; screening of abaca for resistance to bunchy top and mosaic diseases; DNA finger printing in abaca; and collection, conservation, evaluation, and documentation of abaca cultivars, related species, and breeding materials (i.e., in vitro gene banking of abaca), among other studies. The main objective of UPLB's abaca breeding researches was to raise the fiber quality from the residual grade to primary grade and yields from 0.9% fiber recovery to 1.2%. On the other hand, the general objective of the UPLB silkworm breeding research and development program was to develop silkworm hybrids superior in specific characters and adaptable to varying agro-climatic conditions for commercial cocoon production,

Currently, UPLB has 42 on-going researches on fiber crops, but again all these studies are technical in nature (Table 34). The distribution of these studies by research area are as follows: varietal improvement, 29; crop production, 10; and postharvest/processing, 3.

Apart from the researches conducted by UPLB faculty members, a total of 21 M.S. thesis and Ph.D. dissertation on fiber crops had been written by graduate students at UPLB (Table 35). Of this total, 11 were on cotton, three (3) on ramie, and two (2) on abaca. By research area, these studies are distributed as follows: crop production, 11; varietal/crop improvement, 4; and socio-economics research on cotton, 6.

Since 1988, DMMMSU-SRDI undertook a total of 67 studies distributed as follows: mulberry and silkworm/cocoon production, 20; varietal /crop improvement (i.e., germplasm collection, conservation, and evaluation of mulberry varieties including silkworm), 14; postharvest/processing and fiber/silk waste utilization, 23; and sericulture socio-economics and marketing researches, 10 (Table 28). The completed socio-economics researches dealt on the following: impact assessment of the technical training program in sericulture; development of an alternative sericulture project based on the cooperator-businessman's approach/strategy; impact assessment of sericulture piloting;

Table 32. Number of on-going researches on fibercrops conducted by FIDA by type of crop and research area as of January 1999.

RESEARCH AREA	NUMBER OF ONGOING RESEARCHES			Total
	Abaca	Sericulture	General	
Varietal Development/ Improvement	4	1	-	5
Crop Production	5	21	-	26
Postharvest/Processing Utilization	-	-	-	-
Socio-Economics and Marketing	-	-	1	1
Total	9	22	1	32

Source: FIDA

Table 33. Number of completed researches on fiber crops conducted by UPLB by type of crop and research area, 1988-1998.

RESEARCH AREA	NUMBER OF COMPLETED RESEARCHES						Total
	Abaca	Cotton	Salago	Sericulture	Ramie	Fibercrops ^c	
Varietal Development/ Improvement	17	18	3	6	15	5	64
Crop Production ^a	9	4	-	2	5	2	22
Postharvest/Processing Utilization	1	-	-	2	1	-	4
Socio-Economics and Marketing	-	-	-	1	-	-	1
Total	27	22	3	11	21	7	91

^aIncludes Integrated Pest Management

^bMore than one crop

Source of basic data: UPLB

Table 34. Number of on-going researches on fiber crops conducted by UPLB by type and research area as of January 1999.

RESEARCH AREA	NUMBER OF ONGOING RESEARCHES				Total
	Abaca	Cotton	Ramie	Fibercrops ^c	
Varietal Development/ Improvement	7	7	6	9	29
Crop Production ^a	10	-	-	-	10
Postharvest/Processing Utilization	3	-	-	-	3
Socio-Economics and Marketing	-	-	-	-	-
Policy Studies	-	-	-	-	-
Total	20	7	6	9	42

^aIncludes Integrated Pest Management

^bMore than one crop

Source of basic data: UPLB

Table 35. Number of completed M.S. Thesis and PhD dissertation on fiber crops at UPLB by type and research area, 1988-1998.

RESEARCH AREA	ABACA		COTTON		RAMIE		TOTAL
	M.S.	PhD	M.S.	PhD	M.S.	PhD	
Varietal Development/ Improvement	1	-	-	1	2	-	4
Crop Production	1		7	2	1	-	11
Postharvest/Processing Utilization	-	-	-	-	-	-	-
Socio-Economics and Marketing	-	-	4	2	-	-	6
Policy Studies	-	-	-	-	-	-	-
Total	2		11	5	3	-	21

Source of basic data: UPLB

impact assessment of sericulture as an industry in the Philippines; economics of silkworm egg production using 1/4 hectare in La Union; socio-economic evaluation of the DRDAP-assisted sericulture project in Region 1; comparative economic study of mulberry, mango, and banana-based farming system; identification of the problems and issues affecting the pace of sericulture development in the Philippines; survey of the marketing channels of silk and silk allied products in the Philippines; economics of mix cropping in mulberry; and feasibility of hand reeled raw silk for village handling industry.

As regards to the 24 on-going sericulture studies of DMMSU-SRDI, these are distributed as follows: postharvest/processing, 19; socio-economics and marketing, 4 ; and crop production, 1 (Table 30). The latter consist of the following studies: economics of thrown and spun silk yarn production and economics of cocoon production under various ecological conditions.

From 1988 to 1998, VISCA-NARC had a total of 30 completed researches on abaca, of which nine (9) were on crop production; nine (9) on varietal/crop improvement; eight (8) on postharvest processing and utilization; and four (4) on socio-economics (Table 28). The latter dealt on the socio-economic benchmark assessment of abaca fiber production practices and flow of market; linkage mechanism between abaca fiber producers and product users; evaluation of existing marketing schemes and identification of market potentials for high-value abaca products; and marketing schemes/strategies for high-value abaca products in Region 8.

NARC-VISCA aims to continue its focus on varietal improvement including germplasm collection, maintenance and characterization, cytogenetics, screening for high yield, pest/disease resistance, stress tolerance, field evaluation, in vitro conservation, and development of new varieties. The Center has 34 on-going researches on abaca distributed as follows: 12 on crop production; 10 on varietal development/crop improvement; five (5) on postharvest/processing/waste utilization and seven (7) on socio-economics (Table 30). The on-going socio-economic studies include the following: benchmark survey on the abaca industry in Southern Leyte and Southern Leyte; an assessment of the contribution of abaca cooperatives on the abaca industry in Region 8; case study of abaca livelihood in Region 8; impact assessment of abaca livelihood in Region 8; indigenous knowledge systems on abaca; and women in the abaca industry: an assessment of their contribution and constraints to their participation.

To date, PTRI has completed 28 research projects/studies on various fiber crops distributed as follows: ten (10) on studies on genetic resource improvement for silkworm; four on Integrated Pest Management for silkworm; and 14 on postharvest/processing/waste utilization (i.e., two on fiber quality improvement for pineapple and banana; five on process optimization for abaca, banana, pineapple, kenaf, and maguey; one on product development/improvement for recyclability of degumming liquor; and six on postharvest improvement for silk) (Table 28). Current researches of the Institute are focused on process optimization of Philippine tropical fabrics, product development/improvement and market promotion strategies for indigenous fibers suited

for Philippine tropical fabrics. In addition, the Institute is also currently undertaking researches on genetic resource improvement and postharvest improvement for silk.

The details of the completed and on-going studies on fiber crops by agency are presented in Appendix Tables 28-46.

3.3.2 Technology Generated/Adopted Including Constraints to and Consequences of Adoption

Specific technologies developed by each agency were identified in this section to assess which of these technologies were already disseminated and which are ready for commercialization.

To date, UPLB has developed six abaca hybrids resistant to both mosaic and bunchy top viruses. However, current yields and fiber quality of these hybrids are below the optimum level. The NPGRL-Institute of Plant Breeding (IPB) also undertakes germplasm collection for abaca and bast fiber crops such as ramie, jute, salago, kenaf, and cotton. Bast fiber crops come from both local and foreign sources.

As regards UPLB's research accomplishments in its silkworm breeding and egg production projects, this SCU presently maintains two UPLB-developed in breed lines and seven strains and hybrids. The two UPLB-developed strains are currently under performance evaluation in selected/specific locations for further improvement. Three of the nine strains/hybrids have shown promising performance in terms of fecundity, survival rate, adaptability to local conditions, silk yield, and quality. UPLB also developed a degumming technology for ramie, but this technology has not yet been picked up by the business sector. The Philippines has been exporting ramie to China, but has been importing degummed ramie. If this technology is adopted locally, this could result in savings in the country's foreign exchange earnings. Regarding the results of UPLB's cotton breeding work, breeder seeds of UPL-Ct4 were produced. All the seeds were stored at NPGRL.

Compared to UPLB, VISCA-NARC was able to generate more abaca technologies (Appendix Table 47). The Center maintains in its germplasm area a total of 587 accessions collected from all over the country. These consist of 453 cultivated species, 39 hybrids, and 89 wild relatives. About 271 of these collections were given to IPB, UPLB for duplication as active collection and 98 for finger printing while 50 accessions were given to FIDA-Bicol for disease screening. The Center has also identified and selected 16 promising and high-yielding accessions which are now under evaluation/ trial in two different agro-climatic conditions of Region 8.

The technologies generated by VISCA-NARC include the recommended abaca varieties (Laylay for fibercraft and Inosa for cordage, pulp, and paper) which are now commercially grown not only in Eastern Visayas, but also in the Bicol, Caraga, and Mindanao regions. These varieties are high-yielding with good quality fibers and moderately resistant to pests and diseases, drought, and strong winds. Other technologies

which were developed by the Center and had already been introduced to abaca farmers are abaca-based cropping systems, integrated pest management system (IPM), and rehabilitation and rejuvenation of old plantations. Isolation and bioassay test of the causal organisms for *Fusarium* wilt also resulted to the identification of benlate and vitigram as chemical control for the disease. Biocontrol agent against abaca corm weevil was also identified and is now ready for production. Moreover, VISCA-NARC developed a technique on rapid propagation/reproduction of suckers through decapitation by cutting the stalk of mother plants at the base and punctured by a piece of pointed stick. The technology is now used by farmers to enhance more production of suckers in their abaca nurseries.

Apart from the afore-mentioned production technologies, the Center developed technologies on the utilization of different wastes for handmade paper, mushroom culture, and handicraft production which are now commercialized and exported abroad.

The Center has also developed a portable stripping machine which is now being commercialized in various parts of the country. The machine has an output capacity of 80-150 kg dried abaca fibers per day (8 hours operation). So far, the Center has fabricated a total of 19 units of the portable stripping machine for abaca farmers, cooperatives, private individuals and organizations in Region VIII (15 units), Region VII (1 unit), CARAGA (1 unit), Bicol (1 unit), and CARD- Davao (1 unit). The Center received additional orders (12 units) from abaca farmers in Eastern Visayas. Depending on the engine, the cost of the portable stripping machine ranges from P60,000 to P70,000, which is relatively cheaper than that of the fixed stripper developed by FIDA (P180,000 to P200,000). Secondary processing tools and gadgets such as an abaca slicer/sizer and shaver which were developed by the Center were likewise introduced to abaca farmers, handicraft processors, LGUs, and NGOs in Regions VII and VIII as well as in CARAGA. More than 100 units of these secondary tools and gadgets were fabricated by the Center and distributed in these regions. The sizer is used to slice the "umbac" or "bacbac" into different sizes while the shaver is used in removing the inner soft portion of the "umbac." Aside from producing uniform, clean sliced "umbac", using these gadgets reduces the time spent for slicing and cleaning by 70% over the traditional knife method. In addition, VISCA-NARC developed a prototype of the portable moisture meter using cheaper and locally available materials. It can determine moisture of fiber at room temperature and even at high temperature (90°C). About 200 units of collapsible molders of different sizes and shapes for the production of various high-value handicraft products were also developed and fabricated by VISCA-NARC for farmers, cooperatives, rural women, and interested individuals as ordered by LGUs, NGOs, FIDA, and DTI. In addition, the Center developed a prototype portable tensile strength meter which is made of locally available materials, but it is still under evaluation stage. Similarly, the village level twisting and twining machine developed by the Center has not yet been commercialized because it still needs further improvement and modification.

Likewise, FIDA developed several mechanical technologies for fiber crops. One of these is the modified twisting and twining device for abaca which has been designed to increase production capacity and improve twine quality. This device is more efficient

than the traditional twining machines used by abaca farmers in Southern Leyte. According to FIDA, fabricated spare parts for the miniature model are ready for assembly. A portable denting machine was also developed by FIDA for serrating abaca stripping knives. Knives produced by the machine are of uniform V-shape serration. The machine can be operated manually or by a prime mover. As of December, 1998, a total of 188 hand-stripping knives were distributed to interested abaca farmers in Regions IV, V, VI, IX, X, and XI (FIDA, 1998). Moreover, FIDA modified the traditional type of abaca spindle stripping machine by developing two models to make it safe and easy by incorporating a clutch mechanism that would disengage the wooden spindle from the source. The two models developed by FIDA are the stationary type suited for contiguous farms and the mobile type machine mounted with pneumatic tires suited for scattered abaca farms with access roads. However, most abaca farmers in the Bicol Region, which is a typhoon belt area, still prefer using stripping knives to spindle stripping machines because abaca varieties planted in this region are short and therefore, have short fibers. Another mechanical technology designed and developed by FIDA is the abaca dryer. As reported by FIDA, the cost of drying one kilogram of fiber is P2.57, P2.23, P2.06, and P1.95 for 100, 150, 200, and 250 days utilization of the dryer, respectively. Although the newly developed abaca dryer is very efficient and could dry an average of six kilograms of fibers per hour, sundrying of abaca fibers is still widely practiced by the farmers. Regarding village level technologies on cocoon and silk processing, FIDA developed and fabricated a modified reeling device and a re-reeling device (FIDA, 1999). The former is a pedal-operated machine which can be driven by a one-half HP motor and can produce 21 to 42 denier raw silk while the latter is just a laboratory model and has three skein capacity. The re-reeling device, however, still needs improvement because there were frequent breaking of the filament during the test run causing frequent work stoppage. Other devices for silk processing developed by FIDA such as the twisting device which can produce 26 twists per inch and a degumming vat are still undergoing further testing to determine their efficiency. The use of the fabricated twisting device, however, is limited since it only produces the (S) twist. An improved model that can produce both the (S) and the (Z) twists is needed.

FIDA also generated three technologies on the utilization of fiber wastes. The first one is the utilization of fiber extraction wastes as animal feeds. Pupa meals were found to be a good substitute for fish meal at 50% to 75% level. The second one is the utilization of fiber plantation wastes as organic fertilizer for green onions. Based on the technology recommendation of FIDA, ramie and abaca plantation waste composts should be applied to green onions at a rate of 13.23 and 20 tons/ha, respectively. The third one is the utilization of ramie and banana wastes as fertilizer to mulberry.

Another technology developed by FIDA is the production of soft nonwoven materials using 70-30 maguey and abaca blend which is soft, strong, and with textile feel using the nonwoven machine. Moreover, FIDA successfully modified the dyeing method for "tinalak" using "lokow" and "kinalum" plant dyes with alum as the best chemical mordant. Alum can be used alone or in combination with tannic acid or ferrous sulfate. It was found that the addition of chemical mordants in the traditional methods of dyeing improved the fastness properties of "kinalum" and "lokow" dyed fibers. The "kinalum"

dyeing time was reduced from 10 days to two days. This technology was demonstrated to tinalak weavers in Barangays Tablo, Lake Sebu and Edwards, T'boli in South Cotabato in 1997 (FIDA, 1999). Unfortunately, the modified dyeing technology is presently not being practiced by the native weavers of "tinalak" in Barangay Tablo, Lake Sebu due to unavailability of alum in their locality. In addition, the weavers' association in Barangay Edwards, T'boli are now using synthetic dyes which are commercially and readily available due to the shift in market demand from the traditional design of "tinalak" to new designs like striped and checkered of varied colors such as yellow, brown, red, and natural colors of abaca.

Several improved cultural management practices and postharvest technologies for abaca and sericulture/moriculture production were likewise developed by FIDA and are now adopted by farmers. The extent of adoption of FIDA-generated technologies in Regions I, V, and X from August to December 1998 is shown in Appendix Table 48. The abaca technologies which farmers are adopting include tissue cultured plantlets, abaca eyebud propagation/rapid propagation method, intercropping, IPM, use of trap plants, proper shading, roguing, fiber waste composting, proper harvesting of mature stalks, proper drying of fibers, pre-drying of fibers, recommended planting density, weeding method, variety, and chemical/fertilizer application method. On the other hand, the following technologies on moriculture and sericulture which have been generated by FIDA and adopted by farmers are proper plant distancing for mulberry, proper pruning, mulching, recommended fertilizer application method, pest and disease control, leaf harvesting, proper disinfection and sanitation, liming, regular bed cleaning, proper leaf feeding, proper bed spacing, correct regulation of temperature and relative humidity, leaf preservation, proper mounting, proper cocoon harvesting, proper cocoon sorting and classification, proper cocoon drying, and cocoon packaging.

As regards to DMMSU-SRDI, the Institute to date has 283 collections of mulberry varieties, of which five were found promising and were recommended to farmers. In addition, there are 20 identified promising open-pollinated varieties. For its silkworm collections, the Institute has six bivoltine and four multivoltine purelines. Intensive hybridization and selection efforts led to the development and identification of eight promising F1 hybrids, four multivoltine hybrids, three-way cross bivoltine hybrids, and three double-cross bivoltine hybrids. A major problem of the Institute is its modest germplasm resources. To increase productivity and enable the country's sericulture industry to become globally competitive, DMMSU-SRDI direly needs to enrich its existing gene bank continuously and develop better mulberry and silkworm varieties. Other major research accomplishments of the Institute include the generation and verification of several technologies on cocoon processing and utilization of natural dyes. It also developed a number of mechanical technologies (e.g., spinning machine, moth crushing machine, disinfecting machine, manually-operated reeling and re-reeling machines, non-conventional boiler machine, pupa removing machine, degumming and drying vat machine, leaf cutting machine, silk production equipment, silk winding machine, waste disposal carrier, deflowering machine, priming machine, cyclomixer, flying shuttle handloom, and warping machine) and postharvest and processing

infrastructure (e.g., locally manufactured cocoon dryer for rural areas, different types of rearing houses, and steaming chamber) for the sericulture industry.

With regard to the cotton technologies generated by CRDI (now CODA), ten (10) cotton varieties suitable for specific areas have been developed by this agency and are already approved for commercial planting (Appendix Table 49). Among the important cotton varieties are as follows: UPL -Ct1 (Batac 1), UPL-Ct2 (Batac 2), UPL-Ct3, CRDI-1 (Bacani), CRDI-2 (Sebastian), PSB Ct 4, and PSB Ct 6. A seed multiplication program is in place for these varieties. CODA has currently recommended varieties in its germplasm collection. As shown in Appendix Table 49, UPL-Ct2 has 60% adoption rate. This cotton variety is recommended in all cotton production areas and has general adaptability. On the other hand, CRDI-1 and CRDI-2 have 30% and 10% adoption rate, respectively. CRDI-1 is also recommended in all cotton production areas in the country, but it grows best in Mindanao. CRDI-2, which has been promoted nationwide, is highly recommended in Luzon and Visayas.

Other technologies/technology components generated by CRDI/CODA are as follows (Appendix Table 49):

1. Mechanical technologies - These include small tools and machinery for cotton production such as the mechanical planter-fertilizer applicator to cut the cost of planting and fertilizer application by half; the low volume sprayer nozzle to cut labor cost in spraying to about 2/3; and the minimum tillage cotton planter to reduce the cost of planting cotton under minimum tillage condition which is considered very costly; and a cotton delinter which is used in mechanized planting operations. The mechanical planter-fertilizer applicator, however, is not very popular among cotton farmers because the machine uses expensive delinted seeds. Moreover, delinting of cotton seeds is not environmentally friendly because technical grade sulfuric acid solution is used as delinting medium. On the other hand, the minimum tillage cotton planter was tested in farmers' fields, but commercialization of this machine was hampered by budgetary constraints. The low volume spray nozzle technology is incorporated in the recommended cotton package of technology (RCPT). CRDI also developed soil molders for use in cotton transplanting technique. The use of molders was piloted in Candon, Ilocos Sur.
2. Location-specific cultural practices - These consist of seeding rate, seed treatment for seedling disease control, recommended dates and distance of planting for specific growing condition; replanting technology (i.e., not later than 29 days after planting); fertilizer rates by kind of fertilizer, fertilizer placement and time of application, critical soil test value of phosphorous, use of foliar fertilizer, conventional and minimum tillage technology for seedling establishment; thinning technology (not later than 27 days after planting), off-barring and hilling-up cultivation methods, irrigation technology (furrow, flooding, and hose irrigation methods that are location-specific, amounts, and frequency), use of herbicides or weed management, crop pest monitoring

system, garlic-cotton relay cropping pattern, and cotton and legume intercropping. Although CRDI reported that garlic-cotton relay cropping pattern and cotton legume intercropping have been found to be more profitable than cotton monocropping, very few cotton farmers are using these technologies. Seed treatment, minimum tillage method of establishing cotton after rice, and off-barring and hilling-up cultivation are likewise not widely adopted by cotton farmers. On the other hand, the following cotton technologies are adopted by all cotton farmers in cotton growing areas in the country: recommended planting distance and cotton establishment. Foliar fertilizer is adopted nationwide while the recommended fertilizer requirement, fertilizer placement and time of application as well as the critical soil test value of phosphorous are adopted by most cotton farmers in Luzon and Visayas. These technologies cannot be totally adopted in Mindanao due to uncertainty of rains. Irrigating cotton based on available moisture and under minimum tillage condition is another cotton technology included in the RPT.

3. Integrated Pest Management - This includes insecticide/pesticide list validation/evaluation, sequencing of pesticides, and integration of chemical and biocontrol methods of pest management. Tejada (1997), in his Ph.D. dissertation at UPLB, found that only a portion of the IPM has been utilized by cotton farmers. The widely used IPM component technologies were chemical rotation, planting recommended varieties, use of chemicals based on the target pest and crop age, and the practice of spraying based on the critical productivity level. The CRDI low volume nozzle, release of trichogramma and planting of trap crops were the highly ignored IPM component technologies. Findings of the study also showed that the level of technology use significantly influenced the level of cotton productivity or seed cotton yield. The adoption of the cotton IPM technology contributed 43.3% to the level of productivity or seed cotton yield. Results of his study further revealed that cotton farmers experienced difficulties in adopting IPM technology, in part or in full. Among the major problems that confronted most cotton farmers were the unavailability of the agricultural technologist for consultation, inadequate or lack of information about certain components of the technology (i.e., specifically, trichogramma, low volume nozzle, and trap crops) along with material resources to adopt them, inadequate financing extended, and delayed release of loans caused by their inability to submit the requirements on time. The factors which were found to have a significant influence on their level of knowledge of the cotton IPM technology were size of farm planted to cotton, attitude towards conservation, attendance in IPM-related training programs, educational attainment, language and literacy, indigenous knowledge of pest control, income, access to mass media, organizational affiliation, position held, and contact with mass media and the cotton research specialist. According to the cotton growers, they preferred the cotton researcher/cotton research specialist to the agricultural technologist or the cotton technical specialist as a source of information about IPM technology. Moreover, the level of knowledge about the cotton IPM technology, contact

with the cotton research specialist, and organizational affiliation were reported to have a significant effect on the level of technology use. On the other hand, attitude towards the technology delivery channels and acquaintance with the agricultural technologist had a negative influence on the level of technology use.

3. Harvesting/postharvest practices - These consist of the recommended harvesting method (i.e., harvesting bolls that opened 3-4 days after busting by hand picking 2-5 times depending on growing conditions); drying method (i.e., 1-2 days after harvest in canvass and cement floors), sacking using propylene materials, and use of variable density baling equipment; and
4. Other technologies - These are comprised of the use of feed ration for cattle fattening and cotton stalks which are regarded as wastes for particle board production. CRDI also formulated micronutrient recommendations and developed several cotton growth regulators and defoliant, but these are not yet commercially used.

To date, PTRI, on the other hand, has developed the technologies for fiber pre-treatment, yarn production and fabric finishing. These technologies are now applied on a commercial scale for the development of Philippine tropical fabrics which are presently gaining global market acceptance. The Institute has also developed silkworm strains suitable for commercial cocoon production under Philippine conditions.

Moreover, government institutions like PTRI, SCUs such as UPLB, SRDI, CLSU, and other similar entities are into the production of silkworm eggs of multivoline and bivoltine strains (FIDA, 1997). The government handles egg production, considered a critical stage of the industry, to ensure distribution of disease-free silkworm eggs. PTRI has an annual production capacity of 50,000 boxes of F1 hybrids of silkworm (TLRC, 1996). In most cases, the government also takes charge of the hatching of silkworm eggs and rearing silkworms up to the third instar before these are farmed out to cocoon growers.

Based on the foregoing discussions, while several technologies on fiber crops have already been developed and disseminated, there is a dearth of information on the constraints to and the impact of adoption of most of these technologies considering the limited number of socio-economic studies on these issues.

3.4 Strengths and Weaknesses of the Institutional Structure of Research and Extension

Research and extension functions are closely linked. The primary purpose of research is to develop technologies for use in a given environment while the main objective of extension is to transfer such a technology to users (Dar, 1997).

Ideally, due to the limited public funds for R & D/E, there should be a close partnership between the public and the private sectors in research and extension activities. In the Philippines, however, the public sector is the sole local source of funding for fiber crops research considering that the investment of the private sector for fiber crops research is nil. Past research activities performed by the private sector in the country were on the banana, cocoa, coconut, pineapple, rubber, sugarcane, and tomato industries (Pray, 1986). The absence of research investment on fiber crops by the private sector could be attributed to a large extent on the availability and accessibility of public sector research on fiber crops. It is interesting, therefore, to note that the role of the private sector in research was limited to serving as a member of the PCARRD National Industrial Crops R & D Committee, as key informants during the consultation workshops organized by PCARRD and DA-BAR to identify major problems confronting the industry and determine research needs, and as collaborating companies (i.e., ALINDECO and PICOP) in the feasibility study on the commercial production of deco fiber and deco pulp which was conducted by FIDA..

Similarly, extension activities to disseminate or commercialize fiber crops technologies are generally undertaken by the public sector. Among the agencies involved in research and extension activities for fiber crops, FIDA has the strongest research-extension linkage. It has a large pool of extension workers which promote the technologies generated by the Authority through its various government programs/projects. For example, the use of high-yielding and recommended abaca varieties is being promoted in the Abakaunlaran 2000 Project, the Abaca Integrated Development Project in Catanduanes, the Abaca Rehabilitation and Extension Support under the Sorsogon Integrated Area Development Project (SIADP), and the Abaca Industry Integrated (AIIP) Project in Region VIII. To ensure adequate supply of high-yielding and disease-free planting materials, the establishment of tissue culture laboratories and nurseries was included as one of the components of these projects. FIDA constructed three tissue laboratories in the Bicol Region (i.e., Sorsogon, Catanduanes, and Albay). As of December, 1998, FIDA established and maintained nurseries in 34 different sites in Regions I, IV, V, VI, VII, VIII, IX, X, and XI with an accumulated area of 32.35 hectares planted to four different crops (FIDA, 1998). Thirty nurseries are planted to abaca, two to mulberry, one to maguey, and one to pineapple. The total number of abaca planting materials distributed was 27,115 suckers and 95,000 seed pieces while there were 35,150 suckers and 20,000 seed pieces available for distribution.

From its regular budget, FIDA also promoted technologies through the establishment of techno-demo farms in 14 different sites in Regions I, IV, VI, VIII, IX, X, and XI with an accumulated area of 15.47 hectares planted to abaca (12), maguey (1), and mulberry (1) as of December 1998 (FIDA, 1998). The Authority has also deployed more extension personnel in disease-infested areas in Bicol to assist farmers in the identification, prevention, and control of diseases (FIDA, 1996). From 1994 to 1998, FIDA conducted a total of 1,163 farmers' meetings/demonstration classes to disseminate information on fiber crops technologies to 23,378 farmer-owners, tenants, and housewives in Regions IV, V, VI, VII, VIII, IX, X, and XI (FIDA, 1998). A wide range of topics were covered in these meetings/trainings such as handmade papermaking, abaca

production technology, marketing, grading and classification, livelihood opportunities, disease identification, prevention and eradication techniques, and financing, among other topics. Furthermore, FIDA distributed a total of 6,286 information materials (e.g., abaca comics, technoguide, brochures, posters, and slogans) to an equal number of farmers in Regions IV, V, VI, VII, VIII, IX, X, and XI.

To date, the private sector has been actively involved in only three extension and policy advocacy activities of FIDA. To promote pilot commercial models of serrating and spindle stripping machines to end-users in various regions in the country, FIDA collaborated with the Metal Research Development Center in the fabrication of the developed machines. In an effort to maintain the quality of abaca fiber, FIDA has also undertaken a renewed campaign against dirt and plastic contamination (FIDA, 1996). FIDA and the Philippine Fiber Exporters' Association (PFEA) have involved the shippers in this campaign. The Authority's efforts to improve fiber quality have been successful as evidenced by the commendations of visiting foreign buyers and representatives of major abaca pulp and paper companies. Moreover, in line with the government's campaign on environmental protection, FIDA, in cooperation with the Natural Fiber Processors Association of the Philippines (NAFPAP), requested the inclusion of abaca in the country's reforestation program especially to the members of the House of Representatives who come from abaca-producing regions.

Apart from its technology promotion activities, FIDA, through its Marketing Division, conducts market research projects and market development undertakings in the form of trade promotions through participation in international and local fairs and exhibits; market assistance to industry clientele through information dissemination, establishment of direct marketing tie-ups, institutional linkages; and other marketing-related activities (FIDA, 1997).

Similarly, VISCA-NARC has a strong research-extension linkage. Since 1993, VISCA-NARC has implemented an integrated abaca extension program which consists of four components, namely: 1) commercialization of abaca products and by-products; 2) nursery/demonstration farm establishment, seed piece production, and distribution; 3) technical update on abaca technologies (e.g., production of prototype processing machines/tools/gadgets and communication materials such as brochures or technoguides on abaca production and mushroom culture using abaca wastes; exhibits; trainings; and workshops), and 4) technical assistance on all aspects of abaca production, processing, and utilization. Unlike, FIDA which collaborates with the Metal Development Center in the fabrication of machines developed by the Authority, VISCA-NARC fabricates the mechanical technologies that it developed. To mass produce good quality planting materials, a tissue culture laboratory was established for abaca and other crops at VISCA in 1998.

VISCA-NARC has also worked closely with FIDA in the implementation of the ViCARP's flagship program - the Abaca Industry Integrated Program in Region VIII. The ViCARP regional consortium was able to establish new nurseries and maintain old ones with funding from the LGUs (Dar, 1997). ViCARP spearheaded the establishment

of an Integrated Abaca Processing Center in Abuyog, Leyte and the Abaca Stripping Center and Storage Facilities funded by the countryside development fund of the congressman of the first district of Leyte. The active participation of FIDA and DA had generated P2 million from the countryside development fund of this congressman (FIDA, 1996).

To give member-agencies and LGUs easy retrieval and quick access to R & D information, the ViCARP Electronic One-Stop Information Shop (VEOSIS) was set up (Dar, 1997). During the period 1996-1997, 29 abaca technologies involving 29 farmer-associations and six NGOs in Visayas and Mindanao were piloted under ViCARP's Technology Promotion and Commercialization component of the Abaca Industry Integrated Program.

So far, the PCARRD technology promotion strategy that has benefited the fiber crops sector is the publication of an article on the FIDA-developed rapid propagation technique for abaca in the PCARRD Monitor (May-June 1998 issue). The PCARRD Monitor is PCARRD's official bi-monthly newsletter which highlights research news and other agricultural information intended to keep the public, especially the research community, abreast of the developments in the national research system (Dar, 1997). Farmers' Information and Technology Service (FITS), popularly known as TECHNO PINOY, is another PCARRD technology promotion strategy which may also serve the information and technology needs of various clientele in the fiber crops industry. TECHNO PINOY is a one-stop shop of agricultural technologies. Added information such as sources of planting materials, production statistics, processors, traders, manufacturers, agricultural experts, and markets is also made available in each TECHNO PINOY center established nationwide (Dar, 1997). Aside from providing agricultural information, FITS extends other services such as technical assistance through technology training activities, scientists' visits, and lectures; clinic for networking of clients with experts on the solution of agricultural and postharvest problems; and production and dissemination of communication materials.

Although there have been substantial R & D activities in cotton and CRDI/CODA was able to generate many location-specific technologies, the development of the industry is partly constrained by low cotton productivity. This may be attributed to low level of technology adoption due to the weak extension system especially after the devolution of the extension function to the LGUs. The extension delivery function used to be the responsibility of the PCC, but with the cutting of the PCC's budget as a result of the devolution, the delivery of extension services was transferred to the LGU Agricultural Technologists (ATs). Given their multi-commodity and large area coverage, the ATs accorded low priority to cotton. Many of them have limited technical know-how and skills in cotton production considering that they became generalists after the devolution. This new extension set-up, therefore, precluded a specialized cotton delivery system. The inadequacy of specialized extension service in the cotton industry was found to be critical in the adoption process (CODA, 1999).

In a study conducted by Tejada (1997), it was found that the research subsystem played the greatest role in managing the linkage mechanisms with the farmers and the ATs. This was manifested in the conduct of trainings for both the farmers and the ATs, field days, technology verification and demonstration farms, cotton research reviews, technology consultation workshops, and development of communication materials. It was also revealed that the cotton farmer-respondents were rarely visited by the ATs. The CODA Cotton Research Specialist, the CODA Technical Specialist, and the trained farmer-leaders were alternative sources of information.

To overcome the weaknesses of the extension delivery system, the newly reorganized CODA is currently conducting extension activities under its Field Operations Unit. Apart from disseminating technologies to cotton growers, CODA also delivers extension services for ginning to cooperatives and private groups.

In 1998, the Agriculturang Makamasa-Cotton Program was formulated in response to the present need for cotton by the local textile industry and to alleviate poverty at the farm level (DA, undated). The GATT-WTO requires that at least 40% of the raw material used in manufacturing Philippine textile and garment exports should be generated from the country of origin. Through this program, the LGUs shall be assisted in providing support to cooperatives of cotton growers and farmers' groups in the production of cotton, in seedcotton ginning, and in marketing (DA, undated). Extension services shall be provided by the LGU ATs and assisted by the CODA Cotton Development Specialist (CDS) during the first year of the program in a particular production area. In succeeding seasons, the CODA CDS shall move to other production areas. Extension services shall include conduct of farmers' classes on cotton production technology, credit facilitation, regular visits to assess crop status and ensure adoption of the recommended technology, conduct of farmers' field days, and advice on harvesting, processing, and marketing. The CODA CDS, in close coordination with the Municipal Agricultural Officers (MAOs) and ATs of LGUs, shall also establish cotton technology demonstration farms to provide cotton growers a show window of the recommended cotton production technology.

As mentioned earlier, researches on abaca tissue culture and control of abaca diseases such as bunchy top were conducted by UPLB in collaboration with FIDA. Hence, technologies developed from these researches were disseminated by FIDA. Similarly, cotton technologies which were generated by UPLB in collaboration with CRDI/CODA were disseminated by CODA CDS or the ATs.

With regard to research and extension complementation among government agencies and SCUs in the sericulture industry, the development of this industry is being jointly undertaken by FIDA, PTRI, UPLB, DMMMSU-SRDI, and CLSU with FIDA as the lead agency. Moreover, government institutions like PTRI, UPLB, and DMMMSU-SRDI are producing silkworm eggs (FIDA, 1997). These institutions ensure the distribution of disease-free silkworm eggs with annual production capacity of about 60,000 boxes of F1 hybrids and also take charge of hatching silkworm eggs and rearing silkworms up to the third instar before these are farmed out to cocoon growers. Under its

National Integrated Sericulture Development program (NISDP), FIDA established two cocoon and silk processing demonstration centers located in Capiz and Zamboanga (FIDA, 1998). The centers were designed for demonstration and training of cocoon and silk processing based on village level technology.

4.0 Conclusion and Recommendations

Research complementation among the government agencies and SCUs involved in fiber crops research is strong as evident from the fact that some UPLB faculty members were tapped by FIDA and CRDI in the conduct of researches related to plant breeding and pest and disease control, the distribution of some of VISCA-NARC's abaca accession collection to UPLB for duplication as active collection and for finger printing and to FIDA-Bicol for disease screening, and the collaborative efforts of VISCA-NARC and FIDA in the implementation of the ViCARP Abaca Industry Integrated Program and of FIDA, PTRI, UPLB, DMMMSU-SRDI, and CLSU in the conduct of studies on sericulture.

Given the declining productivity and/or area contraction of minor fiber crops such as ramie, maguey, and salago, the country's limited research funds should be allocated only to abaca, cotton, and sericulture.

The analysis of the research expenditure on different types of fiber crops in this paper supported the findings of the study conducted by David et. al. which showed that the research expenditure allocation across fiber crops was highly incongruent with their economic contribution. Abaca research was underfunded compared to cotton and sericulture researches. In view of the fact that the Philippines has a comparative advantage in producing abaca, being the world's largest producer of this commodity and considering its local and export market potential, it is recommended that more research funding should be allocated to abaca compared to other fiber crops especially now that the industry is being threatened by Ecuador due to abaca area expansion and increasing productivity in this country. It is, therefore, imperative that abaca should be given a budget commensurate to its economic contribution to the Philippine economy.

Moreover, the distribution of public funds across research areas for fiber crops is imbalanced. For the past 10 years under review, socio-economics, marketing, and policy research areas have been accorded the least priority.

Among the agencies involved in conducting researches on fiber crops, CRDI/CODA had the highest number of marketing and socio-economic studies. Only CRDI/CODA had undertaken studies to assess the adoption of technologies and evaluate its training programs, communication materials, farmers' cooperatives, and financing schemes.

Although a substantial number of technologies have been generated and several government programs have been implemented to introduce these technologies, there are no existing socio-economic studies undertaken by these agencies with the exception of CRDI/CODA to assess the constraints to and impact of technology adoption and evaluate

the operation and impact of these government programs. The constraints analysis will be useful in providing feedback to researchers on whether there is a need to modify the technologies developed and to policy makers in improving the extension delivery system/mechanism. Furthermore, an evaluation of the operation and impact of government programs will provide useful information to program implementing agencies regarding the flaws or conversely the success factors in program implementation and the benefits derived by various target clientele or beneficiaries from the program. Hence, such a study will serve as basis for deciding either to discontinue the program under study, improve the implementation mechanism, or replicate/expand the program in other locations.

Completed marketing studies were few, location-specific (e.g., the Bicol Region or Region IV only for abaca), and fragmented. Market studies on fiber crops should be expanded to other regions not covered in previous studies considering that these commodities are grown in several regions in the country. Owing to constant changes in market conditions locally and abroad, such market studies should be regularly updated.

Policy researches on the fiber crops industry were also almost nil. FIDA's policy studies focused only on the review of fiber grading and standards and the sanitary and phytosanitary measures for abaca and other fibers. To promote the development of the fiber crops industry, other important policies should be studied.

Based on these considerations, it is recommended that increased funding should be allocated to socio-economics, marketing, and policy research areas along the following research topics:

Socio-economic and Marketing Research Area

1. Socio-economic and biophysical environment characterization of fiber crop production and processing sectors by type of fiber crop and by region
2. Constraints to adoption of technologies by type of fiber crop and by region
3. Impact assessment of technologies for each type of fiber crop and by region
4. Evaluation of the operation and impact of government programs at the regional and national levels
5. Micro-level profitability/investment analysis of new fiber crop technologies and new high-value fiber products by type of fiber crop
6. Market trends and preferences for fiber and fiber products in the domestic and export markets
7. Domestic and export market potential assessment of existing and new fiber products
8. Market development studies by type of fiber crop
9. Assessment of the effects of devolution on the delivery of agricultural extension services

Policy Studies

1. Trade and investment policies
2. Environmental safety
3. Fiscal policies
4. Monetary and credit policies
5. Policy issues related to IPR and biotechnology research (e.g., genetic engineering such as transgenic cotton)

Researches to increase productivity of the major fiber crops and diversify their uses must be continuously pursued and funded owing to the low productivity of these commodities and incomes of fiber crop-producing households.

To complement the afore-mentioned R & D priorities, facility upgrading and human resource development particularly in the social science fields (e.g., economics, sociology, etc.) must be strengthened. Research and extension linkage as well as extension and farmer linkage must be further enhanced especially for cotton by increasing the budget for extension relative to cotton research considering that a substantial number of location-specific technologies have already been developed for this commodity, but the adoption of these technologies is low. Finally, the participation of the private sector must be encouraged in terms of research investments in the development of mechanical technologies and in product diversification of pulp and paper.

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Appendix Table 1. Total world production of abaca, 1990-1997.

YEAR	WORLD PRODUCTION (mt)	PHILIPPINES		ECUADOR	
		Production (mt)	% Share	Production (mt)	%Share
1990	69,242	58,490	84	10,752	16
1991	73,957	62,931	85	11,026	15
1992	71,177	62,159	87	9,018	13
1993	69,536	58,633	84	10,903	16
1994	78,729	65,220	83	13,509	17
1995	76,204	63,821	84	12,383	16
1996	83,109	69,462	84	13,647	16
1997	80,195	66,258	83	13,937	17
Average	75,269	63,372	84	11,897	16
Ave. Annual Growth Rate (%)	2.3	2.0		4.7	

Source of basic data: NSO

Appendix Table 2. Abaca fiber production by region, Philippines, 1991-1997.

YEAR	ABACA FIBER PRODUCTION (MT)									
	Southern Tagalog	Bicol	Western Visayas	Central Visayas	Eastern Visayas	Western Mindanao	Northern Mindanao	Southern Mindanao	Central Mindanao	CARAGA
1991	49	21,906	614	490	24,122	4,608	873	5,736	1,943	2,590
1992	61	23,283	692	226	22,666	4,620	1,421	5,379	1,596	2,215
1993	81	20,297	677	171	22,442	3,493	1,788	5,668	1,728	2,288
1994	83	22,956	658	129	25,419	4,167	1,827	5,807	2,131	2,043
1995	56	22,294	815	206	23,317	4,147	1,562	5,943	2,403	3,078
1996	85	24,442	614	358	26,186	4,617	1,844	6,361	2,106	2,849
1997	64	18,651	787	302	27,263	4,167	2,162	7,175	2,317	3,370
Average	68	21,976	694	269	24,488	4,260	1,640	6,010	2,032	2,633
% Share:										
1991	0.1	34.8	1.0	0.8	38.3	7.3	1.4	9.1	3.1	4.1
1997	0.1	28.1	1.2	0.5	41.1	6.3	3.3	10.8	3.5	5.1
Ave. Annual Growth Rate (%)	9.0	-1.7	5.9	2.5	2.4	-0.6	18.6	4.0	4.0	6.6

Source of basic data: BAS

Appendix Table 3. Area planted to abaca by region, Philippines, 1991-1997.

YEAR	AREA PLANTED TO ABACA (HA)									
	Southern Tagalog	Bicol	Western Visayas	Central Visayas	Eastern Visayas	Western Mindanao	Northern Mindanao	Southern Mindanao	Central Mindanao	CARAGA
1991	783	53,482	1,407	2,425	20,613	8,317	3,287	5,819	3,533	4,287
1992	857	53,508	1,187	2,464	20,970	8,880	2,142	5,906	3,204	2,582
1993	865	52,769	1,262	2,470	21,658	7,187	2,298	6,774	3,204	3,266
1994	872	42,552	1,859	2,482	29,214	7,662	2,532	8,293	3,204	4,255
1995	450	42,563	2,050	2,648	30,069	7,137	2,484	9,663	3,207	5,173
1996	304	50,885	7,804	2,651	27,295	7,495	2,915	8,836	3,207	5,266
1997	331	45,683	7,058	2,712	28,245	7,399	3,093	9,303	3,087	5,373
Average	637	48,777	3,232	2,550	25,438	7,725	2,679	7,799	3,235	4,315
% Share:										
1991	0.8	51.4	1.4	2.3	19.8	8.0	3.2	5.6	3.4	4.1
1997	0.3	40.7	6.3	2.4	25.2	6.6	2.8	8.3	2.7	4.8
Ave. Annual Growth Rate (%)	-10.1	-1.9	53.2	1.9	60.2	-1.5	0.7	8.6	-2.2	7.1

Source of basic data: BAS

Appendix Table 4. Abaca fiber yield by region, Philippines, 1991-1997.

YEAR	ABACA FIBER YIELD (MT/HA)									
	Southern Tagalog	Bicol	Western Visayas	Central Visayas	Eastern Visayas	Western Mindanao	Northern Mindanao	Southern Mindanao	Central Mindanao	CARAGA
1991	0.06	0.41	0.44	0.20	1.17	0.55	0.27	0.99	0.55	0.60
1992	0.07	0.44	0.58	0.09	1.08	0.52	0.66	0.91	0.50	0.86
1993	0.09	0.38	0.54	0.07	1.04	0.49	0.78	0.84	0.54	0.70
1994	0.10	0.54	0.35	0.05	0.87	0.54	0.72	0.70	0.67	0.48
1995	0.12	0.52	0.40	0.08	0.78	0.58	0.63	0.62	0.75	0.60
1996	0.28	0.48	0.08	0.14	0.96	0.62	0.63	0.72	0.66	0.54
1997	0.19	0.41	0.11	0.11	0.97	0.56	0.70	0.77	0.75	0.63
Average	0.13	0.45	0.36	0.11	0.98	0.55	0.63	0.79	0.63	0.63
Ave. Annual Growth Rate (%)	28.6	1.5	-5.8	0.3	-2.4	0.6	26.3	-3.3	6.1	3.8

Source of basic data: BAS

Appendix Table 5. Average world cotton lint production, area, and yield, 1990-1997.

COUNTRY	AVE. COTTON PRODN ('000 MT)	AVE. COTTON HECTARAGE	AVE. COTTON YIELD (KG/HA)
Philippines	5	13774	363
Senegal	11	29650	371
Mozambique	13	69519	187
Zambia	18	75314	239
Afghanistan	22	33435	658
South Africa	36	104348	345
Kazakhstan	69	176471	391
Togo	46	88292	521
Azerbaijan	82	144876	566
Peru	59	104425	565
Spain	62	57890	1071
Colombia	80	137931	580
Chad	59	211470	279
Burkina Faso	70	177665	394
Cameroon	67	137014	489
Tanzania	67	323671	207
Nigeria	64	250980	255
Zimbabwe	80	281690	284
Sudan	79	184149	429
Tajikistan	132	208861	632
Cote D'Ivoire	106	216327	490
Benin	113	239407	472
Paraguay	152	353488	430
Mexico	138	190083	726
Mali	134	266932	502
USSR	1472	925786	1590
Turkmenistan	295	576172	512
Argentina	296	666667	444
Egypt	314	357224	879
Greece	296	354916	834
Australia	406	550882	737
Brazil	516	1312977	393
Syria	200	251889	794
Uzbekistan	1246	2307407	540
Pakistan	1615	2737288	590
India	2392	3778831	633
USA	3812	5243466	727
China Mainland	4260	5518135	772

Source of basic data: CODA

Appendix Table 6. Cotton hectarage by region and by province, Philippines, 1993-1997.

REGION/PROVINCE	AREA PLANTED TO COTTON (HA.)							AVE. ANNUAL GROWTH RATE (%)
	1991	1992	1993	1994	1995	1996	1997	
Region I	3523.43	3983.18	1,694.50	891.75	1,803.98	1,554.65	474.55	-12.1
Ilocos Norte	498.43	711.68	179.00	66.00	245.10	253.50	69.80	17.9
Ilocos Sur	1342.44	1467.90	964.00	517.75	964.13	814.00	223.50	-12.2
La Union	503.50	460.35	133.50	52.00	232.75	251.50	49.50	22.5
Pangasinan	1179.06	1343.25	418.00	256.00	362.00	235.65	131.75	-21.9
Region III	270.70	603.85	154.00	122.00	177.25	140.00		-8.0
Tarlac	270.70	603.85	154.00	122.00	177.25	140.00		-8.0
Region VI	973.35	1447.25	783.00	253.50	218.25	104.25	126.75	-18.2
Iloilo	973.35	1447.25	783.00	253.50	218.25	104.25	126.75	-18.2
Region VII	1158.00	1758.10	707.60	619.05	823.50	1,133.25	412.00	-2.2
Negros Oriental	1158.00	1758.10	707.60	619.05	823.50	1,133.25	412.00	-2.2
Region IX	100.00	1157.25	576.00	266.00	830.00	553.00	250.00	179.5
Zamboanga del Sur	100.00	1157.25	576.00	266.00	830.00	553.00	250.00	179.5
Region XI	6537.00	16852.50	13,531.00	4,460.25	4,022.75	5,404.75	392.00	0.5
Davao del Sur	295.00	1050.50	1,015.00	43.00	83.50	201.00	29.25	51.1
Sarangani		10798.00	9,887.50	3,744.00	3,365.00	4,021.50	245.00	-36.7
South Cotobato	6242.00	5004.00	2,628.50	673.25	574.25	1,182.25	117.75	-23.4
Region XII	1793.00	5544.50	2,934.75	1,228.50	1,017.50	1,731.00	792.00	17.1
North Cotobato	694.00	2057.00	648.00	460.50	257.00	462.00	323.00	17.4
Sultan Kudarat	601.00	1165.50	1,221.75	122.00	55.50	159.00	29.00	9.8
Maguindanao	498.00	2322.00	1,065.00	646.00	705.00	1,110.00	440.00	46.5

Source of data: CODA

Appendix Table 7. Annual baling of salago fiber by district of production, Philippines, 1990-1996.

REGION	ANNUAL BALING (MT)							% Share 1990	%Share 1996
	1990	1991	1992	1993	1994	1995	1996		
Southern Tagalog	5.0	4.3					0.6	0.6	0.1
Bicol	54.3					12.8	50.2	6.4	5.3
Central Visayas	734.3	704.6	888.9	812.0	915.0	806.2	892.0	86.1	94.6
Eastern Visayas	20.0		12.0					2.3	
Western Visayas	28.8	29.6	0.3					3.4	
Northern Mindanao	10.6							1.2	
Philippines	853.0	738.5	901.2	812.0	915.0	819.0	942.8	100.0	100.0

Source of basic data: FIDA

Appendix Table 8. Ramie production by region, Philippines, 1990-1997.

YEAR	RAMIE PRODUCTION (MT)								Philippines
	Western Visayas	Central Visayas	Western Mindanao	Northern Mindanao	Southern Mindanao	Central Mindanao	CARAGA	ARMM	
1990	30	21		12	2,586	40		87	2,776
1991	27	23	-		1,858	41	-	63	2,012
1992	11	-	-	-	735	17	-	-	763
1993	-	-	-	-	148	5		-	153
1994	-	-	-	-	149	3	-	-	152
1995	5	-	-	-	81	-	-	-	86
1996	-	-	-	-	12	-	-	-	12
1997	-	-	-	-	10	-	-	-	10
Average	9	6	-	2	697	13	-	19	746
% Share:									
1990	1.1	0.8	-	0.4	93.2	1.4	-	3.1	100.0
1997	-	-	-	-	100.0	-	-	-	100.0
1990-1997	1.2	0.7	-	0.2	93.5	1.8	-	2.5	100.0
Ave. Annual Growth Rate (%)					-45.0				-46.2

Source of basic data: BAS

Appendix Table 9. Area planted to ramie by region, Philippines, 1990-1997.

YEAR	AREA PLANTED TO RAMIE (HA)								Philippines
	Western Visayas	Central Visayas	Western Mindanao	Northern Mindanao	Southern Mindanao	Central Mindanao	CARAGA	ARMM	
1990	48	143	82	80	1,604	68	21	136	2,182
1991	44	145	-	3	648	87	-	120	1,047
1992	20	-	-	-	502	22	-	-	544
1993	-	-	-	-	408	16	3	-	427
1994	-	-	-	-	80	4	-	-	84
1995	10	-	-	-	45	-	-	-	55
1996	-	-	-	-	20	-	-	-	20
1997	-	-	-	-	15	-	-	-	15
Average	15	36	10	10	415	25	3	32	547
% Share:									
1990	2.2	6.6	3.8	3.7	73.5	3.1	1.0	6.2	100.0
1997	-	-	-	-	100.0	-	-	-	100.0
1990-1997	2.8	6.6	1.9	1.9	75.9	4.5	0.5	5.9	100.0
Ave. Annual Growth Rate (%)					-43.7				-46.4

Source of basic data: BAS

Appendix Table 10. Annual baling of maguey fiber by district of production, Philippines, 1990-1996.

PROVINCE	ANNUAL BALING							% share	% share
	1990	1991	1992	1993	1994	1995	1996	1990	1996
Bohol	107.8	25.1	74.4	68.0	23.0	19.0	16.1	34.0	74.2
Cebu	172.6	94.5	56.8	45.5	21.0	29.8	5.6	54.5	25.8
Pangasinan	36.5	35.5	2.0	30.5	8.4			11.5	
Leyte					0.3				
Philippines	316.9	155.1	133.2	144.0	52.7	48.8	21.7	100.0	100.0

Source of basic data: FIDA

Appendix Table 11. Area planted to mulberry by region, Philippines, 1991-1997.

REGION	AREA PLANTED (HA)								ANNUAL		
	1991	1992	1993	1994	1995	1996	1997	Average	PERCENT SHARE (1991_)	PERCENT SHARE (1997_)	GROWTH RATE (%)
CAR	129.5	79.4	135.3	134.8	145.3	18.1	17.6	94.3	34.9	6.3	-8.5
Ilocos	8.9	73.3	57.9	57.9	57.5	6.0	5.3	38.1	2.4	1.9	100.1
Central Luzon		14.4	64.2	49.0	25.2	2.8	6.1	27.0	0.0	2.2	60.5
Southern Tagalog	11.5	19.4	49.3	39.4	35.7	27.5	26.6	29.9	3.1	9.6	27.9
Western Visayas	36.1	61.8	104.6	119.4	121.6	96.7	100.4	91.5	9.7	36.1	23.3
Western Mindanao		1.5	6.5	44.9	46.3	28.0	20.5	24.6	0.0	7.4	172.2
Northern Mindanao	184.3	135.5	122.0	122.0	122.0	71.3	10.0	109.6	49.7	3.6	-27.3
Southern Mindanao	0.5	10.1	15.4	29.3	29.6	57.5	91.6	33.4	0.1	32.9	369.6
Central Mindanao		1.3	1.3	1.3	0.6			1.1	0.0	0.0	-30.8
Philippines	370.8	396.7	556.5	598.0	583.8	307.9	278.1	449.5	100.0	100.0	

Source of basic data: FIDA

Appendix Table 12. Philippine production of cocoon, raw silk, and fabrics, 1990-1997.

YEAR	PRODUCTION		
	Cocoon (Kgs.)	Raw Silk (Kgs.)	Silk Fabrics (Sq. m.)
1990	8,703.1	310.5	3,920.0
1991	8,893.7	608.5	3,988.0
1992	5,240.1	23,237.0	n.a.
1993	1,910.3	n.a.	n.a.
1994	2,198.4	n.a.	n.a.
1995	2,974.5	n.a.	n.a.
1996	2,434.7	n.a.	n.a.
1997	1,917.2	n.a.	n.a.
Average	2,287.0		
Ave. Annual Growth Rate (%)	-13.1		

na means not available

Source of basic data: NSO

Appendix Table 13. Production of dried cocoons by region, Philippines, 1990-1997.

REGION	DRIED COCOON PRODUCTION (MT)								PERCENT SHARE	
	1990	1991	1992	1993	1994	1995	1996	1997	(1991_)	(1997_)
CAR	1,114.5	300.0	375.8	146.6	279.9	778.6	364.2	302.8	12.8	15.8
Ilocos	850.0	1,180.0	909.1	283.8	676.6	766.9	341.8	364.7	9.8	19.0
Cagayan Valley		30.0								
Central Luzon	130.0	120.0	178.8	238.9	20.2	-	1.0	-	1.5	
Southern Tagalog			5.7	101.5	398.1	121.1	16.8	20.2		1.1
Western Visayas			217.3	472.3	48.7	322.8	1,141.6	565.2		29.5
Western Mindanao			23.0	20.0	153.3	197.1	181.2	212.4		11.1
Northern Mindanao	6,608.6	7,263.7	3,518.0	647.2	560.5	688.4	341.5	402.0	75.9	21.0
Southern Mindanao			11.2		61.4	99.6	151.6	49.9		2.6
Central Mindanao			1.2							
Philippines	8,703.1	8,893.7	5,240.1	1,910.3	2,198.7	2,974.5	2,539.7	1,917.2	100.0	100.0

Source: NSO

Appendix Table 14. Production of piña fiber and fabrics, Philippines, 1990-1997.

YEAR	LOOSE FIBER (Kgs)	KNOTTED FIBER (Kgs)	FABRICS (Meters)
1990	59.96	54.33	10,295
1991	96.11	88.28	12,331
1992	149.37	134.56	12,440
1993	347.04	367.28	20,404
1994	347.99	294.58	27,657
1995	405.42	357.54	23,749
1996	867.2	761.95	38,153
1997	920.01	761.32	38,247
Average	399.14	352.48	22,910
Ave. Annual Growth Rate (%)	54.97	57.50	23.86

Source of basic data: FIDA

Appendix Table 15. World export of abaca fiber, 1990-97.

YEAR	WORLD EXPORTS (MT)	PHILIPPINES		ECUADOR	
		Quantity (MT)	% Share	Quantity (MT)	% Share
1990	33,731	22,979	68.1	10,752	31.9
1991	30,688	19,662	64.1	11,026	36.0
1992	26,635	17,617	66.1	9,018	33.9
1993	26,306	15,403	58.6	10,903	41.4
1994	31,649	18,140	57.3	13,509	42.7
1995	31,721	19,338	61.0	12,383	39.0
1996	31,594	17,947	56.8	13,647	43.2
1997	31,728	17,791	56.1	13,937	43.9
Average	30,507	18,610	61.0	11,897	39.0

Source: NSO

Appendix Table 16. Quantity of exports of Philippine abaca fiber crafts, 1990-1997.

YEAR	QUANTITY (NUMBER)									
	Rugs	Doormats	Placemats	Coasters	Hot Pads	Table Linen	Hats	Handbags (Plaited)	Handbags (Fabrics)	Total
1990	3,396	2,064	3,509,304	618,547	288,048	215	2,218,821	1,129,587	3,299,010	11,068,992
1991	7,193	131	1,895,498	50,019	55,252	-	2,068,621	2,316,115	899,256	7,292,085
1992	16,465	30,983	2,152,147	169,249	67,854	-	1,302,903	3,168,733	1,662,905	8,571,239
1993	7,882	6,508	2,229,222	339,897	55,010	-	1,279,285	4,170,308	2,209,505	10,297,617
1994	16,252	18,229	943,109	102,273	1,610	-	1,101,113	4,134,601	1,734,055	8,051,242
1995	13,756	18,339	1,360,875	93,207	15,152	-	545,802	3,188,056	5,880,191	11,115,378
1996	12,741	27,831	669,859	39,850	5,867	-	621,467	1,746,202	11,666,073	14,789,890
1997	9,870	27,172	547,279	12,380	30,133	-	533,763	1,747,316	3,444,296	6,352,209
Average	10,944	16,407	1,663,412	178,178	64,866	27	1,208,972	2,700,115	3,849,411	9,692,332
% Share, 1997	0.16	0.43	8.62	0.19		0.47	8.40	27.51	54.22	100.00
Ave. Annual Growth Rate (%)	35.64	3,372.66	-15.91	a	a		-15.74	14.94	41.51	-0.60

Source of basic data: NSO

Appendix Table 17. Export earnings from Philippine abaca fiber crafts, 1990-1997.

YEAR	VALUE (FOB US \$)									
	Rugs	Doormats	Placemats	Coasters	Hot Pads	Table Linen	Hats	Handbags (Plaited)	Handbags (Fabrics)	Total
1990	36,457	10,795	1,361,722	95,635	111,451	344	703,378	3,597,082	6,019,817	11,936,681
1991	116,650	1,144	1,015,030	11,540	21,669		696,235	7,374,241	1,432,547	10,669,056
1992	219,109	171,643	1,264,981	34,184	62,716		621,504	10,230,294	2,472,365	15,076,796
1993	153,968	92,519	1,699,425	81,509	46,840		566,787	13,684,158	4,110,976	20,436,182
1994	209,605	164,658	754,026	47,720	633		940,923	14,689,761	5,490,950	22,298,276
1995	178,333	193,531	1,303,064	38,138	11,802		846,490	10,326,577	15,444,299	28,342,234
1996	227,278	309,817	650,343	18,275	12,178		712,165	5,514,135	8,658,098	16,102,289
1997	171,616	215,670	500,469	4,227	29,788		344,520	5,968,293	9,824,793	17,059,376
Average	164,127	144,972	1,068,633	41,404	37,135	344	679,000	8,923,068	6,681,731	17,740,111
Ave. Annual Growth Rate (%)	43.18	2127.64	-3.21	a	a		-4.58	16.68	35.29	9.32

Source of basic data: NSO

Appendix Table 18. Quantity of Philippine exports of silkworm cocoons and silk products, 1990-1997.

KIND OF PRODUCT/ DESTINATION	QUANTITY								PERCENT SHARE	PERCENT SHARE
	1990	1991	1992	1993	1994	1995	1996	1997	1990	1997
Silkworm Cocoons (kgs)	4880	4232	161				1300			
Japan	4880	3232					1300		100	
South Korea			161							
Hongkong		1000								
Raw Silk (kgs)			2340	2166				452		
Japan				1681						
South Korea			1500	485						
Sri Lanka			840							
Greece								452		100.00
Silk Wastes (kgs)			379	250		437		262		
Japan						437				
South Korea			379	250				262		100.00
Silk Fabrics (sq. meters)	36053	1203	6247	168018	323744	275715	192757	134409		
Japan	36053	1203	5777	166907	320235	197310	125838	84745	100.00	63.05
Singapore						77578	40497	38821		28.88
Hongkong								8097		6.02
Micronesia								956		0.71
United Kingdom								625		0.46
Belgium								360		0.27
France								325		0.24
South Korea							233	254		0.19
Spain								145		0.11
United Arab Emirates								52		0.04
Indonesia								29		0.02
United States			470	1107	483	827	2164			
Taiwan					2259					
Italy					425					
Trust Territory of Pacific Islands				4	342			14489		
China										
Lebanon							9536			

Source: NSO

Appendix Table 19. Quantity of exports of Philippine fibers from fiber crops, 1990-1997.

YEAR	QUANTITY OF EXPORTS (MT) ^a					
	Abaca	Ramie	Buntal/Raffia	Salago	Other Fibers ^b	Total
1990	22,979	2,005	17	827	10	25,838
1991	19,662	1,548	3	705	111	22,029
1992	17,617	589	10	828	57	19,101
1993	15,403	254	47	746	156	16,606
1994	18,140	159	67	789	98	19,253
1995	19,338	74	52	683	74	20,221
1996	17,947	16	33	723	54	18,773
1997	17,791	1	32	714	68	18,606
Average	18,610	581	33	752	79	20,053
% Share, 1990	88.93	7.76		0.07	3.20	100.00
% Share, 1997	95.62	0.01		0.17	3.84	100.00
% Share, 1990-1997	92.80	2.90		0.16	3.75	100.00
Ave. Annual Growth Rate (%)	-3.01	-57.8		71.65	-1.47	153.18

^aExcludes coco coir

^bIncludes piña, silkworm cocoons, banana, musa factory wastes, canton, kozo, and maguey. Maguey fibers were only exported in 1991 while piña fibers were exported in 1990, 1991 and 1993.

Source of basic data: NSO

Appendix Table 20. Quantity of Philippine exports of salago fiber by country of destination, 1990 and 1997.

COUNTRY OF DESTINATION	1990		1997	
	Quantity (mt)	Percent Share	Quantity (mt)	Percent Share
Japan	322.9	39.1	111.3	14.8
Taiwan	431.6	52.2	363.2	48.3
China (Mainland)			74.5	9.9
Thailand	72.0	8.7	203.0	27.0
Total	826.5	100.0	752.0	100.0

Source: Foreign Trade Division, NSO

Appendix Table 21. Philippine volume and value of imported ramie products by country of origin, 1990-1997.

TYPE OF PRODUCT/ ORIGIN	1990				1997				PERCENT CHANGE IN VOLUME
	Volume (mt)	% Share	Value (FOB US\$)	% Share	Volume (mt)	% Share	Value (FOB US\$)	% Share	
Yarn	23.52		94,718		48.7		403,830		107.1
Korea	6.94	29.5	37,149	39.2	31.0	63.7	313,357	77.6	346.7
China					10.00	20.5	35,000	8.7	
Hong Kong	16.49	70.1	55,752	58.9	4.30	8.8	18,090	4.5	-73.9
Kuwait					2.20	4.5	28,584	7.1	
Taiwan					1.2	2.5	8,799	2.2	
Japan	0.09	0.4	1,817						-100.0
Fabrics	3750573^a		5,192,146		390956^a		545,114		-89.6
Taiwan	175,554	4.7	90,503	1.7	263,503	67.4	447,282	82.1	50.1
Vietnam					109,290	28.0	57,226	10.5	
Hong Kong	3,405,441	90.8	4,802,009	92.5	11,612	3.0	23,590	4.3	-99.7
Korea	12,114	0.3	19,966	0.4	6,551	1.7	17,016	3.1	-45.9
Japan	29,749	0.8	114,707	2.2					-100.0
China	127,715	3.4	164,961	3.2					-100.0
Ramie Noils	18		43,575						
Taiwan	18	100.0	43,575	100.0					-100.0

^a In square meters

Source of basic data: NSO

Appendix Table 22. Philippine volume and value of imported raw silk and silk products by country of origin, 1990-1997.

TYPE OF PRODUCT/ ORIGIN	1990				1997				PERCENT CHANGE IN VOLUME
	Volume (mt)	% Share	Value (FOB US\$)	% Share	Volume (mt)	% Share	Value (FOB US\$)	% Share	
Raw Silk	4.7		49,262		16.5		437,330		251.00
China	4.7	100.0	49,262	100.0	12.6	76.4	326,781	74.7	168.00
Singapore					1.7	10.3	56,757	13.0	
Vietnam					1.6	9.7	37,345	8.5	
Hong Kong					0.6	3.6	16,447	3.8	
Silk Wastes					10.1		42,495		
China					10.0	99.0	42,000	98.8	
Taiwan					0.1	1.0	495	1.2	
Silk Yarn	0.7		4,184		2.2		7,086		214.30
Korea					1.9	86.4	2,088	29.5	
Germany					0.2	9.1	3,042	42.9	
Japan					0.1	4.5	1,956	27.6	
France	0.7	100.0	4,184	100.0					-100.0
Silk Fabric	194^a		1,218,186		302806^a		776,964		155,985.6
Korea	44.9	23.14	426,236	35.0	190,760	63.0	372,865	48.0	424,755.2
Singapore					39,258	13.0	119,746	15.4	
China	14	7.22	99,232	8.1					-100.0
Italy	9	4.64	89,060	7.3	21,793	7.2	132,278	17.0	242,044.4
Hong Kong	88.5	45.62	396,717	32.6	19,446	6.4	21,078	2.7	21,872.9
India	7.9	4.07	63,477	5.2	13,473	4.4	32,498	4.2	170,444.3
France					4,068	1.3	2,930	0.4	
Thailand	4.6	2.37	29,234	2.4	2,950	1.0	3,634	0.5	64,030.43
Japan	22.6	11.65	85,695	7.0	2,808	0.9	12,919	1.7	12,324.78
Germany					2,467	0.8	29,040	3.7	
Spain					2,453	0.8	11,280	1.5	
United States	2.5	1.29	27,835	2.3	1,826	0.6	15,056	1.9	72,940.00
Others ^b					1,504	0.5	23,640	3.0	

^aIn square meters^bIncludes Hawaii, Malaysi, Taiwan, and United Kingdom.

Source of basic data: NSO

Appendix Table 23. Philippine volume and value of imported sisal fiber and sisal products by country of origin, 1990 and 1997.

TYPE OF PRODUCT/ ORIGIN	1990		1997	
	Volume (mt)	% Share	Value (FOB US\$)	% Share
Raw Fiber			1162.1	746,340
Kenya	737.80	63.5	490,031	65.7
China	303.30	26.1	173,439	23.2
Tanzania	105.00	9.0	71,400	9.6
Netherlands	16.00	1.4	11,470	1.5
Yarn	48		31,680	
China	48.0	100.0	31,680	100.0
Twine, Cordage	2.88		16,900	
Switzerland	2.01	69.8	9,663	57.2
United Kingdom	0.38	13.2	380	2.2
Taiwan	0.20	6.9	3,840	22.7
Japan	0.12	4.2	533	3.2
Hong Kong	0.11	3.8	853	5.0
United States	0.05	1.7	1,378	8.2
Netherlands	0.01	0.3	253	1.5
Binder, Baler	15.20		20,434	
Hongkong	14.70	96.7	19,942	97.6
Taiwan	0.50	3.3	208	1.0
Japan	0.02	0.1	284	1.4

Source of basic data: NSO

Appendix Table 24. Responsibilities of selected government agencies and SCUs in Fiber crops R&D as part of the National Commodity Research and Development (NMCRDCs).

A. National Responsibility		
1. Central State University Muñoz, Nueva Ecija	Industrial Crops (Fiber Crop- sericulture)	
2. Visayas State College of Agriculture Baybay, Leyte	Industrial Crops (Fiber Crop- abaca)	
3. University of Southern Mindanao Kabacan, North Cotobato	Industrial Crops (Fiber Crops- Basic fiber plantation crops)	
B. Regional Responsibility		
1. University of the Philippines Los Baños College, Laguna	Industrial Crops (Fiber Crops)	
2. Mariano Marcos State University Kabacan, North Cotobato	Industrial Crops (Fiber Crop- sericulture)	
C. Responsibility As Cooperating Agency		
1. Panay State Polytechnic College Mambusao, Capiz	Industrial Crops (Fiber Crop- piña)	
D. Responsibilities As Cooperating Station		
Attached Agencies		
1. Fiber Industry Development Authority Research Center Tacloban City	Fiber Crops	
Fiber Industry Development Authority Research Center Marambulan, Davao City		

Source: David, et.al., 1998

Appendix Table 25. Prioritization of commodities based on selected statistical parameters
(developed by the Science and Technology Coordinating Council,
STCC, 1989).

Commodity	Weighted Score 1 ^a	Rank	Weighted Score 2 ^a	Rank	Weighted Score 3 ^a	Rank	Resulting Priority Levels and Rankings
A. Crops							Level 1 (A-E)
1. Sugarcane	4.3	1	4.25	1	4.6	1	1. Sugarcane
2. Corn	5.0	2	7.50	5	6.4	3	2. Cassava
3. Pineapple	5.0	2	4.50	2			3. Corn
4. Cassava	5.3	3	6.75	4	6.2	2	4. Coconut
5. Tobacco	6.3	4	6.25	3	7.0	5	5. Tobacco
6. Mango	6.6	5	6.75	4	7.8	6	6. Mango
7. Rice	8.3	6					7. Banana
8. Fiber Crops	9.0	7	12.00	9	11.4	8	8. Coffee
9. Coconut	10.0	8	7.75	6	6.8	4	9. Fiber Crops
10. Banana	10.0	8	8.00	7	8.0	7	10. Calamansi
11. Peanut	11.0	9	12.75	11			
12. Rubber	11.0	9	10.25	8			Level 2 (A-D)
13. Onion	11.6	10	12.25	10			1. Pineapple
14. Sweet Potato	14.0	11					2. Rubber
15. Garlic	14.0	11					3. Rice
16. Mungbean	14.0	11					4. Onion
17. Coffee	15.3	12	12.75	11	12.2	8	5. Peanut
18. Calamansi	15.6	13	15.75	12	14.8	9	
19. Tomato	16.6	14					Level 3 (A-C)
20. Cabbage	18.0	15					1. Sweet Potato
21. Eggplant	19.6	16					2. Garlic
B. Livestock & Poultry							3. Mungbean
1. Chicken, eggs	2.00	1					4. Tomato
2. Carabao	3.66	2					5. Cabbage
3. Chicken	4.00	3					6. Eggplant
4. Dairy	4.00	3					
5. Goat	5.30	4					
6. Duck Eggs	6.00	5					
7. Hogs	6.00	5					
8. Duck	6.66	6					
9. Cattle	7.33	7					

^aWeighted score 1 is the average of the commodity's relative ranking for the following statistical parameters: change in production, value of production, and change in gross value added.

^bWeighted score 2 is the average of the commodity's relative ranking for the following statistical parameters: change in production, value of production, change in gross value added, and value of exports.

^cWeighted score 3 is the average of the commodity's relative ranking for the following statistical parameters: change in production, value of production, change in gross value added, value of exports, and number of beneficiaries.

Source: DOST

Appendix Table 26. PCCARD listing of priority commodities including their rank and percent in the total research budget.

RANK/COMMODITY	SHARE OF FUNDING
<p>Priority I</p> <ol style="list-style-type: none"> 1. Coconut and oil palm 2. Corn and sorghum 3. Fiber crops (includes cotton) 4. Legumes (includes soybean) 5. Plantation crops (includes coffee and cacao) 6. Rootcrops (includes sweet potato) 7. Sugarcane 8. Vegetable crops (includes sweet tomato and garlic) 9. Aquaculture (includes tilapia, milkfish and prawn) 10. Marine fisheries (includes roundskad and tuna) 11. Forage, pasture, and grasslands 12. Carabeef 13. Dipterocarp and lesser-used species 14. Pines and other softwood species 15. Mangrove and beach type forest 16. Agroforestry and forest plantation 17. Bamboo, rattan, forest vines, and other medicinal plants 18. Mineral resources: discovery to utilization 19. Agricultural engineering 	80%
<p>Priority II</p> <ol style="list-style-type: none"> 1. Fruit crops (includes banana and pineapple) 2. Rice, wheat, and other cereal grains 3. Tobacco 4. Beef/chevon 5. Inland waters 6. Molave type forest 7. Farming systems 8. Soil resources 9. Water resources 10. Mineral resources: management and economics 	10%
<p>Priority III</p> <ol style="list-style-type: none"> 1. Ornamental and medicinal plants 2. Dairy 3. Pork 4. Poultry 5. Parks, wildlife, and forest range 	3%

Source: PCCARD

Appendix Table 27. Regional Priority Commodities under NAREA of BAR.

National Priority Commodities	Regional Priorities												
	1	2	3	4	5	6	7	8	9	10	11	12	CAR
I. Basic Commodities													
A. Crop Sector													
1. Cereals													
1.1 Rice	x	x	x	x	x	x	x	x	x	x	x	x	x
1.2 Corn	x	x	x	x	x	x	x	x	x	x	x	x	x
2. Fruit Crops													
2.1 Citrus	x	x	x	x	x	x		x		x	x	x	x
2.2 Watermelon	x	x	x	x								x	
3. Vegetables													
3.1 Tomato	x	x	x	x	x	x	x	x		x	x		x
4. Rootcrops													
4.1 Sweet Potato	x	x	x	x	x		x	x		x			x
4.2 Cassava	x	x	x	x	x		x	x		x			
5. Legumes													
5.1 Mungbean	x	x	x	x		x	x	x	x			x	x
5.2 Peanut	x	x	x	x		x	x	x	x				x
5.3 Soybean	x		x				x						x
5.4 Cowpea				x			x						x
6. Fiber Crops													
6.1 Cotton	x										x		
7. Multi-purpose Trees			x	x	x	x			x		x	x	
8. Garlic	x		x										
A. Animal Sector													
1. Livestock													
1.1 Cattle	x	x	x	x	x	x	x	x	x	x	x	x	x
1.2 Swine	x	x	x	x	x	x	x	x	x	x	x		x
1.3 Carabao	x	x	x	x	x	x	x	x	x	x	x		x
1.4 Goat	x	x	x	x	x	x	x	x	x	x	x	x	x
1.5 Sheep	x	x	x		x		x	x	x	x		x	x
2. Poultry													
2.1 Chicken	x	x	x	x	x	x	x	x	x	x	x	x	x
2.2 Duck		x			x	x	x				x		
II. Export Commodities													
A. Crop Sector													
1. Fruit Crops													
1.1 Mango	x	x	x	x	x	x	x		x	x	x	x	
1.2 Banana		x		x	x		x		x	x	x	x	x
1.3 Pineapple		x		x	x	x							
1.4 Papaya					x			x					
1.5 Durian										x	x	x	
1.6 Cashew	x		x		x	x				x	x	x	
1.7 Pili					x	x				x			
2. Plantation Crops													
2.1 Sugarcane			x		x	x				x			
2.2 Coconut		x		x	x			x		x	x		
2.3 Rubber									x		x	x	
2.4 Castorbean			x										
2.5 Coffee	x	x		x	x				x	x	x		x
2.6 Cacao	x	x			x					x	x		
2.7 Tobacco	x	x											
3. Rootcrops													
3.1 Yam	x	x	x										x
4. Ornamentals				x	x			x		x	x		x
5. Fiber Crops													
5.1 Abaca					x			x	x		x		
6. Bamboo				x	x	x			x		x		

Appendix Table 28. List of completed cotton researches conducted by the CRDI/CODA, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement/ Development	1. Branching Habit & Productivity of Selection from Breeder Seed Production of Cotton UPL	1988-1989
	2. Analysis of Genetic Variations from Populations of Sea Island and UPL-C2	1989-1990
	3. Running Check Comparison	1989-1990
	4. Recurrent Selection for Hairiness and Prolificacy in Cotton CV, UPL-C2	1989-1991
	5. Genetic Analysis of Earliness in Cotton	1989-1992
	6. Genetic Analysis of Some Agronomic Characters of Cotton (<i>Gossypium Hirsutum</i> L.)	1989-1992
	7. Phenotypic Recurrent Selection	1983-1993
	8. Irradiated Cotton: A Preliminary Study	1993-1995
	9. Comparative Quality Analysis of Fibers Ginned From Roller Gin	1987-1988
	10. Relationship of Rainfall and Lint Quality in Type I and III Climate	1988-1989
	11. Relationship of Type of Climate and Precipitation on Fiber Quality of Cotton	1993-1995
	12. Advance Variety Trial for Earliness in Cotton (SS)	1983-1990
	13. Evaluation of Cotton Hybrids	1997-1998
	14. Optimum Number of Replications, Locations, and Seasons for Regional Cotton Variety Trials	1987-1988
	15. Biotechnology- Assisted Projects on Cootn Breeding and Pest Management: Mapping and Tagging Fiber Quality in Cotton	1997
	16. Variability 'N UPL-C2 & Deltapine 16: Morphological & Agronomic Characteristics of the Variants	1985-1986
	17. Response of UPL-C2 to Missing Hills	1986-1987
	18. Percentage Germination and Vigor of Delinted and Undelinted Cotton Seeds	1988-1989
	19. Morphophysiological Growth of Cotton (Var. CRDN 174) as Affected by Nitrogen Level and Hill Spacing	1995-1996
II. Crop Production and Cultural Management (Including Pest & Disease Control)	1. Green Manure Studies	1985-1989
	2. Pesticide Evaluation Against Phytotoxicity	1988-1989
	3. Relationship of Photosynthetic Pigments to Seedcotton Yield and Agronomic Characters	1986-1989
	5. Fruiting Behavior of Cotton	1983-1990
	6. Osmotic Concentration Response of Cotton Root Cells at Different Salt Levels	1988-1990
	7. Studies on Plant Soil Moisture Relations: Plant Characters as Bases for Irrigation	1988-1990
	8. Leaf Type As Index to Yield Improvement Phase A: Production of Isolines	1989-1990
	9. Plant Characters Associated with Yield Performance in Cotton	1989-1990
	10. Agro-climatic Indices in Selected Cotton Growing Areas	1989-1992

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
II. Crop Production and Cultural Management * Physiology Studies * Demonstration and Verification Trials of Matured Cotton Production Technologies * Pest Management * Weed Control * Disease Control * Cultural Management * Cotton Based Cropping System * Determination of Optimum Fertilizer * Soil Fertility Mapping * Water Management Practices	11. Optimum Leaf Area Index in Cotton	1992-1994
	12. Salt Tolerance in Cotton	1986-1994
	13. Establishment of Field Monitoring Growth Models in Cotton	1992-1995
	14. Corn + Cotton Cropping Pattern	1986-1988
	15. Technology Verification/Demonstration Trial: Stand Density x Fertilizer Level	
	16. Garlic/Cotton Relay Cropping	1986-1989
	17. Technology Verification/Demonstration trial: The Cotton Contract Growing Laboratory	1986-1990
	18. Cotton Technology Verification Trial On Fertilizer Level	1989-1990
	19. Performance Evaluation of the Recommended Cotton production Technology Under Saline Soil	1986-1990
	20. Technology Verification/Demonstration Trial: Conventional and Minimum Tillage Method of Establishing Cotton	1986-1990
	21. Cotton Transplanting Technology	1989-1990
	22. Demonstration of Weed Control Approaches in Cotton	1989-1990
	23. Garlic + Cotton Intercropping	1989-1992
	24. Verification Trial of Garlic + Cotton/+ Mungbean Cropping System After Lowland Rice	1991-1992
	25. Monitoring of Farmers' Cotton Production Technologies and Area Characterization	1989-1992
	26. Verification Trial of Cotton + Mungbean Cropping System	1991-1992
	27. Cotton Production Technology Verification Trial on Sidedress N	1991-1992
	28. Cotton Technology Verification Trial: CRDI-1 and MC Nair 220	1991-1992
	29. Verification Trial of the Integrated Cotton Pest Management on Cotton Pest Management on Cotton (Use of <i>T. Chilonis</i>)	1991-1992
	30. Demo/Verification of the Recommended Cotton Production Technology: Sidedress Nitrogen Level	1990-1994
	31. Demo/Verification of the Recommended Cotton Production Technology: Irrigating Cotton Under Limited Water Supply	1990-1994
	32. Field Evaluation of the Effectivity of Pheromones for the Control of Pink Bollworm	1987-1990
	33. Determination of Adequate Sampling Size of Cotton Insect Pests	1990-1992
	34. <i>Bacillus Thuringensis Berlinger</i> Against Cotton Bollworm	1987-1994
	35. Fungicidal Efficacy of <i>T. Viride</i> on <i>S. Rolfsii</i> (Sacc.) & <i>R. Solani</i>	1990-1994
	36. Cropping System for Trapping Cotton Pests	1987-1996
	37. Evaluation of <i>Trichoderma sp.</i> as Biological Control Against <i>Fusarium Oxysporum f. sp.</i>	1993-1996

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	<i>Vasinfecutum</i>	
	38. Evaluation of Biological Control Agents on Flowerweevil	1995-1996
	39. Study on the Economic Threshold Levels/Critical Pest Level of Major Cotton Insect Pests	1978-1998
	40. Trichogramma Against Bollworm	1984-1998
	41. Beekeeping Technology: A Component of Cotton Integrated Farming System	1994
	42. Ecotoxicity of Soils from Cotton Growing Areas Applied with Chemical Inputs	1994
	43. Bionomics of Cotton Flowerweevil <i>A. Lata</i>	1989-1990
	44. Effect of Dusting Intervals of Sevin-Sand Combination on Flowerweevil	1989-1990
	45. Smoking Formulation Against Flowerweevil	1996-1998
	46. IPM Technology for Cotton Insect Pests	1994
	47. IPM Package of Technology: Trap Crop, <i>Bacillus Thuringiensis</i> , <i>Trichogramma Chilonis</i> and <i>Jatropha</i> Product	1994
	48. Biology and Behavior of Bollworm	1981-1993
	49. Seasonal Occurrence of Insect Pests	1985-1998
	50. Survey and Evaluation of Insect Population in the Ginnery	1988-1989
	51. Entomogenous Microorganisms on Insect Pests of Cotton	1992-1995
	52. Yield Loss Assessment Due to Insect Pest	1995-1996
	53. Mixed Cropping Potential on Insect Pest Management	1997-1998
	54. Sensitivity Test of Key Natural Enemies of Cotton Insect Pests to Chemical Insecticides	1992-1995
	55. Evaluation of Different Nozzle Types & Spraying Techniques in Cotton	1990-1992
	56. Field Evaluation of the CRDI Low Volume Nozzle	1990-1992
	57. Egg & Larval Parasitoids & Predators of Cotton Insect Pests	1990-1993
	58. Field Biology of Pink Bollworm: Developmental Stages	1983-1990
	59. Chemical Control Application for Pink Bollworm	1986-1988
	60. Weed Population as Affected by Cropping Pattern and Weeding Regime	1985-1988
	61. Critical Period of Cotton-Weed Competition	1985-1992
	62. Biology & Response of <i>E. Colona</i> to Fluazifop-Butyl	1989-1991
	63. Weed Control Approaches in Cotton	1980-1995
	64. Assessment of Yield Loss Due to Boll Rot of Cotton	1985-1996
	65. Studies on Boll Rot	1987-1993
	66. Monitoring of Cotton Diseases	1982-1988

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	67.CMP: Variety x Plant density/Planting Pattern x Fertilizer	1987-1988
	68. Relationship of Boll size with Average Boll Weight Per Plant	1987-1988
	69. CMP: Plant Density x Fertilizer	1988-1989
	70. Effect of Plant Spacing/Density on the Growth and Yield of Cotton	1988-1989
	71. Effects of Different Planting Pattern on Seedcotton Yields & Other Agronomic Characters of UPL-C2	1988-1989
	72. Performance Monitoring of Ratooned and Regrown Cotton	1988-1989
	73. CMP: Hill Spacing & N Fertilizer in Late Planted Cotton	1989-1990
	74. CMP: Plant Density & Fertilizer Study in Palawan	1989-1990
	75. CMP: Plant Density & Fertilizer Study in the Sub-optimal Areas of Piat, Cagayan	1989-1990
	76. CMP: Plant Spacing x Fertilizer	1989-1990
	77. CMP: Time of Planting x Fertilizer	1989-1990
	78. Effect of Planting Pattern & Fertilizer Levels on Yield & Boll Rot Occurrence in Cotton	1989-1990
	79. CMP: Plant Spacing & Nitrogen Fertilizer in Late Planted Cotton	1990-1991
	80. CMP: Plant Spacing & Fertilizer Level in the Sub-optimal Areas	1990-1991
	81. Cultural Management Practices: Density x Fertilizer on CRDI-1	1991-1992
	82. Cultural Management Practices: Variety X Plant Density x N Fertilizer Levels	1991-1992
	83. Performance of UPL-C2 and McNair 220 As Influenced By Different Planting Distances	1992-1993
	84. Effects of Hill Spacing and Nitrogen Levels in the Performance of McNair 220	1993-1994
	85. Performance of Promising Cotton Lines Under Different Planting Density	1993-1994
	86. The Performance of CRDI-1 & McNair 220 Under Different Row & Hill Spacing	1992-1994
	87. Performance of D113, CRDI-1 and McNair 220 Under Different Spacings	1993-1994
	88. Performance of CRDI-1, McNair 220 and D113 Under Different Planting Densities	1993-1994
	89. Effects of Hill Spacing and N Level on the Performance of CRDI-2	1994-1995
	90. Performance of Promising Cotton Genotypes Under Different Spatial Arrangement and Planting Density	1994-1995
	91. Technology Verification Trial: Minimum Tillage Technology	1994-1995
	92. Yield Potential of CRDI-2 Cotton Variety	1996-1997
	93. Growth and Yield Performance of Cotton (Var. CRDN 174) As Influenced By Nitrogen Levels and Hill Spacing	1996-1997
	94. Yield Potential of CRDI-1 and CRD 43 Cotton Varieties	1997-1998

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	95. Potential Boll Productivity of CRDI-1 and CRD 43-131-7-71B	1997-1998
	96. Morpho-Physiological Growth of Cotton As Affected By Hill Spacing and Nitrogen Level	1997-1998
	97. Performance of Cotton (G. Barbadense L. Var. CRDN 174) As Influenced By Planting Date and Plant Population Density	1997-1998
	98. Evaluation of Different Cropping Systems	1987-1988
	99. Cotton Seedling Establishment in Corn-Cotton Relay Cropping Pattern	1984-1989
	100. Cotton and Legume Intercropping Technology	1988-1997
	101. Performance Trial On Garlic-Cotton Technology	1984-1997
	102. Garlic + Cotton and Garlic + Legume Intercropping: Verification Project	1995-1996
	103. Productivity Performance of Cotton As Affected By Wokozim Yield Booster	1990-1991
	104. Boll Productivity and Lint Yield Potentials of CRDI-2 At Three Nitrogen Fertilizer Levels (Fertigated)	1996-1997
	105. Response of Cotton To Varying Levels of NPK	1981-1995
	106. Establishment of Critical Soil and Plant Test Values in Cotton	1985-1994
	107. Response of Cotton to Varying Levels of Phosphorous	1985-1994
	108. Effects of Different Techniques of Foliar Urea Nitrogen Fertilizer	1987-1988
	109. Field Evaluation of Algafer LPF Plus Liquid Fertilizer on Cotton Yield and Quality	1989-1991
	110. Liming x Fertilizer Study	1989-1991
	111. Effect of Different Fertilizer Levels on the Productivity of Cotton, Garlic & Mungbean Cropping Pattern	1990-1991
	112. Growth & Yield of CRDI-1 Cotton Variety Planted on Soils With Different pH Levels	1990-1991
	113. Response of UPL-C2 & CRDI-1 Cotton Varieties To Fertilization	1990-1991
	114. Fertilizer Trial On Cotton in Lahar Covered Areas	1991-1994
	115. Nitrogen Fertilizer Requirements of CRDI and Improved McNair 220	1992-1994
	116. Organic Fertilization on Cotton	1985-1995
	117. Performance of UPL-C2 in Different Soil Lahar Mixture Ratios	1991-1994
	118. Response of CRDI and McNair 220 to Fertilizer Rates Grown On Volcanic Ejecta-Affected Area	1991-1994
	119. A Survey on Potassium-Deficient Areas in the First District of Ilocos Sur	1993-1996
	120. Fertilizer Response of Promising Cotton Varieties in Lahar-Covered Soils	1993-1994
	121. Response of Cotton to Bio-organic Fertilizer	1993-1995

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	122. Yield Response of Cotton to Fertilizer Applications in Potassium-Deficient Soils	1993-1994
	123. Nitrogen Fertilizer Requirements of D-113 and CRD 33-29-95 Cotton Varieties	1994-1995
	124. Seedcotton Yield As Affected By Irrigation and Sidedressing Frequencies	1994-1995
	125. Response of Cotton to Multi K and Munti NPK Foliar Fertilizer	1994-1995
	126. Technology Verification Trial: Minimum and Conventional Tillage	1994-1995
	127. Soil Characterization of Rice-Cotton Technology in Pilot Project Areas	1997-1998
	128. Rooting Characteristics of Cotton Under Drip and Conventional Method of Irrigation	1996-1997
	129. Effects of Tillage Practices on Water Consumptive Use (ET) & Yield of Cotton	1985-1988
	130. Pan Evaporation Data As Basis for Irrigating Cotton	1985-1988
	131. Irrigation Management in Conventional & Minimum Tillage for Cotton in Lowland Condition	1986-1989
	132. Irrigation Strategies for Cotton Production Under Limited Water Supply	1987-1990
	133. Rainwater Impounding Project	1987-1988
	134. Timing Irrigation of Cotton Based on Available Soil Moisture in Three Soil Types	1987-1989
	135. Irrigation Management in Minimum Tillage (With and Without Mulch) Under Lowland Condition	1986-1989
	136. Establishing Furrow length for Optimum Water Application Efficiency for Cotton	1990-1991
	137. Fiber Characteristics of Cotton Subjected to Water Stress	1990-1991
	138. Rainfall Distribution in Palawan	1990-1991
	139. Response of Cotton to Inter-tillage & Irrigation Schedule Under Lowland After Rice Condition	1990-1991
	140. Effect of Water Stress on Three Cotton Varieties	1991-1992
	141. Evaluation on the Use of Hydrosorp for Cotton	1991-1992
	142. Agroclimatic Suitability of Cotton Production Areas Based on Rainfall Data: A Re-evaluation	1992-1994
	143. Shallow Groundwater Pumping for Cotton Irrigation	1992-1994
	144. Influence of Soil Mulch on the Water Consumption and Yield of Cotton	1993-1994
	145. Irrigation Frequency for Drip-Irrigated Cotton	1993-1994
	146. Cotton Planting Schedule Based on Rainfall	1992-1994
	147. Soil Suitability and Other Related Information	1993-1994
	148. Evaluation of Alcosorb for Cotton	1994-1995
	149. Hydraulic Conductivity of a Designed Twin-wall Emitter Trickle Irrigation Tubing	1994-1995
III. Postharvest/Processing/ Waste Utilization	1. Development & Evaluation of a Cotton Delinter	1985-1990
	2. Survey and Evaluation of Artificial Dryers	1985-1990
* Small Farm Tools Dev't.	3. Cotton Quality and Quantity Gradients in Commercial Gins	1985-1989

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
*Cotton Post-harvest Handling & Processing	4. Design, Construction and Testing of a Cotton Gin	1987-1992
*Agricultural Seed Storage	5. Design and Development of a Roller Gin	1989-1991
	6. Performance Evaluation of the Newly Acquired NCC Saw Gin	1995-1996
	7. Standard Criteria for Cotton Production Machineries and processing Equipments	1991-1992
	8. Soil Molder-Digger for Cotton	1985-1990
	9. Design, Fabrication & Testing of A Rota-Spray Nozzle	1990-1991
	10. Design and Development of a Sprayer Nozzle	1991-1992
	11. Design and Evaluation of a Minimum Tillage Cotton Planter	1985-1994
	12. Applicability of the Earthway Precision Garden Seeder & Fertilizer Applicator to Cotton Farming	1988-1989
	13. Development of a Minimum Tillage Cotton Seeder: Further Testing and Improvement	1990-1993
	14. Cotton Transplanting: Effect of Container Types & Different Fertilizer Forms & Seedling Age at Transplanting	1984-1988
	15. Design, Construction & Evaluation of Animal-drawn Cotton Weeder/Cultivator	1986-1992
	16. Characterization of Cotton Seed Oil & Meal from Locally Produced Cotton Seeds	1988-1989
	17. Particle Board Construction from Cotton Stalks	1996-1997
	18. Fiber and Seed Characteristics of Bolls Harvested at Different Maturity Dates	1987-1988
	19. Cotton Quality and Quantity Gradients in Commercial Gins	1985-1989
	20. Preliminary Study on Harvesting and Postharvest Loss Assessment in Cotton	1991-1992
	21. Seedcotton Harvesting Management Systems and Techniques	1991-1996
	22. Evaluation of the Different Storage Methods for Cotton	1995-1996
	23. Effects of Seed Sources and Seed Treatment on Seedcotton Yield and Agronomic Characters	1988-1989
	24. Survey of Dryers & Their Preliminary Evaluation of Seedcotton Drying	1985-1990
	25. Cottonseed Delinting	1985-1992
	26. Cotton Seed Coating	1985-1996
IV. Socio-economics and Statistics	1. Adoption Behavior of Cotton Farmers To Recommended Technology	1984-1990
	2. Acceptability of Cotton as a Crop by Ilocano Farmers	1987-1988
	3. Comparative Advantage of Cotton Production: Philippines	1986-1991
	4. Studies on Cooperatives	1991-1995
	5. Economic Evaluation of the RCPT	1987-1992
	6. Cotton Price Monitoring and Analysis	1991-1995

Appendix Table 28. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	7. Profitability of Cotton Growing in Luzon	1985-1995
	8. Resource Productivity Study for Cotton Farms: Philippines	1986-1989
	9. Social Returns to Cotton Research and Extension in the Philippines	1988-1990
	10. Role Performance of Trained DA technicians in the Cotton Development Program	1992-1995
	11. Process Documentation of the Marcos CFA	1987-1988
	12. Socio-economic Evaluation of Cotton-based Cropping Systems	1987-1988
	13. Training and Communication Needs Analysis of Cotton Technicians	1987-1989
	14. Evaluation of Cotton Training Programs	1989-1990
	15. A Sectoral Action plan for Cotton	1989-1990
	16. Application of Software Development	1989-1991
	17. Evaluation of the CRDI RCpT in Demo-Pilot Projects	1989-1990
	18. Evaluation of the PGCP Technology Comic Booklets on Cotton Production	1990-1991
	19. Assessment of the Cotton Production Technology	1990-1991
	20. Farmers' Association as a Vehicle for Rural Development: The Case of the Samahang Kabuhayan ng Iloilo Sa Bulak (SKIB)	1990-1991
	21. Structure, Conduct and Performance of Cotton Markets in Luzon	1990-1991
	22. Supply Response of Cotton Farmers in the Philippines	1990-1991
	23. Technology Assessment in Demo-Pilot Farms	1990-1991
	24. An Economic Evaluation of the Financing Schemes for Cotton Production in Western Visayas	1991-1992
	25. Comparative Operation and Performance of CFA's in Region 1	1991-1992
	26. The Profitability Analysis of Cotton-based Cropping Systems	1991-1992
	27. Utilization of CRDI-trained DA Technicians as Cotton Extensionists	1991-1992
	28. Credit Schemes for Cotton Production	1992-1993
	29. Farming Practices of Cotton Farmers in Sarangani, South Cotobato & General Santos City	1992-1993
	30. Role Performance of Trained DA Technicians in the Cotton Development Program	1992-1993
	31. Farming Practices of Cotton Farmers in the Major Cotton-producing Areas in South Cotobato, Sarangani, and General Santos City, CY 1993-94	1993-1994
	32. Performance of Cotton Farmer Leaders	1993-1994
	33. Performance of Cotton Technicians	1993
	34. The Spring of Cotton Farmers' Cooperative Revisited	1993-1994
	35. Benchmark Evaluation and Development of Business Plan for Cotton-based Cooperatives and Loomweavers' Association	1997-1998

Source: CODA

Appendix Table 29. List of on-going cotton researches being conducted by the CRDI/CODA as of 1999.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement/ Development	1. Germplasm Collection, Maintenance and Evaluation: Field Evaluation & Rejuvenation	1983-Continuing
	2. Germplasm Database Management	1988-Continuing
	3. Hybridization & Development of Selection Population: Hybrid Breeding (Crosses/Anther Culture)	1983-Continuing
	4. Hybridization & Development of Selection Population: F5 Population	1998-Continuing
	5. Hybridization & Development of Selection Population: F6 Population	1998-Continuing
	6. Hybridization & Development of Selection Population: Interspecific Hybridization	1998-Continuing
	7. Population Improvement in Cotton	1998-Continuing
	8. Fiber Quality Improvement of Cotton (<i>Gossypium Hirsutum L.</i>) CV, UPL-C2	1998-Continuing
	9. Increasing Fiber Strength of Outstanding Lines/Variety of Cotton	1998-Continuing
	10. Varietal Evaluation: Early Generation Tests	1998-Continuing
	11. Varietal Evaluation: Preliminary Cotton Variety Trial	1983-Continuing
	12. Varietal Evaluation: National Cotton Variety Trial	1980-Continuing
	13. Varietal Evaluation: Regional Cotton Variety Trial	1980-Continuing
	14. Varietal Evaluation: Advanced Variety Yield Trial	1980-Continuing
	15. Varietal Evaluation: Farmers' Field Cotton Variety Trial	1980-Continuing
	16. Varietal Evaluation: Evaluation of Chinese Cotton Variety	1987-Continuing
	17. Varietal Evaluation: Preliminary Evaluation of <i>Gossypium Barbadense L.</i> Varieties	1987-Continuing
	18. Nucleus/Breeder Seed Production and Seed Increase of Varieties for Evaluation for Next Cropping Season/Evaluation and Seed Increase of Outstanding Cotton Cultivars	1998-Continuing
	19. Cotton Seed Multiplication	1985-Continuing
	20. Fiber Laboratory	1998-Continuing
	21. Wild Cotton Garden	1998-Continuing
	22. Tissue Culture : Hybridization	1994-Continuing
II. Crop Production and Cultural Management * Physiology Studies * Demonstration and Verification Trials of Matured Cotton Production Technologies * Pest Management	1. Cotton Technology Verification Trial	1979-Continuing
	2. Performance Evaluation of the Recommended Cotton Production Technology: A Demonstration Trial	1989-Continuing
	3. Sterile Insect Technique for Bollworm and Flower Weevil	1997-2000
	4. Determination, Extraction, Identification and Evaluation of Flower Weevil Pheromone	1997-2000
	5. Potential of <i>Eriborus Sp.</i> As Biological Control Agent for Bollworm, <i>Helicoverpa Armigera</i>	1997-2000
	6. Mass Production, Maintenance & Demonstration on the Utilization of Trichogramma	1990-Continuing
	7. Screening <i>Gossypium Barbadense</i> Cultivars Against Flower Weevil	1990-Continuing

Appendix Table 29. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
* Weed Control	8. Evaluation of <i>Eurobella annulata</i> Against Flower Weevil	1998-1999
* Disease Control	9. Re-evaluation/Screening of Granular Insecticides Against Flower Weevil	1979-Continuing
	10. Screening of Herbicides to Control Cotton Pests	1981-Continuing
	11. Fungicide Screening to Control Cotton Pests	1982-Continuing
* Cultural Management	10. Evaluation of Other Substances for Flower Weevil Control	1998-1999
* Cotton Based Cropping System	11. Development of Integrated Pink Bollworm Management: Life Tables for Pink Bollworm	1998-1999
	12. Evaluation of <i>Jatropha Curcas</i> L. As Pesticide	1989-Continuing
* Determination of Optimum Fertilizer	13. Screening of Indigenous Plants Against Cotton Pests	1984-2000
	14. Screening of Cotton Genotypes to <i>Amrasca Biguttula</i> Resistance	1988-Continuing
* Soil Fertility Mapping	15. Screening Cotton Cultivars/Lines for Cotton Pink Bollworm Resistance	1983-Continuing
	16. Varietal Screening for Resistance to damping-off Disease of Cotton	1986-Continuing
* Water Management Practices	17. Demonstration/Verification of IPM Package of Technology: Seed Treatment, Trap Crop, Tricons and Systemic Insecticides	1998-1999
	18. Evaluation of the Potential of Mixed Cropping System As IPM Strategy	1998-1999
	19. Development and Promotion of Biopesticide from Physic Nut Oil for Selected Crops	1998-1999
	20. Extraction, Evaluation, Identification and Formulation of the Insecticidal Principle from <i>Piper bettle</i> L. for Cotton Pest Control	1998-1999
	21. Development of Cheap Mass Rearing Technique for <i>Eriborus</i> sp.	1998-1999
	22. Evaluation of Bollworm Trapping and Egg Intensity Index as Index to Pest Control	1998-1999
	23. Screening Cotton Cultivars/Lines for Cotton Leafhopper Resistance	1998-1999
	24. Antibiosis Test for Cotton Bollworm on Different Cotton Cultivars/Lines	1998-1999
	25. Seasonal Occurrence of Cotton Insect Pests	1998-1999
	26. Re-evaluation of the Critical Cotton Productivity Level of Bollworm	1998-1999
	27. Effects of Herbicides on Soil Biodiversity in Rice-Cotton Cropping Pattern	1998-1999
	28. Re-evaluation of the Recommended Rate of Insecticides for Insect Pest Control	1998-1999
	29. Organic Fertilization for Sustainable Rice-Cotton Production	1996-2000
	30. Yield Potential of Drip-Fertigated Cotton	1998-1999
	31. Verification Trial of Drip Fertigation	1996-2000
	32. Measuring Sustainability of Cotton-based Production System at the Farmer Level	1998-1999
	33. Effect of Organic Fertilizer on the Growth of Cotton	1978-2000
	34. Soil Analysis/Mapping and Characterization of Cotton Production Areas	1979-2000

Appendix Table 29. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
III. Postharvest/Processing/ Waste Utilization	1. Design, Development and Testing of a Herbicide Wiper Applicator for Cotton	1997-2000
	2. Cottonseed Oil Extraction and Processing	1997-2000
* Small Farm Tools Dev't.	3. Design, Construction, and Testing of Cottonseed Pelletizer	1998-1999
* Cotton Post-harvest	4. Utilization of Cotton Stalks in the Production of Cement-Bonded Particle Board	1997-2000
Handling & Processing	5. Evaluation of Cotton Seeds as Supplemental Feeds for Ruminants	1997-2000
* Agricultural Seed Storage	6. Seed Coating Machine	1996-2000
	7. A Farm Level Seedcotton Packing Module	1996-2000
IV. Socio-economics and Statistics	1. Cotton Farmers and Loom Weavers Business Capability Enhancement, Research and Business Development	1998-1999
	2. Socio-economic Profile of the Cotton Industry	1998-Continuing
	3. Benchmark Evaluation of the Rice/Cotton/Corn/Cotton Cropping System	1997-1999
	4. Profitability of Rice-Cotton/Corn-Cotton Cropping Cropping System	1997-1999
	5. Adoption of Production Technologies in Rice-Cotton/Corn-Cotton Cropping Sytems	1997-1999
	6. Gender Analysis of Participation in the Rice-Cotton Cropping Project	1997-1999
	7. Establishment of Coefficient of Variation for Cotton Field Experiments	1997-2000
	8. Profitability of Cotton Growing	1998-1999
V. Others	1. Techno-Demo of the Rice-Cotton Cropping Pattern: Demo of New Rice/Cotton Varieties	1998-1999
* Technology Transfer	2. Techno-Demo of the Rice-Cotton Cropping Pattern: Techno Demo/Verification of Generated Production Technology Components	1998-1999

Source: CODA and PCCARD

Appendix Table 30. List of completed researches on multi-commodity/fiber crops conducted by FIDA, 1988-1999.

RESEARCH AREA	COMMODITIES	STUDY TITLE	DURATION
I. Varietal Improvement	Abaca	1. Characterization of Selected Abaca Varieties	1994-1998
	Abaca	2. Adaptability Test of Musa Tex Hybrids (Bicol Series) in Region XI	
	Abaca	3. Collection, Characterization and Evaluation of Abaca Varieties/ Cultivars in Region IX	1998
	Abaca	4. Collection and Evaluation of Abaca Varieties and Hybrids in the Bicol Region	1994
	Abaca	5. Field Evaluation of Tissue-Cultured Abaca Plantlets in the Bicol Region	1993
	Abaca	6. Evaluation of Promising Abaca Cultivars/Hybrids Against Bunchy-Top and Mosaic Under Field Condition	1991
	Abaca	7. Performance Test of Promising Abaca Cultivars Under Established Coconut Plantation	1991
	Abaca	8. Transmission Study of Viruses on Promising Abaca Cultivars/ Hybrids	1989
	Jute	9. Regional Performance Trial of Jute	1993
	Salago	10. Yield Trial of Salago Under EVIRFESS Condition	
	Salago	11. Salago Yield Trial in Davao City	1993
	Mulberry	12. Performance Trial of Different Mulberry Varieties Under the Davao Agro-Climatic Condition	1997
II. Crop Production	Abaca	1. Atlas of Philippine Fibers	1998
	Abaca	2. Verification Trial on the Effect of Different Concentrations of Kerosene and Diesel in the Eradication of Bunchy-top and Mosaic Infected Abaca Plants in the Province of Catanduanes	
	Abaca	3. Abaca Rehabilitation Project in the Bicol Region	1997
	Abaca	4. Transmission Study of Abaca Viruses	1997
	Abaca	5. Rapid Propagation Techniques for Abaca Study 2. Effects of Cutting the Abaca Stalks on the Production of Eyebuds	1995
	Abaca	6. Implementation of Integrated Pest Management (IPM) in Abaca Production in the Bicol Region	1995

Appendix Table 30. Continued.

RESEARCH AREA	COMMODITIES	STUDY TITLE	DURATION
	Abaca	7. Verification on Chemicals Versus Conventional Method in Eradicating Virus Infected Abaca Plants	1995
	Abaca	8. Rapid Propagation on Technique on Abaca Study I Germination and Growth of Abaca Eyebuds as Affected by Size and Depth of Planting	1992
	Abaca	9. Elimination of Abaca Viruses by Chemotherapy and Meristem Culture	1993
	Abaca	10. Test of Tordon or Picloran Herbicide in Eradicating Bunchy-Top Infected Abaca Plants	1989
	Salago, Maguey and Pineapple	11. Tissue Culture of Salago, Maguey and Pineapple	1993
	Maguey	12. Fiber Yield and Quality of Maguey at Different Stages of Maturity	1991
	Salago	13. Salago Regrowth Studies in Davao	
	Salago	14. Verification Trial on the Planting Distance of Salago	1993
	Salago	15. Effects of the Different Pruning Time on the Growth and Yield of Transplanted Salago	1993
	Salago	16. Fermentation Study on the Germination Ability of Salago Seeds	1991
	Salago	17. Nitrogen Fertilizer Application x Planting Distance x Age of Harvesting Studies on Salago in Region XI	1988-1991
	Silk	18. Municipal Sericulture Centers (La Union, Benguet)	
	Mulberry	20. Consumptive Use of Mulberry at Various Growth Stages	1996
	Mulberry	21. Utilization of Ramie and Banana Wastes as Fertilizer to Mulberry	
	Mulberry	22. A Study on the Germination of Mulberry Cuttings	
	General	23. Regional Adaptability Trials (8 Studies)*	
III. Post Production/Processing and Product Development	Silk	1. Packaging and Commercialization of Technologies on Plant Fibers (Handmade Paper; Silk Processing; Fiber)	
	Silk	2. Conduct of Development/Adaptation Researches on the Utiliza-	

Appendix Table 30. Continued.

RESEARCH AREA	COMMODITIES	STUDY TITLE	DURATION
		tion of Plant Fiber (Handmade Paper Products, Pulp Production, Nonwoven Production)	
	Silk	3. Provision of Testing Services (Physical, Chemical and Morphological Characteristics of Fibers, Pulping and Testing of Sheets, Fiber Extraction)	
	Silk	4. Conduct of Studies on Development/Improvement of Post-harvest Technology for Plant Fibers	
	Silk	5. Support Activities (Maintenance of Fiber Processing and Utilization Laboratory)	
	General	6. Investigation of the Quality of Plant Fibers (Physical, Morphological and Chemical Characteristics)	
	Abaca	7. Modification of the Abaca Spindle Stripping Machine, 1996	1996
	Abaca	8. Modification of the Dyeing Method for Tinalak Using Lokow and Kinalum	
	Abaca	9. Design and Fabrication of Denting Machine, 1996	1996
	Abaca	10. Production of Soft Nonwoven Materials Using Abaca-Maguey Pulp Blend, 1994	1994
	Abaca	11. Technology Development for Nonwovens Utilizing Abaca and other Selected Fibers, 1992	1992
	Abaca and Ramie	12. Utilization of Fiber Plantation Wastes as Organic Fertilizer for Green Onions, 1993	1993
	General	13. Utilization of Fiber Extraction Wastes as Animal Feeds, 1992	1992
	Abaca	14. Determination of Pulping Characteristics of Low Grade Abaca Fiber (L, M. WS and TOW)	
	Abaca	15. Modification of Twisting and Twining Device for Abaca	
	Abaca	16. Production of Nonwoven as Wrapping Material	
	Abaca	17. Documentation of the Modification of the Dyeing Method for Tinalak Using Kinalum and Lokow Plant Dyes With Alum as Chemical Mordant	
	Silk	18. Development and Fabrication of Modified Reeling Device	

Appendix Table 30. Continued.

RESEARCH AREA	COMMODITIES	STUDY TITLE	DURATION
	Silk	19. Development and Fabrication of Twisting Device	
	Silk	21. Development of Degumming Vat	
	Silk	22. Laboratory Trials on the Reeling Process in Raw Silk Production	
	Silk	23. Laboratory Trials on the Re-reeling Process in Raw Silk Production	
	Silk	24. Laboratory Trials on Twisting Process in Raw Silk Production	
	Silk	25. Laboratory Trials on Degumming/Dyeing Process in Raw Silk Production	
	Silk	26. Laboratory Trials on Cocoon and Silk Products	
	Abaca	27. Improvement of the Fiber Extraction and Identification of Higher Yielding Abaca Varieties (CFC/UNIDO)	
	Abaca	20. Improvement of Abaca Fiber Extraction and Processing Tools/Machineries	
	Abaca	21. Commercialization of Deco Abaca Fiber: Feasibility Study	
	Abaca	22. Development of Philippine Tropical Fabrics (GTEB): Improvement of Decorticating Machine for Banana and Piña Fibers	
	Abaca	23. Fabrication of Serrating Machines	
	Abaca	24. Design, Development and Test of an Integrated Abaca Processing Center	1996
	Abaca	25. Comparative Study on the Recovery Rate and Quality of Maguey Fibers Using the Decorticating Machine and the Traditional Retting Method Under the Ilocos Region Condition	1993
IV. Socio-economic and Marketing	Abaca and Ramie	1. A Case Analysis on the Marketing Cooperative System for Abaca and Ramie	1989
	Piña	2. Supply-Demand Analysis for Piña Cloth	1989
	Abaca	3. A Study on the Potential Demand for Abaca and Other Natural Fibers for Non-woven Processing	1989
	Abaca	4. In-depth Analysis of Abaca Wallcover Industry in the Province of Albay	1990

Appendix Table 30. Continued.

RESEARCH AREA	COMMODITIES	STUDY TITLE	DURATION
	Abaca	5. A Study on the Supply and Demand Situation of "Bitool" Knotted Hemp in Valencia, Negros Oriental	1990
	General	6. A Study on Bicol Region Handmade Paper Industry	1991
	General	7. Profile of the Handmade Paper Industry	1991
	Abaca	8. Survey on Raw Material Requirements of Handmade Paper-makers in Metro Manila and Laguna Areas	1992
	Piña	9. A Study on the Hand Embroidery Industry in Region IV	1992
	Abaca	10. Study on the Different Weaves (Supply and Market Outlet Analysis)	1994
		11. A Study on the Coir Industry in Region IV	1994
	Abaca	12. The Pinukpok Livelihood Project in the Bicol Region	1994
	Abaca	13. An Evaluative Study on the Role of Abaca Cooperative and Its Impact on the Development of the Abaca Industry in the Bicol Region	1995
	Abaca	14. Impact Evaluation of the SSK (Standardized Stripping Knives Project)	
	Abaca	15. Impact Evaluation on the Use of Abaca Dryer on the Fiber Quality	
V. Policy	Abaca	1. Review/Revision of the Abaca Grading System	
	Abaca	2. Study on Sanitary and Phytosanitary Measures for Abaca and Other Fibers	

Appendix Table 31. List of on-going researches on multi-commodity/fiber crops conducted by FIDA.

RESEARCH AREA	COMMODITIES	STUDY TITLE	DURATION
I. Varietal Improvement	Abaca	1. Collection, Evaluation and Characterization of Abaca Varieties, Hybrids and Strains	Continuing
	Abaca	2. Collection, Evaluation and Characterization of Abaca Varieties, Hybrids and Strains	Continuing
	Abaca	3. Collection, Evaluation, and Characterization of Abaca Varieties, Hybrids and Strains	1994-1999
	Abaca	4. Field Evaluation of Tissue-Cultured Musa Tex 52 from Different Subcultures	1996-2000
	Mulberry	5. Performance Trial of Selected Promising Mulberry Varieties Under EVIRFES	1996-1999
II. Crop Production	Abaca	1. Abaca Production Pilot Project	1998-2002
	Abaca	2. Abaca Production Pilot Project	1995-1999
	Abaca	3. Abaca Production Pilot Project	1995-1999
	Abaca	4. Development of an Abaca Based Cropping System in Bunchy-Top & Mosaic Disease Eradicated Area	1997-2002
	Abaca	5. Survey, Identification and Control of Fungi Affecting Abaca Plants, Raw Fibers and Finished Products	1995-2000
	Silk	6. Development of Cultural Management Practices (17 studies)*	1992-2000
	Silk	7. Development of Crop Protection Strategies (4 Studies)*	1992-2000
III. Socio-economic and Marketing	General	1. Basic Investment Information on: Handmade Papermaking, Sinamay Weaving, and Piña Cloth Weaving	1999

Appendix Table 32. List of completed researches on abaca conducted by the UPLB, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. In Vitro Gene Banking of Root Crops and Abaca: Study 1. Development of Protocols for in Vitro Genebanking of Rootcrops and Abaca	1996
	2. In Vitro Gene Banking of Root Crops and Abaca; Study 2. Maintenance of in Vitro Cultures of Root Crops and Abaca Germplasm	1996
	3. In Vitro Gene Banking of Root Crops and Abaca; Study3. Field Establishment of in Vitro Derived Plants of Root Crops and Abaca	1996
	4. PCR-based Fingerprinting of Bananas and Other Musa Species in the Philippines for Plant Breeding and in Vitro Culture Applications	1994-1995
	5. In Vitro Gene Banking of Root Crops and Abaca (2 Studies)*	1991-1994
	6. Abaca Breeding	1 year
	7. Development of Tissue Culture Techniques for Rapid Mass Propagation of Abaca	1.5 years
	8. In Vitro Gene Banking of Root Crops and Abaca	4 years
	9. Abaca Improvement and Integrated Disease Management Program: Project I: Varietal Improvement of Abaca (2 Studies) *	1992-1997
	10. Abaca Breeding	1996-1998
	11. Abaca Improvement and Integrated Disease Management Program. Project 3. Relations, Epidemiology of and Losses Due to Bunchy-Top Diseases of Abaca: Study 2. Mechanism of Resistance	1992-1997
	12. Abaca Improvement and Integrated Disease Management: Project 2. In Vitro Production of Variants and Micropropagation of Abaca Hybrids and Cultivars for the Breeding Program	1992
	13. In Vitro Production and Micropropagation of Abaca Variants and Hybrids	1998-1999
	14. Abaca Improvement and Integrated Disease Management Program 3: Relations, Epidemiology of and Losses Due to Bunchy-Top Diseases of Abaca Study 1: Purification, Visualization and Characterization	
	15. In Vitro Gene Banking of Root Crops and Abaca	1990
II. Crop Production	1. Rehabilitation and Maintenance of a one-hectare Abaca Farm	1994-1995
	2. Entomological Studies in Support of the Varietal Improvement of Abaca (3 Studies)*	5 Years
	3. Abaca Production Studies	10 years
	4. Epidemiology and Integrated Management of Abaca Virus Diseases in the Bicol Region Project B. Integrated	1998-1999

Appendix Table 32. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	Control of Aphid Vectors of Abaca Bunchy-Top and Mosaic	
	5. Epidemiology of Abaca Virus Diseases	1997-1999
	6. Identification and Biology of the Natural Enemies of the Vector of Abaca and Banana Bunchy Top, <i>Pentalonia nigronervosa</i>	1992-1995
	7. The Possible Control of Quality and Yield of Fiber From Abaca (<i>Musa textilis</i> Nee) Using Plant Growth Regulators (2 Studies)*	1988-1991
	8. Abaca Development Program. Project 2. Development of Control Strategies for Crop Protection in Abaca (3 Subprojects)*	1975-1993
III. Post Production/Processing and Product Development	1. Abaca Post Production Studies	3 years

Appendix Table 33. List of completed researches on cotton conducted by the UPLB, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. Cotton Breeding	1996-1998
	2. Screening of Cotton and Other Fiber Crops for Resistance to Diseases	1996-1998
	3. Biotechnology Assisted of Improvement of Flower Weevil and Bollworm Resistance in Cotton	
	4. DNA/Isozyme Finger Printing of a Germplasm, Varieties, Hybrids	
	5. Marker Assisted Breeding of Cotton for High Yield, Improved Fiber Quality and Fusarium Wilt Resistance	
	6. Field Evaluation of Cotton Lines For Resistance to Hoppers and Bullworms	
	7. Cotton Breeding (6 Studies) *	
	8. Screening of Cotton Lines and Varieties for Resistance to Fungal and Bacterial Diseases (3 Studies) *	
	9. Screening for Segregating and Advance Populations for Leafhopper Resistance in Cotton	
	10. Cotton Breeding	1996-1998
	11. Screening of Cotton and Other Fiber Crops for Resistance to Diseases	1996-1998
II. Crop Production	1. Mass Production of Trichogramma Parasites and its host, Corcyra cephalonic	
	2. Mass production of Trichogramma Parasitoids Against Lepidopterous Pests of Cotton	
	3. Insect Management of Cotton (2 Studies) *	

Appendix Table 34. List of completed researches on ramie conducted by the UPLB, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. Ramie Breeding	1946-1998
	2. Breeding for High Quality Ramie	
	3. Breeding for Fine Fiber and High Yielding Ramie	1992-1993
	4. Breeding for High Quality Ramie Fibers (3 Studies)*	1.5 years
	5. Ramie Breeding (4 Studies)*	2 years
	6. Breeding for High Quality Ramie Fibers (3 Studies)*	1988-1991
	7. Ramie Breeding, Ramie Pathology	1986-1989
	8. Ramie Breeding	1996-1988
II. Crop Production	1. Screening for Ramie for Resistance to Diseases (4 Studies)*	1992-1993
	2. Ramie Physiology	
III. Post Production/Processing and Product Development	1. Bio-processing of Ramie	1990-1991

Appendix Table 35. List of completed researches on other fiber crops conducted by the UPLB, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. Salago Improvement	1988
	2. Jute Kenaf and Salago Breeding	1996-1998
	3. Tissue Culture of Salago, Maguey and Pineapple	1991-1993
	4. Studies on Salago (Wilkstoemia sp.) Diseases and Screening of Species for Resistance to Major Diseases (2 Studies)*	
	5. Textile Fiber Crops Breeding Program	
	6. Bast Fiber Breeding	1.5 years
	7. Textile Fiber Crops Breeding Program	1.5 years
II. Crop Production	1. Disease Resistance in Jute and Kenaf	
	2. Disease Resistance in Jute and Kenaf	3 years

Appendix Table 36. List of completed researches on silk conducted by the UPLB, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. National Integrated Sericultutre Research and Development Program; Project 1. Silkworm Breeding and Egg Production	1993-1998
	2. Integrated Silk Agro-industry Research and Development Program; Study 1. Silkworm Breeding and Egg Production	1990-1995
	3. Integrated Silkworm Development Program	
	4. Silkworm Breeding and Egg Production	1993-1994
	5. National Integrated Sericulture Research and Development Program Project 1. Silkworm Breeding and Egg Production	1993-1998
	6. Operationalization of the Silkworm Breeding and Egg Production Center and Development/Improvement of Silkworm Strains for Philippine Agro-climatic Environment	1993-1998
II. Production		
A. Cocoon	1. Integrated Silk Agro-industry Research and Development Program; Study 2. Silkworm Rearing and Pathology	1990-1995
B. Mulberry	1. Integrated Silk Agro-industry Research and Development Program; Study 3. Mulberry Plantation Management and Varietal Improvement	1990-1995
III. Post Production/Processing and Product Development	1. Integrated Silk Agro-Industry Research and Development Program; Study 4. Silk Processing and Evaluation	1990-1994
	2. UPLB Integrated Sericulture Research and Development Program; Study 4. Silk Processing and Evaluation	1990-1994
IV. Socio-economic and Marketing	1. Establishment and Integration of Support Sevices for the Silk Industry Development in 3 Regions(IV, VI, XI) of the Country	

Appendix Table 37. List of on-going researches on other fiber crops conducted by the UPLB.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. Bast Fiber Breeding Study 1. Ramie Breeding	1988-Contg.
	2. Ramie Breeding (4 Studies)*	Contg.
	3. Jute, Kenaf and Salago Breeding (2 Studies)*	Contg.
	4. Kenaf and Salago Jute, Kenaf and Salago Breeding (2 Studies)*	Contg.
	5. Varietal Improvement of Fiber Crops	Contg.

Appendix Table 38. List of on-going researches on cotton conducted by the UPLB.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. Cotton Breeding (6 studies)* 2. Field Evaluation of Cotton Lines for Resistance to Hoppers and Bullworms	1990-Contg.

Appendix Table 39. List of on-going researches on abaca conducted by the UPLB.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	1. Development of Tissue Culture Techniques for Rapid Mass Propagation of Abaca 2. Abaca Breeding (3 Studies)* 3. Bast Fiber Breeding 4. Collection, Conservation, Evaluation and Documentation of Abaca Cultivars, Related Species and Breeding Materials Study 1. Collection and Conservation of Abaca Cultivars Related Species and Breeding Materials 5. Screening of Abaca for Resistance to Bunchy Top and Mosaic	1975-Contg. 1975-Contg. 1988-Contg. 1988-Contg. 1987-Contg.
II. Crop Production	1. Abaca Development Program: Relations, Epidemiology of and Losses Due to Bunchy and Losses Due to Bunchy Top and Mosaic Virus Disease of Abaca 2. Entomological Studies in Support of the Varietal Improvement of Abaca (3 Studies)* 3. Development of Control Strategies for Crop Protection in Abaca 4. Development of Abaca Production Systems 5. Abaca development Program: Project 3. Development of Abaca Production Systems on Hillylands 6. Development of Strategies for Crop Protection in Abaca	Contg. 1991-Contg. Contg. 1995-2010 1975-Contg. 1995-2010
III. Post Production/Processing and Product Development	1. Abaca Post Production Studies. Changes in Abaca Fiber Derived From Tuxies Stored at Various Durations 2. Abaca Post Production Studies. Changes in Abaca Fiber Derived From Tuxies Stored at Various Durations 3. Post Production Studies	1975-Contg. Contg. 1995-2010

Appendix Table 40. List of completed MS and PhD thesis on fiber crops conducted at UPLB, 1988-1998.

RESEARCH AREA	COMMODITY	THESIS TITLE	DURATION
I. Varietal Improvement			
MS	Ramie	1. Morphological and Cytological Characterization of Some Ramie (<i>Boehmeria nivea</i> Gaud.) Accessions	1990
		2. Stability of Yield and Fiber Fineness in Ramie	1993
	Abaca	3. Resistance of Abaca (<i>Musa textilis</i> nee) F1 Hybrids to Abaca Bunchy-Top Virus	1997
PhD	Cotton	1. Single and Two-Stage Index Selection Schemes in Cotton	1988
II. Crop Production			
MS	Abaca	1. Elimination of Abaca Viruses by Chemotherapy	1993
	Ramie	2. Response of Ramie (<i>Boehmeria nivea</i>) to Soil Moisture Stress and Flooding	1990
	Cotton	3. Evaluation of Cotton (<i>Gossypium hirsutum</i> L.), Garlic (<i>Allium sativum</i> L.) and Mungbean (<i>Vigna radiata</i> L.) Cropping System After Paddy Rice	1990
	Cotton	4. Mass Production and Efficiency of <i>Trichogramma</i> Species Against the Pink Bollworm, <i>Pectinophora gossypiella</i> Saunders and the Cotton Bollworm <i>Heliothis armigera</i> (Hubner)	1990
	Cotton	5. Isolation and Screening of <i>Bacillus Churingiensis</i> Berliner against the Cotton Bollworm: <i>Helicoverpa armigera</i> (Hubner) (Lepidoptera: Noctuidae).	1990
	Cotton	6. Resistance of Cotton Cultivars to Cotton Leafhopper, <i>Amrasca biguttula</i> (Ishida) and Its Association With Some Plant Characters	1989
	Cotton	7. Abundance of <i>Heliothis armigera</i> and Its Natural Enemies in Cotton Intercropped With Cereals or Legume	1989
	Cotton	8. Development of Tactics for the Population Management of the Cotton Bollworm	1992
	Cotton	9. Host-plant Resistance in Eggplant Germplasm to Cotton Leafhopper, <i>Amrasca biguttula biguttula</i> (ISHIDA)	1997

Appendix Table 40. Continued.

RESEARCH AREA	COMMODITY	THESIS TITLE	DURATION
Phd	Cotton	1. Management of the Cotton Flower Weevil <i>Amorphaidea Lata</i> Motschulsky (Coleoptera curculionidae) Population	1996
		2. Insect Population Diversity and Density in Cotton Cropping System	1989
III. Socio-economic and Marketing MS	Cotton	1. Supply Response of Cotton Farmers in the Philippines	1990
		2. Optimum Cropping Patterns in Selected Town of Pangasinan	1990
	Cotton	3. Economic Evaluation of the Financing Schemes for Cotton Seeds, Western Visayas, 1990-1991	1992
	Cotton	4. Economic Evaluation of the Financing Scheme for Cotton Production, Western Visayas, Philippines	1992
PhD	Cotton	1. Integrating Ecological Impacts of Particle Use in Cotton (<i>Gossypium hirsutum</i> L.) Productivity Analysis	1997
	Cotton	2. Communication Analysis of the Utilization of Cotton Integrated Pest Management Technology in the Philippines	1997

Appendix Table 41. List of completed abaca researches conducted by the VISCA-National Abaca Research Center, 1988-1998.

RESEARCH AREA	STUDY TITLE	STUDY LEADER	DURATION
I. Varietal Improvement/ Development	1. Collection, Morphological Characterization & Maintenance of Abaca Gene Bank (Phase I)	E. Alcober	1993-1995
	2. Cytological, Cytogenetics, & Pollen Viability Studies of Abaca Varieties & Related Species	L. Moreno	1988-1998
	3. Characterization & Chemical Composition of Abaca Fibers in the Germplasm Collection	L. Moreno	1986-1998
	4. Production of Disease-free Planting Materials Through Tissue Culture	T. Nguyen	1985-1988
	5. Development of Disease Resistant Abaca Lines/Varieties By <i>In Vitro</i> Culture	T. Nguyen	1985-1988
	6. Development of Abaca Varieties with the Desired Fiber Qualities (Phase I)	O. Capuno	1987-1992
	7. Development of a Technique for Identifying Promising Abaca Cultivars at Early Stage of Growth	O. Capuno	1987-1992
	8. Non-replicated Progeny Testing & Replicated Trials of Promising Abaca Cultivars/Hybrids	O. Capuno	1988-1998
	9. Regional Abaca Cultivar & Progeny Testing	N. Gloria	1983-1988
II. Crop Production and Cultural Management (Including Pest & Disease Control)	1. Identification of Economically Important Tree Species Appropriate As Shade for Abaca Variety <i>Laguais</i>	L. Gonzal	1986-1998
	2. Economic Feasibility of Intercropping Selected Abaca Varieties with Annual Crops in Flat, Open Lands	L. Moreno	1987-1992
	3. Collection, Identification, Evaluation & Culture of the Natural Enemies of the Abaca Corn Weevil	L. Borines	1987-1995
	4. Effect of Different Stages of Stalk Maturity & Location of Eyebuds in the Corm Seedling Emergence & Growth of Abaca	L. Moreno	1988-1993
	5. Evaluation of Selected Fruit Trees at Various Distance of Planting Used for Abaca	C. Carcallas	1984-1990
	6. Management Technique of Shade Trees for Optimum Abaca Farm Productivity	R. Agbisit	1984-1990
	7. Rejuvenation of Old/Neglected Abaca Plantation	R. Santiago	1984-1988
	8. Epidemiology & Control of Fusarium & Bacterial Wilt Diseases of Abaca in Leyte	E. Salamat/ G. Bastasa	1992-1998
	9. Rapid Propagation of Suckers Through Decapitation Technique	R. Armechin	1993-1996

Appendix Table 41. Continued

RESEARCH AREA	STUDY TITLE	STUDY LEADER	DURATION
III. Postharvest/ Processing/Waste Utilization	1. Improvement of Existing Hand & Mechanical Stripper	M. Loreto/ F. Sinon	1987-1993
	2. Field Evaluation & Commercialization of Portable Abaca Stripper	F. Sinon/ A. Matinez	1994-1998
	3. Development of a Drying Technology Applicable to Village Level	M. Escalante	1987-1993
	4. Improvement of Existing Secondary Processing Tools & Gadgets	M. Loreto/	1987-1993
	5. Testing, Evaluation & Improvement of the Present Practices of Storing Abaca Fibers in Eastern & Central Visayas	M. Escalante	1987-1993
	6. Development of a Portable Tensile Strength Meter	F. Sinon/ M. Loreto/	1992-1995
	7. Development of a Portable Moisture Meter	F. Sinon/ M. Loreto/	1992-1995
	8. Development & Pilot Testing of a Portable Tensile Strength Meter & Portable Moisture Meter	F. Sinon/ M. Loreto/	1996-1998
IV. Socio-economics and Marketing	1. Socio-economic Benchmark Assessment of Abaca Fiber Production Practices & Flow of Market in Region 8	R. Laguna	1987-1993
	2. Linkage Mechanism Between Abaca Fiber Producers & Product Users	R. Laguna	1987-1993
	3. Evaluation of Existing Marketing Schemes & Identification of Market Potentials for High-value Abaca Products	M. Binongo	1987-1993
	4. Marketing Schemes/Strategies for High-value Abaca Products	J. Layola	1987-1993

Source: VISCA-NARC

Appendix Table 42. List of on-going abaca researches being conducted by the VISCA-National Abaca Research Center as of 1999.

RESEARCH AREA	STUDY TITLE	STUDY LEADER	DURATION
I. Varietal Improvement/ Development	1. Collection, Morphological Characterization & Maintenance of Abaca Genebank (Phase II)	L. Moreno	1996-2000
	2. Characterization of Phil. Abaca Germplasm by Isozyme Analysis	R. Sebidos	1998-2004
	3. Heritability of Abaca Varieties/Hybrids	L. Moreno	1999-2006
	4. In Vitro Propagation of Abaca (<i>Musa textiles</i> Nee): Initiation, Proliferation & Development of Shoot Tip Culture	L. Gonzal	1997-1999
	5. In Vitro Maintenance of Abaca Germplasm to Rescue, Conserve & Propagate Threatened Cultivars	L. Moreno	1997-1999
	6. Development of Abaca Varieties with the Desired Fiber Qualities (Phase II)	O. Capuno	1993-2000
	7. Field Evaluation of Abaca Varieties & Hybrids (Phase II)	L. Moreno	1997-2002
	8. Screening of Abaca Germplasm for Resistance to <i>Fusarium</i> Wilt & Virus Diseases	G. Bastasa/ Salamat	1996-2000
	9. Screening of Promising Abaca Varieties/Cultivars Tolerant to Acid Upland Soils	L. Gonzal	1998-2003
	10. Screening of Promising Abaca Varieties/Cultivars Suited for Specific End Uses	L. Moreno	1998-2003
II. Crop Production and Cultural Management (Including Pest & Disease Control)	1. Survey & Identification of Abaca Varieties with Mycorrhizal Association	R. Armecin	1996-2002
	2. Evaluation of Potential Mycorrhizal Fungi for Increased production	R. Armecin	1997-2003
	3. Utilization of Mycorrhizal Fungus for the Control of Root-knot Nematode & <i>Fusarium</i> of Abaca	R. Armecin/ G. Bastasa	1996-2002
	4. Microbial Control of <i>Fusarium</i> Wilt of Abaca	G. Bastasa	1999-2005
	5. Identification of Appropriate Intercrops at Different Growth Stages of Abaca	R. Armecin	1993-1999
	6. Appropriate Planting Distance & Management Practices of the Intercrops Suitable with Different Growth Stages of Abaca	R. Armecin	1993-1999
	7. Improvement of Productivity of Abaca Grown Under Coconut with the Use of Creeping Legumes	R. Armecin	1992-1999
	8. Development of Appropriate Cultural Management Practices for Abaca-Coconut Cropping Systems	R. Armecin	1992-1999
	9-12. Formulation of Fertilizer Recommendation for Abaca in Eastern Visayas (Four Studies)	R. Armecin	1999-2006
III. Postharvest/ Processing/Waste Utilization	1. Mechanization of Village-level Woven Products/Processing	F. Sinon/ M. Loreto	1998-2002

Appendix Table 42. Continued.

RESEARCH AREA	STUDY TITLE	STUDY LEADER	DURATION
III. Postharvest/ Processing/Waste Utilization - Continued	2. Development of Low-cost Housing Materials Using Abaca Fibers & Wastes	M. Loreto/ F. Sinon	1996-2000
	3. Utilization of Abaca Stripping Wastes for Handmade Paper & Development of High Quality Novelty Items	L. Moreno	1997-2001
	4. Production of Alcohol from Abaca Wastes	L. Gonzal	1998-2002
	5. Production & Characterization of Starch from Abaca Corm	R. Lauzon	1998-2002
IV. Socio-economics and Marketing	1. Benchmark Survey on the Status of the Abaca Industry in Southern Leyte	L. Moreno	1997-1999
	2. Benchmark Survey on the Status of the Abaca Industry in Leyte	L. Moreno	1997-1999
	3. Abaca Cooperatives: An Assessment of Their Contribution to the Abaca Industry in Region 8	R. Velarde/ P. Pala	1997-2001
	4. Case Study of Abaca Livelihood in Region 8	R. Velarde/	1999-2000
	5. Impact Assessment of Abaca Livelihood in Region 8	R. Velarde	1999-2001
	6. Indigenous Knowledge Systems on Abaca	B. Vega	1997-1999
	7. Women in the Abaca Industry: An Assessment of Their Contribution & Constraints in Their Participation	B. Vega	1998-2001

Source: VISCA-NARC

Appendix Table 43. List of completed researches on silk conducted by the DMMSU, 1988-1998.

RESEARCH AREA	STUDY TITLE	DURATION
I. Varietal Improvement	<ol style="list-style-type: none"> 1. Project 1. Silkworm Germplasm Collection, Evaluation Characterization and Maintenance 2. Project 1. Germplasm Collection, Conservation, Evaluation and Documentation of Mulberry Varieties 3. Project 6. Convergent Crossing of Silkworm Lines 4. Project 7. Combination Ability of Promising Multivoltine Lines (Performance of Multivoltine and Their Reciprocals) 5. Project 9. Screening for Disease and High Temperature Resistant Silkworm 6. Project 12. Adaptability Trials of Silkworm Hybrids Under Philippine Climatic Types 7. Project 13. Performance Evaluation of DMMSU Hybrids in the Different Seed Cotton Areas 8. Project 2. Development of Bivoltine Purelines 9. Project 2. Hybridization and Genetic Improvement of Mulberry Varieties 10. Project 3. Development of Multivoltine Purelines 11. Project 3. Triploid Induction in Mulberry 12. Project 4. Combining Abilities of Promising Silkworm Strains (Combining Ability Trials of Promising SW Strains) 13. Project 4. Screening of Mulberry Varieties for Cocoon Yield and Quality, Resistance to Diseases and Environmental Stress 14. Project 5. Development of Double Cross Hybrids Machine 	
II. Production		
A. Cocoons	<ol style="list-style-type: none"> 1. Study 4. Reeling Performance of Multivoltine and Bivoltine Cocoons 2. Study 12. Evaluation of Different Types of Rearing Houses 3. Project 16. Silkworm Egg Production and Preservation 4. Project 18. Silkworm Rearing Management/Cocoon Production Tech. 5. Study. Effect of Varying High Temperature on the Performance of Silkworm 6. Pruning Techniques 7. Project 20. Silkworm Pest Management 8. Project 10. Silkworm Resistance Studies on Viral and Fungal Diseases 9. Project 11. Silkworm Resistance on Bacterial and Pebrine Diseases 10. Project. Development of a Farming Systems Model Through Sericulture Aquaculture Integration 11. Project. Development of a Sericulture Based Farming 	<p>1994-1996</p> <p>1996-1998</p>

Appendix Table 43. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
B. Mulberry	Systems Model For Pilot Sites of SRDI	
	1. Project. Technology Verification on Improved Mulberry Production Technologies For Various Agro-ecological and Agro-climatic Zones in the Philippines	
	2. Project 2. Cultural Management Studies in Mulberry	
	3. Project 1. Mulberry Establishment	
	4. Project 3. Approaches in the Management of Violet Root Rot of Mulberry (<i>Morus Indica</i> L.)	
	5. Project 2. Effect of Mulching Materials on the Leaf Yield of Mulberry Under Rainfed Lowland Conditions	
	6. Project 1. Pest Management of Mulberry	
	7. Project 2. Management of Mulberry Leaf Rust	
	8. Study. Water Management Study in Mulberry	
III. Post Production/Processing and Product Development	9. Project. Development of a Sustainable Mulberry-Based Sericulture Models For Lowland Irrigated Areas Through Intercropping and Biotechnology Strategies-Inoculation and Integrated Waste Recycling	
	1. Study 12. Appropriate Number of Twist Per Meter of Woven Silk Scarft Using Plain Weave	1994-1997
	2. Study 16. Development of Appropriate Design For Silk	1994-1996
	3. Study 26. Development of Appropriate Silk By Product Utilization	1994-1997
	4. Study 27. Utilization of Silk Waste	1994-1996
	5. Study 3. Raw Silk Quality as Affected by Methods and Duration of Cocoon Stifling	1994-1996
	6. Study 1. Design, Construction and Test Performance of Locally Manufactured Cocoon Dryer For Rural Areas	1994-1996
	7. Study 10. Design, Construction and Evaluation of Spinning Machine	1994-1996
	8. Study 11. Design, Construction and Evaluation of Moth Crushing Machine	1994-1996
	9. Study 12. Design, Construction and Evaluation of Disinfecting Machine	1994-1996
	10. Study 2. Design, Construction and Evaluation of Leaf Cutting Machine	1994-1996
	11. Study 3. Design, Construction and Evaluation of Waste Disposal Carrier	1994-1996
	12. Study 4. Design, Construction and Evaluation of Acid Treatment Bath	1994-1996
	13. Study 5. Design, Construction and Evaluation of De-Flowering Machine	1994-1996
	14. Study 6. Design, Construction and Evaluation of Priming Machine	1994-1996
	15. Study 7. Design, Construction and Evaluation of Cyclo-	1994-1996

Appendix Table 43. Continued.

RESEARCH AREA	STUDY TITLE	DURATION
	mixer	
	16. Study 8. Design, Construction and Evaluation of Flying Shuttle Handloom Weaving	1994-1996
	17. Study 9. Design, Construction and Evaluation of Warping Machine	1994-1996
	18. Study 1. Development of Transporting and Packaging Materials	1994-1997
	19. Study 2. Raw Silk Quality as Affected by Methods and Duration of Cocoon Drying	1994-1996
	20. Study 5. Characterization of Cocoons and Raw Silk Produced at Farmers' Fields	1994-1996
	21. Study 6. Storage of Steam Stifled and Hot Air Dried Multivoltine and Bivoltine Cocoons and Its Reeling Performance	1994-1996
	22. Study 7. Raw Silk Quality as Affected by Pre-Steamming of Long Stored Cocoons	1994-1996
	23. Study 8. Development of Cocoon Storage Materials (Strains)	1994-1997
IV. Socio-economic and Marketing	1. Study 11. Impact Assessment of the Technical Training Program in Sericulture	1996-1998
	2. Impact Assessment of Sericulture Piloting	1994-1996
	3. Study 2. Impact Assessment of Sericulture as an Industry in the Philippines	1994-1997
	4. Study 7. Economics of Silkworm Egg Production Using 1/4 Hectare in La Union	1994-1997
	5. Study 1. Socio-economic Evaluation of DRDAP Assisted Sericulture Project in Region 1	1994-1997
	6. Study 10. Comparative Economic Study of Mulberry, Mango and Banana Based Farming System	1994-1999
	7. Study 3. Identification of Problems and Issues Affecting the Pace of Sericulture Development in the Philippines	1994-1996
	8. Study 5. Survey of Marketing Channels of Silk and Silk Allied Products in the Philippines	1994-1996
	9. Study 8. Economics of Mix Cropping in Mulberry	1994-1996
	10. Study 9. Feasibility of Hand Reeled Raw Silk For Village Handling Industry	1991-1996

Appendix Table 44. List of On-going researches on silk conducted by the DMMSU.

RESEARCH AREA	STUDY TITLE	DURATION
I. Post Production/Processing and Product Development	1. Study 15. Determination of Appropriate Yarn Size for Specific Silk	1994-2000
	2. Study 15. Development of Water Softener	1996-2000
	3. Study 20. Dyeing of Silk Fabric Using Indigenous Materials	1996-2000
	4. Study 21. Effects of Liquor Ratio and Dipping Duration on the Quality of Silk Products	1996-2000
	5. Study 22. Quality of Silk Fabric Using Varying Concentration and Duration of Bleaching Materials	1996-2000
	6. Study 23. Effects of Commercially Available Textile Paint on the Printed Silk Fabric	1996-2000
	7. Study 28. Maximum Utilization of Waste Cocoon Through Development of Cocoon Fashion Accessories and Gifts	1996-2000
	8. Study 29. Design, Development and Evaluation of Dress Accessories and Collectors Items From Silk By-products	1996-2000
	9. Study 24. Studies on Special Finishing Techniques	1996-2000
	10. Study 13. Improvement of Manually Operated Reeling and Re-reeling Machine	1996-2000
	11. Study 14. Design, Construction and Evaluation of Steaming Chamber	1996-2000
	12. Study 16. Design, Construction and Evaluation of Non-Conventional Boiler Machine	1996-2000
	13. Study 17. Design, Construction and Evaluation of Pupa Removing Machine	1996-2000
	14. Study 18. Design, Construction and Evaluation of Degumming and Drying Vat Machine	1996-2000
	15. Study 19. Development of Hydroextractor	1996-2000
	16. Study 20. Design, Construction and Evaluation of a Solar Cocoon Dryer	1996-2000
	17. Study 21. Design, Construction and Evaluation of Silk Production Equipment	1996-2000
	18. Study 22. Design, Construction and Evaluation of Silk Winding Machine	1996-2000
	19. Study 13. Influence of Storage Duration on Commercial Characteristics of Multivoltine and Bivoltine	1994-2000
II. Production	1. Study 9. Reeling Performance of Bivoltine and Multivoltine Cocoons Using Pan and Conveyor	1994-2000
III. Socio-economic and Marketing	1. Study 13. Development of an Alternative Sericulture Project Industry Cooperator Businessman's Approach/Strategy	1996-1999
	2. Study 14. Economics of Thrown Silk Yarn Production	1994-2000
	3. Study 25. Economics of Spun Silk Production	1994-2000
	4. Study 6. Economics of Cocoon Production Under Various Agro-Ecological Conditions	1994-2000

Appendix Table 45. List of completed researches on multi-commodity/fiber crops conducted by various institutions, 1988-1999.

RESEARCH AREA	INSTITUTION	COMMODITIES	STUDY TITLE	DURATION
I. Varietal Improvement	ESSC	Abaca	1. Adaptability Trials of Abaca Varieties in Eastern Samar	1995
	USM	Ramie	2. Germplasm Collection, Maintenance and Evaluation of Ramie	
II. Crop Production	DA-R.1	Cotton	1. Seed Multiplication:F. Cotton	1992-1996
	PSU	Salago	2. Response of Salago to Different Levels of Irrigation	
	PSU	Salago	3. Response of Salago to Different Rates of Fertilizer	
	CLSU	Silk	4. Silkworm Cocoon Pilot Project and Development	
	FPRDI	General	5. Identification Handbook of Philippine Bast Fiber Producing Trees and Shrubs	
III. Post Production/Processing and Product Development	WMSU	Silk	6. Sericulture Project (Phase II)	1996
	FPRDI	Abaca	1. Pilot Scale Production and Utilization of Lignin From Waste Liquor of Commercial Pulping of Abaca for Cement Additive	
	FPRDI	Abaca	2. Production and Utilization of Abaca Mechanical Pulp as Extender to Secondary Fiber for Printing Paper Manufacture	1996
	FPRDI	Abaca	3. Utilization of Abaca and Banana Fiber Waste for the Production of Cement Bonded Board	
	PTRI	Silk	4. Development of an Array of Silk Products From Spun Silk Yarns	
			5. Improvement of the Natural Fiber Pretreatment Technology Thru Biotechnology Techniques	1994-1996
IV. All	MMSU	Silk	1. Sericulture Research and Development Program	
	NVSIT	Silk	2. Sericulture Project	

Appendix Table 46. List of on-going researches on multi-commodity/fiber crops conducted by various institutions, 1988-1999.

RESEARCH AREA	INSTITUTION	COMMODITIES	STUDY TITLE	DURATION
I. Varietal Improvement	USM	General	1. Germplasm Collection, Evaluation and Maintenance of Fiber Crops (Pineapple, Kenaf, Jute, Salago, Etc.)	1995-2005
II. Crop Production	USM	Salago	1. Integrated Research and Development of Salago	1996-2005
III. Socio-economic and Marketing	RSC	Silk	1. Establishment, Development and Management of Community-Based Sericulture Industry in Rizal	19996-2000

Appendix Table 47. Technologies generated for abaca and commercialized by NARC-VISCA, 1988-1998.

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
A. Technologies Generated and Commercialized	
1. Recommended Abaca Varieties	<ul style="list-style-type: none"> Two varieties suited for specific end uses are recommended for commercial planting: the Inosa for the cordage and pulp and paper industry and Laylay for the fibercraft industry. These varieties are high-yielding, moderately resistant to pests and diseases, drought and strong winds.
2. Intercropping Annual Crops with Abaca	<ul style="list-style-type: none"> Annual crops such as peanut, sweet potato, pearl millet and upland rice can be intercropped with abaca during the early stage of growth. These intercrops provide additional source of income and as source of food to farmers while waiting for the abaca plant to be harvested (up to the second month). Taro, ginger and pineapple can be planted as intercrops during the later stage of growth of abaca. These intercrops were found to contribute to more than 50% of the total gross income of the farm.
3. Intercropping Abaca with Established Fruit Trees	<ul style="list-style-type: none"> Abaca can be planted as intercrops with established fruit trees such as lanzones, rambutan, durian, cacao and citrus spaced at 8 x 8 m apart to maximize land utilization, increase farm income, suppress weed growth, minimize pest and disease infestation, and improve the growth of trees
4. Rapid Sucker Production Through Decapitation Method	<ul style="list-style-type: none"> Developed a technique of rapid propagation or production of suckers through decapitation. The stalk of the mother plants (6-8 mm old) is cut at the base and punctured by a piece of pointed bamboo. The technology is now used by farmers to enhance more production in their abaca nurseries. By using this technology, a greater number of suckers/eyebuds can be produced in a relatively shorter time.

Appendix Table 47. Continued

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
5. Portable, Mechanical Abaca Spindle Stripping Machine (Steel Model)	<ul style="list-style-type: none"> • Developed and fabricated an efficient, cost effective and portable abaca stripper which can be dismantled and carried by 5-6 persons or attached to a sled pulled by carabao or carried in a tractor; the machine has an output capacity of 80-150 kg dried fibers per 8-hr operation; can serve 10-15 hectares of abaca plantation. • Fabricated a total of 19 units for individual farmers, farm cooperatives, private individuals and organizations in Region 8 (15 units), Bicol (1 unit), Region 7 (1 unit), CARD-Davao (1 unit), and CARAGA (1 unit). • Additional units are being fabricated for abaca cooperatives in Burauen/District II of Leyte Province (5 units) and CARAGA. • The machine facilitates stripping in hilly areas and produces more fibers of higher quality. • It provides additional source of income to owners of the spindly stripper. About 20-30% of stripped fibers are paid to the owner of the machine. • It has shorter payback period than the fixed spindle stripper. The portable spindle stripping machine is cheaper, costing PHP 60,000 to PHP 75,000 depending on the engine compared to the cost of the fixed stripper developed by FIDA which is PHP 180,000 to PHP 200,000.
6. Abaca Slicer-Shaver	<ul style="list-style-type: none"> • Developed and fabricated gadgets for processing abaca wastes (outer leafsheath) into higher value products. • It facilitates slicing and shaving of abaca wastes, and bamboo splits for handicraft production. • Fabricated more than 100 units for abaca farmers, cooperatives and interested individuals. • Already used in Surigao and Agusan Sur (CARAGA), Leyte, Southern Leyte and Samar (Region 8), Cebu and Negros Oriental (Region 7).

Appendix Table 47. Continued.

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
7. Collapsible Wooden Molders of Different Sizes and Shapes for the Production of Various High-Value Handicraft Products	<ul style="list-style-type: none"> • Developed collapsible wooden molders of different sizes and shapes for the production of products from abaca wastes, nito and bamboo from scrap lumber or wood. • Fabricated more than 200 units of molders for farmers' cooperatives, rural women and other interested individuals as ordered by FIDA, DTI, LGU and NGO. • It is easy to use and facilitates production of high-value products of different shapes and sizes especially in abaca-growing areas.
8. High-value Handicraft Products from Abaca Wastes (outer leafsheaths) and Reject Fibers and Innermost Leafsheaths	<ul style="list-style-type: none"> • Developed high-value products from abaca wastes; increased value added to the abaca plant; efficient waste management through proper utilization of waste products. • Creates livelihood and employment opportunities for OSY, housewives, disabled individuals, and farmers, especially in the countryside. • Contributed to the increase in income of abaca farmers, teachers, government employees, OSY's and • ROI of 28.7% obtained for backpacks • Products of cooperative exported to Hawaii, Europe, Australia, Japan, etc.
9. Handmade Paper From Abaca Stripping Wastes	<ul style="list-style-type: none"> • 40-50% pulp can be recovered from stripping wastes • Pulp is used for making handmade paper for the production of novelty products such as fans, tissue holders, envelopes, as material for water color painting, packaging materials, etc. • Creates livelihood and employment opportunities to OSY's, housewives, students and other unemployed of the community. • Contributes to waste management in abaca areas.

Appendix Table 47. Continued.

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
10. Mushroom Culture using Abaca Wastes	<ul style="list-style-type: none"> • Hanging dried leaves, outer leafsheaths and tuxy wastes are used as growing medium for mushroom culture. • Increased value added to the abaca plant. • Generated/provided employment opportunities and source of income to OSY,s, housewives and others. • Solved problems of waste disposal and eliminated breeding ground of pests and diseases. • Provided source of nutritious food and helped solve the malnutrition problem in rural areas.
B. Technologies Generated and Ready for Commercialization	
1. Abaca Collection in the VISCA Germplasm	
a. Promising Abaca Accessions	<ul style="list-style-type: none"> • A total of 567 abaca collections, consisting of 442 cultivated species, 39 hybrids and 89 wild relatives have been collected from all over the country and maintained in the genebank to widen the genetic base for breeding work in abaca; 100 of these accessions are already duplicated <i>in vitro</i>. Characterization as to morphology, fiber chemical characteristics, physical properties and fiber quality resulted to the selection of a number of promising accessions suited to specific end uses. • Identified and selected 16 high-yielding promising abaca accessions for field evaluation trials; 20 promising accessions possess the desired chemical characteristics suited for the pulp and paper manufacture and 17 promising accessions possess long, strong, ivory white, lustrous and with slightly uniform to uniform fibers suited for the handicraft industry. • Identified promising potential parental materials and widened genetic pool available for varietal improvement work in abaca to support the future of the abaca industry. • Planting materials of these collection were given to IPB, UPLB for duplication as active collection (271), for finger printing (98), and to FIDA-Bicol for disease screening (50). • Selected 5 high-yielding (1.5 to 3.0 kg/ha) promising accessions from the field evaluation trial.

Appendix Table 47. Continued.

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
a. Promising Abaca Accessions	<ul style="list-style-type: none"> Identified and recommended the commercial planting of 2 abaca varieties: Laylay (for fibercraft) and Inosa (for pulp and paper).
b. Promising Abaca Hybrids	<ul style="list-style-type: none"> MABIP has a pending order of 50,000 seedpieces of tissue cultured Laylay variety to be planted in Abuyog penal colony in support of their weaving industry. Five promising abaca hybrids (Linawaan x Tangongon, Inosa x Canarahon, Gaes x Canarahon, Korokotohan x Canarahon, and Samoro x Tangongon) were selected and identified to be high-yielding (1-3 tons/ha/year) and possess good quality fibers suited to specific end uses which will greatly increase income of farmers if proven to have stable yield across different agro-climatic conditions.
2. Intercropping Abaca with Established Fruit Trees	<ul style="list-style-type: none"> Abaca can be intercropped with established fruit trees such as durian, cacao, rambutan and citrus. Abaca planted between durian and citrus performed better in terms of number of suckers, stalk circumference, leaf number and fiber yield than those between lanzones. Only light intensity is significantly correlated with yield among the biophysical data taken. Will increase income of farmers, maximize land use, minimize weed growth and pest/disease infestation.
3. Companion Crop for Abaca at Early Stage of Growth	<ul style="list-style-type: none"> Intercropping annual crops such as peanut and sweet potato had higher net return than mungbean, upland rice and cowpea. Increased income for abaca farmers and served as alternative source of income while waiting for the first harvest of abaca.
4. Creeping Legumes as Live Mulch for Abaca	<ul style="list-style-type: none"> Creeping legumes such as <i>Desmodium ovalifolium</i>, <i>Centrosema pubescence</i> and <i>Calopogonium muconoides</i> could be planted as good cover crops under abaca grown under coconut. Creeping legumes can be used as live mulch for abaca to maintain soil fertility. Planting of creeping legumes under abaca grown under coconut could be more profitable by increasing and maintaining the fertility of the soil; sustain productivity of abaca farm.

Appendix Table 47. Continued.

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
5. Distal Eyebuds as Better Source of Planting Materials for Abaca	<ul style="list-style-type: none"> • Eyebuds taken from the distal portion of the corm have higher germination percentage. • Plants taken from the distal end of the corm matured either earlier compared to those taken from the distal end. • Source of planting materials
6. Biological Control of Corm Weevil and Toxicological Studies of <i>Metarrhizium</i>	<ul style="list-style-type: none"> • <i>Metarrhizium anisopliae</i>, an entomopathogenic fungus which can cause 68-88% mortality of the weevil, is a biological control agent for the abaca corm weevil isolated from the different abaca growing areas in Eastern and Central Visayas. • Toxicity tests showed no harmful effect on both native chicken and broiler • The fungus can be easily cultured using corn grains as medium • Will reduce dependence on insecticide which pollutes the environment to control the weevil; environment-friendly
7. Portable Moisture Meter	<ul style="list-style-type: none"> • Prototype of the portable moisture meter was developed using cheaper and locally available materials; sensitive multi-tester can determine moisture of fibers at room temperature and even at high temperature (90°C). • Will be used in determining moisture content of abaca fibers, hence, will minimize cheating or mixing wet dried fibers as practiced by some farmers. • Maintain fiber quality to command higher price.
8. Portable Tensile Strength Meter	<ul style="list-style-type: none"> • The prototype tensile strength meter is made of locally available materials, easy to use and can be operated by a farmer. • Has an estimated total weight of 30 kgs and the breaking load of one sample with 10 fiber strands can be determined in 30-40 seconds. • Will be used in determining the tensile strength of fibers for the fibercraft industry. • Easy to operate and can be carried from one place to another for ease in determining fiber strength.

Appendix Table 47. Continued.

TECHNOLOGIES/SIGNIFICANT INFORMATION GENERATED	STATUS/MAJOR ACCOMPLISHMENTS
9. Village Level Twisting and Twining Machine	<ul style="list-style-type: none"> • The prototype machine can produce 1/8th diameter continuous twisted yarn at approximately 300 m/day. • Made of locally available materials and easy to operate. • The twine can be used in making sacks, bags, doormats, slippers, hammocks and others. • Generates employment/livelihood opportunities in the rural areas.

Source: VISCA-NARC

Appendix Table 48. FIDA-generated technologies generally adopted by farmers by region, Philippines, August-December, 1998.

REGION	NO. OF FARMERS INVOLVED	TECHNOLOGY ADOPTED	RESULTS
I	Abaca - 3		
	3	Recommended planting density	*Suggestions were followed
	3	Regular weeding	
	Sericulture - 13		
	5	Proper plant distance	*Right timing of application of
	5	Proper pruning	chicken dung promotes
	1	Mulching	production of mulberry leaves
	4	Fertilizer application	
	1	Pest and disease control	
	10	Leaf harvesting	
	10	Proper disinfection and sanitation	
	7	Liming	*Rice hull charcoal was applied
	10	Regular bed cleaning	instead of lime yet the effect is
	8	Proper bed spacing	the same as that of lime
	10	Proper leaf feeding	*In terms of production, it was
	8	Regularion of temperature and relative humidity	observed that those fed with
	5	Leaf preservation	Batac variety of mulberry
	10	Proper mounting	produced higher cocoon yield
	10	Proper cocoon harvesting	than those fed with Alfonso or
	10	Proper cocoon sorting and classification	other varieties.
V	1	Proper cocoon drying	
	3	Proper cocoon packaging	
	49		
	2	Tissue culture plantlet	
	15	Recommended variety	
	8	Recommended plant density	
	35	Regular weeding	*More fiber was produced
	4	Intercropping	
	16	Shading	*More suckers/disease free
	21	Pest and disease control	*More suckers/healthy plants
	4	Roguing	
	8	Chemical application	
	8	Impregnation	*Good quality of fibers
	4	Fiber waste composting	
	24	Harvesting mature stalks	*Well-maintained plantation
X	19	Pre-grading of fibers	
	20	Proper drying of fibers	
	299		
	1	Tissue culture plantlet	*Minimized presence of diseases
	125	Recommended variety	*Increased production
	77	Recommended planting density	*Increased production

Appendix Table 48. Continued.

REGION	NO. OF FARMERS INVOLVED	TECHNOLOGY ADOPTED	RESULTS
X	67	Regular weeding	*Minimized AMV
	9	Fertilizer application	*Normal growth of plants
	2	Cash cropping	*Increased farmers' income
	9	Intercropping	*Increased farmers' income
	2	Trap plants	*Provided good quality/tensile
	20	Shading	strength of fibers
	25	Roguing	*Minimized expenses
	1	Chemical application	*Provided good quality fiber
	1	Abaca eyebud propagation	* Provided abundant supply of
	5	Harvesting mature stalks	disease-free planting materials
	3	Pre-grading of fibers	
	5	Proper drying of fibers	

Source: FIDA, Individual Monitoring and Evaluation Report of Regional and Division's Activities and Accomplishments in Extension as of December, 1998.

Appendix Table 49. CRDI- generated technologies.

TECHNOLOGY	APPLICATION/GROWING CONDITION	PRESENT EXTENT OF UTILIZATION	REMARKS
CROP PHYSIOLOGY			
1. Auxins, Cytokinins and Gibberellic Acid as Plant Growth Regulators (increases sympodia and productivity)	Apply at squaring and early flowering stages	Not in commercial use	Worth considering to use but must be coupled with good pest management
2. Ascorbic acid and seasoil as cotton growth regulators (improves vegetative growth and productivity)	Apply at early squaring and early flowering stages	Not in commercial use	Worth considering to use but must be coupled with good pest management
3. Pix and cycocel as cotton growth regulators (vegetative growth retardant but increases productivity)	Apply at early squaring and early flowering stages	Not in commercial use	This technology allows to increase plant populations per unit area; Applicable in cotton rainfed areas wherein over vegetative growth occurs
4. Cotton Defoliant (Def 6 and Dropp)	Apply pre-harvest at 60% flossing stage	Not in use	Technology applicable where rains are unpredictable at harvest time
5. Micronutrient Recommendations (B, Zn, Mn, Cu)	Apply at foliar when the deficiency occurs	Boron was the only one emphasized in early 1980's	Requires expertise to diagnose the deficiency in the field
6. Fruiting and Shedding Behaviors of Cotton Varieties	From squaring to flowering to bolling and flossing stages	Not in commercial use	For crop breeding research; Tedious but basic and important information in varietal description
7. Leaf area and LAI Estimation by ODW Method	At any crop stage	Noted some thesis students using it	For research use (agronomical character)
8. Drought Tolerance in Cotton (chemical/ laboratory tests)	At 70-80 DAE cotton grown in the field	Used in an undergraduate thesis	For research: basic data for germplasm
9. Salt Tolerance in Cotton (chemical/ laboratory tests)	At 70-80 DAE cotton grown in the field	Used in an undergraduate thesis	For research: basic data for germplasm
10. Field Monitoring Cotton Growth Patterns/ Models and Productivity	At all growth stages		Okay for use
CROP BREEDING			
1. Use of New Cotton Varieties			
a. UPL-Ct2	All cotton production areas; general adaptability	60%	A total of 10 new varieties; others varieties include UPL-Ct1 and UPL-Ct3, among others; has germplasm collections
b. CRDI-1	All production areas; best in Mindanao	30%	
c. CRDI-2	Recommended for Luzon and Visayas	10%	

Appendix Table 49. Continued.

TECHNOLOGY	APPLICATION/GROWING CONDITION	PRESENT EXTENT OF UTILIZATION	REMARKS
CROP PROTECTION			
1. Crop Pest Monitoring System	21087 DAP	Researchers, farmers	
2. Insect Pest Management	Before and after planting	Portions are being utilized by farmers	Mostly cultural and chemical portion
3. Weed Management	Before planting until 47 DAP	Researchers, farmers	
4. Seed Treatment	Before planting	Researchers, farmers	Few
5. Pesticide Management	21-87 DAP	Researchers, farmers	Not so much on the proper dosage at specific crop stage
AGRONOMY AND CROPPING SYSTEMS			
1. Minimum Tillage Method of Establishing Cotton After Rice	Suitable in areas where harvesting rice is late	Utilized by few cotton farmers	Allows earlier time of planting cotton and lower production cost
2. Garlic-Cotton Relay Cropping Pattern	Suitable in areas where cotton is grown	Practiced by a few cotton farmers	More income is derived from the technology compared to monocrops
3. Planting Distance	Practiced in all cotton growing areas throughout the country	All cotton farmers	Locations with varying soil and agro-climatic conditions differ in planting distances
4. Cultivation (Off-barring and Hilling-up)	Practiced in all cotton growing areas throughout the country	Some cotton farmers	Maybe optional in areas where weed is not a problem
5. Cotton Establishment	Practiced in all cotton growing areas throughout the country	All cotton farmers	Dibbling is done in minimum tillage Hill-dropping and covering seed with fine soil is practiced in conventional method
6. Cotton and Legume Intercropping (Cowpea, mungbean, peanut, soybean)	Suitable in non-weedy areas; suitable in all cotton growing areas throughout the country	Practiced by some cotton farmers	More profitable than cotton monocropping
SOILS AND CHEMISTRY			
1. Fertilizer Requirement	General recommendations were revised in areas where more or less soil conditions are the same where fertilizer trials were conducted	Adopted by most farmers in Luzon and Visayas	Cannot be totally adopted in Mindanao due to uncertainty of rains
2. Fertilizer Placement and Time of Application	The technology is now adopted; basal and sidedress application of fertilizer is most suitable in areas where irrigation is available	Adopted by most farmers in Luzon and Visayas	Cannot be totally adopted in Mindanao due to uncertainty of rains

Appendix Table 49. Continued.

TECHNOLOGY	APPLICATION/GROWING CONDITION	PRESENT EXTENT OF UTILIZATION	REMARKS
3. Critical Soil Test Value of Phosphorus	Phosphorus recommendation were adjusted based on soil analysis	Adopted by most farmers in Luzon and Visayas	
4. Foliar Fertilizer	It is used as supplement to recommended rate of inorganic fertilizer to further improve yield; used to check nutrient deficiency		
AGRICULTURAL ENGINEERING			
1. Irrigating Cotton Based on Pan Evaporation	21-41-61-80 DAE (light to medium soil) 25-53-77 DAE (heavy soil).	Incorporated in the RCPT but converted into DAP, DAE or WAE or WAP	
2. Irrigating Cotton Based on Available Moisture	Feel method	Incorporated in the RCPT	
3. Irrigating Cotton Under Minimum Tillage Condition	4-8-10-14 WAE	Incorporated in the RCPT	
4. Irrigating Cotton Under Limited Water Supply	Water stress at vegetative and squaring stage up to 10 days of temporary wilting		For use by researchers
5. Soil Molders	For use in cotton transplanting technique		Piloted in Candon, Ilocos Sur
6. Transplanting Cotton	Applicable in areas where the preceding crop is harvested late and planting within the cropping calendar is not possible also applicable in saline areas		Piloted in Candon, Ilocos Sur
7. Minimum Tillage Cotton Planter	To reduce high cost of planting cotton under minimum tillage condition		Tested in farmer's field but commercialization was hampered by budgetary constraints
8. Mechanical Planter-fertilizer Applicator	To reduce cost of planting operations		The machine uses expensive delinted seeds
9. Cotton Delinter	For delinting cottonseeds using technical grade sulfuric acid solution as delinting medium; for is in mechanized planting operations		Delinting of seeds is not environmentally-friendly

Appendix Table 49. Continued.

TECHNOLOGY	APPLICATION/GROWING CONDITION	PRESENT EXTENT OF UTILIZATION	REMARKS
10. Weeder/cultivator	Reduce weeding/cultivating expenses		
11. Harvested Seedcotton Technique	Three times harvesting at 1/3, 2/3 and 100% flossed bolls using improvised bags such as apron and bamboo basket	Incorporated in the RCPT	
12. Low Volume Spray Nozzle Technology	A low cost fine-mist sprayer nozzle which fits into the common farmer knapsack sprayer	Incorporated in the RCPT	
13. Planting Calendar for Cotton	Developed based on agroclimatic indices; applicable in all cotton growing areas of the country	Incorporated in the RCPT	

Source: CODA