

PROJECT DATA SHEET

1. TRANSACTION CODE

A = Add  
 C = Change  
 D = Delete

Amendment Number

1

DOCUMENT CODE

3

2. COUNTRY/ENTITY

LAC Regional

3. PROJECT NUMBER

598-0579

4. BUREAU/OFFICE

LAC/DR/RD

5. PROJECT TITLE (maximum 40 characters)

LAC Crop Credit Insurance Systems

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)

MM DD YY  
 1 2 3 1 8 4

7. ESTIMATED DATE OF OBLIGATION

(Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 77 B. Quarter 4 C. Final FY 84

8. COSTS (\$000 OR EQUIVALENT \$1 = )

A. FUNDING SOURCE	FIRST FY 77			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	( 100 )	( )	( 100 )	( 6,110 )	( )	( 6,110 )
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S. 1.						
Other U.S. 2.						
Host Country					12,813	12,813
Other Donor(s)						
<b>TOTALS</b>	100		100	6,110	12,813	18,923

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH. CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) FN	241	041		4,375		1,735		6,110	
(2)									
(3)									
(4)									
<b>TOTALS</b>				4,375		1,735		6,110	

10. SECONDARY TECHNICAL CODES (maximum 5 codes of 3 positions each)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To develop viable crop credit insurance organizations that protect LDC farmers and their sources of financing.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM YY  
 0 4 8 1 0 4 8 4

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000  941  Local  Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a \_\_\_\_\_ page PP Amendment.)

Funding for Life of Project and the Project Period are amended as described in the PP.

17. APPROVED BY	Signature	18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION
	Title	
	Date Signed MM DD YY	MM DD YY

April 15 Draft  
ORIGINAL

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I. FACE SHEET

II. RECOMMENDATIONS

Approval for the following is recommended:

- A. That life of project grant funding be increased by \$1,735,000 to a new total of \$6,110,000; and
- B. That the project completion date be extended from August 31, 1983 to December 31, 1984.

III. PROJECT BACKGROUND AND DESCRIPTION

Attempts to design programs to guarantee agricultural loans invariably lead to systems resembling crop insurance. This was usually been rejected, however, as too difficult and too costly for developing countries. Close examination in 1976 revealed that, although it was a long shot, crop insurance was theoretically feasible and might even be practical under certain circumstances. The two most important of these conditions would be the linking of insurance to banking, thus leading to the now accepted title "crop credit insurance," and the injection of business discipline into the insurers management.

The identification of a series of potential collateral benefits argued for a positive social benefit/cost analysis. The financial analysis was more questionable, however, as it was assumed that subsidies would be required to reach small farmers who would require relatively high administrative expenditures for the premiums that they would pay. But, since no successful small farmer, LDC crop credit insurers existed, it was impossible to say with certainty whether or not this was true. A review of the insurers in existence determined that they owed their failures to poor design and/or management rather than some factor which makes crop insurance, per se, infeasible.

Once feasibility was accepted as a premise, we were able to posit two hypothesis. These are:

- A. Farmers, who would be able to transfer certain production risks to the insurers, would be willing to accept more risk in other ways. Specifically, they would use more of the modern technologies which agencies such as ours are trying to develop and promote. A corollary to this is that, after suffering losses, they would be better capitalized than uninsured farmers and would also be more likely to return to production quickly and at optimal levels; and
- B. Lenders, including public and private, formal and non-formal, would face less risk and reduced costs and would be more willing to lend to small farmers than what had previously been the case. A corollary here is that the position of private sector lenders would be particularly enhanced

since the crop credit insurance mechanism would provide an alternative to the Government Ag Bank, which until then was the major permanent institution serving this clientele.

The project was designed to test these hypothesis. Since there were no successful programs already in operation at which we could look, it was necessary to create the laboratory before starting the experiment. This was done by beginning new insurers in Ecuador and Bolivia and linking up with the insurer which had been started the year before in Panama. It was also intended to gather and analyze data from the portions of the Mexican program which were believed to provide an opportunity for insight into some of the research questions. (Because of anomalies in its programs, Mexico later turned out to be inappropriate as a research site, thus necessitating the wait for the other three countries until meaningful data could be gathered.)

This effort would allow us to:

- A. Develop the basic crop credit insurance technology which was lacking, even in the more developed countries;
- B. Gather data, cost, actuarial and otherwise, which was needed for efficient management of the program;
- C. Test and demonstrate the feasibility, or lack thereof, of the concept; and
- D. Train the personnel who would be called on to replicate the program if successful.

The final major element in the project design was the identification of the need for some kind of international pool with which to fund the very large disasters that occur from time to time. This was to be studied and reported on during the project.

As originally conceived, the experimental crop insurers were to have been government entities. But, the need for the study of the reinsurance issue led to the present understanding of the need for private sector participation. Briefly, the situation is as follows.

If one intends to insure only the larger of the commercial farmers, it is probably possible to build a self-supporting commercial system in the private sector. This scheme would use a private local company to write the business and the international commercial reinsurers to spread the risk.

If one intends to insure smaller commercial farmers; then the catastrophic nature (i.e., statistically dependent exposure units of the crop hazard, the immense size of the potential loss, and the expense of reaching LDC small farmers as well as their financial marginality make government's participation necessary. Political management of catastrophic type insurances leads to a loss of discipline with respect to an insurer's loss ratio. Once this begins to consistently exceed 1.00, commercial reinsurance becomes impossible because it is being used as a source of subsidy rather than as a risk spreading

mechanism. The government, therefore, must pay for all losses; but, if it is poor, as are most AID clients, this is impossible. The crop insurance program inevitably becomes a living bankrupt (or a financial Zombie, if the reader will allow a more graphic term) like so many LDC national financial and service agencies.

The "cure" is to retain the government but to introduce private insurance companies between it and the farmers. Government becomes a regulator, finances and partial reinsurer; roles which it can perform well. With the financial discipline of the private insurers reinjected, the international commercial reinsurers are able to make their risk spreading services available again.

This is an unusual approach to the private sector and development. It is recognized that neither sector can successfully provide crop insurance to small, commercial, LDC farmers. Working together in a "partnership of the sectors", it would seem possible to have truly viable schemes.

If the project provided affirmative answers to the various questions presented above, a second stage (CCI II) would be proposed. Here the first three insurers would be developed beyond the pilot level and new insurers begun in other countries.

To implement the project, a total of \$4,375,000 was approved. This was to be spent over a period of five years and used as follows.

Sub-grants to the three countries for operating expenses.....	\$2,162,000
Grant to IICA, the implementing organization.....	\$1,884,000
RSSA with USDA for support to project management.....	\$ 329,000

IICA, the Interamerican Institute for Cooperation on Agriculture was chosen to implement the project. Although it had no capacity in the agricultural insurance field, neither did anyone else at that time. It was believed that, at least, IICA's activities in the field of agriculture would be complementary to the insurance task. The public sector nature of IICA nor its inability to self-fund were not considered at that time.

IICA put together a competent team of advisers who have generally developed a good knowledge of the topic. They obtained a charter for the Bolivian insurer, ASBA, in 1980, and for the Ecuadorian insurer, CONASA, in 1981. The Panamanian insurer is called ISA.

The quantitative research is being carried out by a small staff of economists at IICA. They are looking at the impact of crop credit insurance on lenders as well as farmers, and are gathering actuarial and cost data needed for managing operations. A second line of research, which is non-quantitative and is

concerned with the interrelated areas of finance and general management, is being carried out by the project's two senior staff members: N. Maurice of USDA and W. M. Gudger of IICA. Details of this research are reported in section IV, F.

#### IV. SUMMARY FINDINGS

##### A. Preliminary Findings

In a very general and preliminary manner, the research to date tends to support the following propositions.

1. Crop credit insurance is feasible.
2. Farmers are concerned about risk. The usefulness of the insurance being directly proportional to the amount of risk present, crop credit insurance is more likely to promote the adaptation and continued use of modern technology in high risk than low risk situations.
3. In moderate and low risk situations, insurance is useful for introducing modern technology but not essential for farmers to keep on using it. (Neither, it appears, is credit.)
4. Crop credit insurance can be a necessary, but not a sufficient, factor in getting lenders to provide or expand production credit to farmers.
5. Lenders see crop credit insurance as a way to lower their risk and operating expenses.
6. Crop credit insurance could be used to enhance efforts for developing private sector lending programs.
7. The insurance can be self-financing for a certain class of larger farmers, but requires outside support if small scale commercial farmers in LDC situations are to be served.
8. With very careful and business-like management of the financial and risk portfolios, and of affairs in general, crop credit insurers can be self-financing with surprisingly small farmers. Puerto Rico, working mostly with small farmers, had an unsubsidized and reasonably successful program for over thirty years. Yet, small farmer oriented programs elsewhere failed because of the juxtaposition of indulgent management and inadequate subsidies. Indeed, even the Puerto Rico program has run into this kind of trouble and has had to be bailed-out by the U.S. Federal Government. We do not yet know at what farm size subsidies become indispensable but are aware of the enormous impact of management on the need for outside financial support.
9. Many of the subsidies enjoyed by the world's present insurers are granted for political rather than purely financial reasons.

10. Losses stem from two primary sources rather than one as had been originally conceived. The first cause, of course, includes the natural causes such as weather, insects, and disease. The second, and frequently larger, source is institutional. Mismanagement arising from political interference is a serious and endemic problem among crop insurers. This is called moral hazard among insurers.

11. An international pool funded by donors or the LDC's themselves is infeasible where the moral hazard problem is not controlled. Control mechanisms are being developed by this project.

12. Commercial reinsurance has been demonstrated to be available when the moral hazard is controlled. It is capable of providing a large part of the capital financing needed by the crop insurers, but does not have the capacity to reinsure the catastrophic hazards from a very large number of nations. Development bank participation will be required.

13. The use of private sector insurers would control the moral hazard problem, but in LDC's they do not have the kind of assets necessary to underwrite the heavy start-up and capital costs involved in crop credit insurance. Governments have this financial ability, but reinject the moral hazard problem.

14. A model called "The Partnership of the Sectors" can overcome these problems. It is successfully being used in South Africa and is now being introduced in the US. Here the insurer is private and runs its own business and obtains its own reinsurance. The government enters by providing a subsidy which is fixed by contract as a percent of premium so as to bring the total premium up to an actuarially adequate rate. It may also under certain circumstances that are not yet well known provide surplus reinsurance to complement that available from the private market.

15. Crop insurance demands heavy inputs of management and assistance to management. If the TA agency is linked to the reinsurance brokerage agency (TA/B), the technical assistance cost can eventually be shifted to the insurer.

16. The development impact from crop credit insurance seems to derive more from the credit than the crop side. The implication of this is that AID might also find other developmentally oriented credit insurances to be useful.

17. AID has at least one instrument (Sec. 222A of the FAA) and possibly others which can support development through credit type insurances.

## B. Achievements

In addition to the enhancements of knowledge listed above, the project has achieved the following accomplishments.

1. A corps of eleven solid, international technicians has been created, and another group of approximately three times as many has also been trained at the national level.
2. A good amount of data has been collected and analyzed in Panama and the process begun in Bolivia and Ecuador.
3. The three project insurers have been started or assisted, plus insurers in Venezuela, Chile, and Australia have been started (with extra-project funding). Assistance has also been given to about 15 other countries.
4. Underwriting (or cookbook) knowledge of how to do crop insurance has been developed and disseminated.
5. Knowledge of costs, of losses, and of economic impacts have been developed and disseminated.
6. Conferences involving research scientists, bankers, insurers, and government leaders have been held.
7. Linkages have been built to other development institutions so as to test the validity of our work and increase its impact.

#### C. Status of the Panama Program

The Panamanian insurer, ISA (Instituto de Seguro Agropecuario) created in 1975 as part of the process of restructuring the agricultural sector, was designed to protect small and medium size farmers from severe losses. ISA began pilot operations in 1976. In its seven cycles of insurance, ISA has become a nationwide program insuring a substantial part of the official credit extended to agriculture as well as growing volumes of private sector credit. This can be seen in Table 1 on page 9. The agricultural and livestock portfolios are well balanced and highly dispersed, and are shown in Table 2 on page 10. A large portion of the agricultural portfolio, however, remains in the dry Pacific region.

Recent decisions by the government of Panama to remove the administrative subsidy from the public sector agricultural development bank, the Banco de Desarrollo Agropecuario (BDA), has created a dramatically increased demand for ISA's insurance. The BDA would like to insure its entire portfolio with ISA or alternatively, only issue loans to producers who meet ISA's criteria for insurance. This would appear to portend a major growth for ISA.

This rapid growth is occurring at a time when ISA is prepared administratively to manage it but is suffering very heavy losses due to drought in the sorghum and rice producing areas. The administrative costs have declined substantially to about 3.5% of coverage. For ISA to cover all administrative expenses from premium incomes and not require subsidies, these costs must be lowered to 1.5% - 2.0% of coverage. The recent computerization, financed through the IICA-ISA agreement, promises to contribute significantly to reducing the costs of manual accounting, policy emission, and record keeping.

Table No. 1: PANAMA: SUMMARY OF ISA'S OPERATIONS

	1976/7	1977/8	1978/9	1979/80	1980/1	1981/2	TOTAL
<b>TOTAL PORTFOLIO</b>							
Coverage	\$25,898	1,129,579	2,636,498	8,131,592	13,114,208	13,449,904	38,487,679
No. policies	9	351	809	2,114	2,722	2,785	8,790
Indemnities	1,588	17,784	102,462	194,642	402,143	969,270	1,687,889
Net premium	1,165	58,723	113,815	331,567	519,579	761,812	1,786,661
Loss ratio	1.36	0.3	0.9	0.59	0.77	1.27	0.94
<b>CROP INSURANCES</b>							
Coverage \$	25,898	1,130,433	1,887,511	4,575,710	6,806,637	8,894,768	23,320,957
Hectares	122	5,410	7,307	13,988	16,183	18,328	61,338
No. policies	9	351	525	1,284	1,446	1,796	5,411
Indemnities	1,588	17,784	93,731	130,451	290,013	753,969	1,287,536
Net premium	1,165	58,723	103,741	269,630	356,261	456,950	1,246,470
Loss ratio	1.36	0.3	0.9	0.48	0.81	1.65	1.03
<b>LIVESTOCK INSURANCES</b>							
Coverage \$	---	---	748,987	3,555,862	6,307,571	4,605,136	15,217,556
No. of head	---	---	3,392	11,677	18,969	13,885	47,923
No. policies	---	---	284	830	1,276	989	3,379
Indemnities	---	---	8,731	64,191	112,130	215,301	400,353
Net premium	---	---	10,074	61,937	163,318	304,862	540,191
Loss ratio	---	---	0.87	1.04	0.69	0.70	0.74

Table No. 2: PANAMA: ISA'S PORTFOLIO STRUCTURE 1981/2

INSURANCE LINE	COVERAGE	NET PREMIUM	INDEMNITY	LOSS RATIO	%AGR PORT.	%ANIMAL PORT.	% TOTAL
<b>CROPS</b>							
Rice	5,080,265	251,545	184,193	0.73	57	---	38
Maize	1,545,080	77,151	54,710	0.71	17	---	11
Sorghum	1,107,285	54,104	323,645	5.98	12	---	08
Tomato	689,078	46,650	85,130	1.82	08	---	05
Beans	25,060	1,273	6,596	5.18	*	---	*
Onions	448,000	26,224	99,691	3.80	05	---	03
Totals	8,894,768	456,947	753,965	1.65	100	---	66
<b>ANIMALS</b>							
Feeder cattle	1,020,569	52,537	34,236	.65	---	22	08
Breeding bulls	603,632	54,340	51,930	.96	---	13	04
Breeding cows	2,920,683	185,047	127,099	.68	---	63	22
Others	60,252	12,937	1,600	.12	---	01	*
Totals	4,605,136	304,861	214,865	.70	---	100	34
<b>GRAND TOTAL</b>	<b>13,499,904</b>	<b>761,808</b>	<b>968,830</b>	<b>1.27</b>	<b>100</b>	<b>100</b>	<b>100</b>

\*Less than 1/2 of one percent

At the same time that ISA's administration is preparing for a major expansion, the experience in the field has cast considerable doubt upon the adequacy of the premium structure. At present, agricultural insurance premiums vary between 3% and 7% while livestock premiums vary from 2.5% and 6%. During the first six cycles of insurance, the overall loss ratio was 0.94%. However, in the 1981-82 agricultural year a drought which caused very heavy sorghum losses pushed the loss ratio to 1.65, the first year that the loss ratio had exceeded 1.00 since 1976-77 (see Table 1). Unfortunately, this loss has been followed by an even more severe loss, again due to drought, on rice. The loss on rice alone in the 1982-83 agricultural year will probably exceed \$3 million. Continued losses of this size are obviously unsustainable.

In order to identify the source of these losses and to design a program that will produce both a balanced portfolio and an adequate premium, the IICA technical staff has undertaken a study to identify the source of losses. Two factors have been identified which are responsible for most of the losses. The first and most important is the structure of the portfolio and the premiums charged. Both the weight of the productive activities in the overall portfolio and the correlations within the portfolio are important variables. Table 2 shows clearly one of the major imbalances in the portfolio. Rice constitutes a full 60% of the agricultural portfolio and 38% of the total portfolio. Although rice has never had a loss ratio greater than 1.00, the loss ratio has steadily increased from 0.08 in 1978-1979 to 0.73 in 1981-82. The obvious conclusion is that rice premiums must be recalculated and adjusted upward for the progressive increase in the loss ratio.

The IICA team has presented a plan to ISA wherein, once the volume of business (coverage) reaches \$25 million, they could be viable by carefully selecting their risk portfolio. They are currently insuring about \$13 million. Viable here means that they could survive on their small subsidy they are now receiving from the GOP, and would not require large scale bail-outs every few years from the government. The GOP, however, has refused to allow ISA to manage its risk portfolio or to charge an adequate premium. This has resulted in a large loss this year and the likely loss of ISA's access to reinsurance.

This year's large loss has sensitized the GOP to the financial implications of the current management strategy. This increases the probability that we can persuade the GOP to review its policy regarding ISA, and to restructure it along the lines of the partnership of the sectors model. This is the key task facing the project staff in Panama.

#### D. Status of the Bolivia Program

The severe economic crisis of the Bolivian economy continued and worsened in 1982. The hyperinflation continued and the Bolivian Peso continued to lose ground against the dollar. The principal institutional source of agricultural credit, the Banco Agrícola Boliviano (BAB), lacked liquidity to enable it to channel significant volumes of credit to the agricultural sector. As a result, the economic crisis severely affected the agricultural sector. The continued turn-over of governments and high public officials, contributed to the chaotic economic situation.

Economic conditions affected and conditioned the development of the Aseguradora Boliviana Agropecuaria (ASBA) by choking off most avenues of growth and reduced the value of its reserve to a fraction of its past worth. As there were limited volumes of credit, the expansion of the agricultural and livestock credit insurance was very difficult. Many of the insurance coverages that were to be issued for the 1981-82 agricultural year have been reprogrammed for the 1982-1983 agricultural year.

Notwithstanding the general crisis, ASBA was able to significantly expand its portfolio. Building on the experience gained in the potato insurance program in the Melga region of Cochabamba Valley, ASBA expanded potato coverage to another area in the same valley at a lower altitude. Pilot potato insurance operations were undertaken on a small scale in Tarija in the Iscayachi area. New offices were opened in the Departments of Potosi and Tarija; ASBA now has offices in four major agricultural departments, La Paz, Cochabamba, Potosi and Tarija. An office in Santa Cruz is scheduled to open in early 1983. The number of crops insured on a pilot basis was also expanded from maize, potatoes and eight species of vegetables to include fruits, oats, wheat, soybean, garlic, peanuts and sorghum. At the same time that the portfolio was expanding, ASBA has actively sought to work with private sector lenders, which include private banks and cooperatives.

In addition, ASBA was able to initiate the pilot stages of the new insurance products. The first livestock policies were issued, and more importantly for the operating results of ASBA, significant volumes of group credit life insurance was issued.

At the close of the 1982 agricultural year (June 30, 1982) ASBA had 181 agricultural insurance policies with a total coverage of \$b/8 million; 807 insureds in its credit life program with a total coverage of approximately \$b/73 million; and had just issued its first two livestock policies. The 1982 agricultural year also closed with ASBA having 2,500 requests for agricultural credit and group credit life insurance with a total coverage of about \$b/75 million that could not be issued due to a lack of credit.

Administratively, ASBA has completed its conversion from a quasi-state agency of limited duration into a mutual insurer. At the same time, the new ASBA Mutual took over ownership of the reserve supplied under PL-480 Title III. Under the terms of ASBA PL-480 agreement these funds were to be used as premium subsidies exclusively for the BAB. The delivery of the reserve to ASBA Mutual relieves it of this obligation and will allow it to develop actuarially fair premiums based on actual experience.

ASBA, the project staff, and the Mission are now studying the possibility of using the authority contained in Section 222A of the F.A.A., to reinsure the portion of ASBA's portfolio that originates from private banks and coops.

The central technical assistance unit, working closely with the Bolivian insurer, has taken advantage of the recession in the Bolivian economy together with the continued financing of the administrative costs of AID/Washington to lay the basis for an expansion of the ASBA Mutual. When the current economic crisis ends, ASBA Mutual will have in place offices in five major agricultural departments, a large line of insurance products, a new administrative and legal structure and most importantly a well-trained staff. As credit begins to flow to the agricultural sector again, ASBA will be there to provide protection against natural risk.

An element of ASBA's operations which seems to impress all observers is its effect on technology adoption. This was predicted in the original project design and arises from two facts. First, with the insurance available, the farmers are more willing to try new ideas. Second, it is in the best interest of the insurance company to not sit and wait for losses to occur, but to be aggressive in extending technical assistance to farmers so as to prevent losses. We originally hypothesized that crop insurance would be an effective and efficient agricultural extension vehicles in LDC's. This certainly seems to be the case in Bolivia. ASBA is now studying how to charge (government?; banks?; farmers?) for these services so as to enhance its prospects for financial viability.

The major problem facing ASBA today is rooted in the traditional instability and poverty of the GOB. It is unlikely that the government can provide ASBA with the financial support necessary to overcome the elevated administrative expenses characteristic of Bolivia. To overcome this ASBA requires forceful technical assistance to help it become more of a commercial insurer. This would involve developing complementary product lines which could be written on a commercial basis, thus helping to lower the overall administrative costs. Also, the management of its risk portfolio in the manner developed in Panama will help reduce the overall riskiness of its business and will increase the likelihood of obtaining commercial reinsurance.

Thus, it is hoped that the severely eroded reserve (due to exchange rate instability) can be professionally managed and preserved. This is a major step for ASBA Mutual in transition from a limited duration pilot project under government sponsorship to a new insurer serving the needs of the agricultural sector with effective risk management tools.

#### E. Status of the Ecuador Program

The Ecuadorian insurer, CONASA, whose creation was initially delayed due to internal GOE political considerations, began its gradual planned expansion in 1982. After an initial pilot operation with potatoes in 1981, CONASA began in 1982 to issue coverage for potatoes in Carchi, rice in Guayas and two types of corn: hard corn on the coast and soft corn grown in the mountains. In addition, livestock insurance was initiated, mostly of registered dairy stock, including both semen bulls and dairy cows.

The underwriting results were expected to produce a loss due to the slight spread of risk and a lack of knowledge on the insurers' part of the risks it was accepting, thus producing adverse selection. The actual results were as adverse than expected, as shown in Table No. 3, on the page 14.

Table No. 3: ECUADOR: CONASA'S 1982 EXPERIENCE

INSURED LINE	NO. OF POLICIES	COVERAGE	PREMIUMS	INDEMNITIES	LOSS RATIO
<u>CROPS</u>					
Potatoes (Carchi)	37	4,515,950	270,957	861,186	318.0
Rice (Guayas)	50	13,075,816	653,790	1,140,646	175.0
Hard corn (coast)	14	1,362,600	54,538	54,150	99.0
Soft corn (mountains)	13	1,071,000	42,272	22,428	53.0
<u>ANIMALS</u>					
Cattle	29	6,122,500	281,725	178,500	69.0
<u>TOTAL</u>	143	26,147,860	1,303,282	2,256,910	173.0

N.B.: Monetary figures are in Sucres. During the year 1982, the value of the Sucre sunk from 32 to the US Dollar to 76 to the Dollar.

While a net loss of 954,000 Sucres is not serious, the implied risk premium of 19% for potatoes and 9% for rice will make it difficult indeed for farmers to accept insurance on these two basic staples. For the present, the corn and cattle premium rates seem adequate.

Obviously, at this stage we do not know whether 1982 was an atypically bad year or if CONASA has been adversely selected against. Several more agricultural cycles are necessary to develop a more accurate understanding of the risks insured and the premiums required.

The total paid-up capital is 10,750,000 Sucres of which the Banco Nacional de Fomento has contributed 4 million Sucres and the Ministry of Agriculture 6,150,000 Sucres. The Government thus owns about 95% of the company. The remaining 5% is owned by three private sector partners. The total investment portfolio of CONASA is now valued at about 12.5 million Sucres. In addition, the Central Bank has constituted a reserve of almost 30 million Sucres to be delivered to CONASA in annual installments during the life of the pilot project.

While CONASA has adequate financial resources to develop a much larger program of agricultural insurance, the results to date suggest that the slow incremental growth of the portfolio should continue until a better knowledge of the frequency and severity of production risks is acquired. While this necessarily implies high administrative costs, the alternative of trying to achieve economies of scale and risking a ruinous loss is far less attractive.

In this pilot stage of the project in Ecuador, two concrete achievements can be cited. First, an operating agricultural insurer has been created. Second, and more importantly, agricultural producers have in large and growing numbers recognized the utility of insurance as an instrument to manage production risks. Thus, the groundwork has been laid for a steady expansion to other areas, crops and activities as soon as we are able to gather, process and analyze sufficient data to permit us to set adequate premium rates and develop the administrative system to reach large numbers of highly dispersed producers.

One major shortcoming must also be recognized. Because of excellent technical support from IICA here, the administrative accomplishments of the firm are quite impressive. However, (in the opinion of N. Maurice) the management strategy and structure of the firm will surely push it towards being a welfare agency and away from being a professional insurer. When AID funds are eventually withdrawn and with the normal changes in government and the possible diminution of GOE financial support, the technical staff will probably evaporate. Therefore, the impressive administrative capacity vulnerable and should be seen as ephemeral. "Hardening in" of this capacity can probably only be done by changing CONASA into a GOE reinsurer/regulator/financier and by bringing in the domestic private insurers in the manner of the "Partnership" model. CONASA's management has refused to consider this possibility and a stalemate exists between the project staff and CONASA's management.

In order to overcome this stalemate and to involve GOE policymakers beyond CONASA's direct management in a policy dialogue, an evaluation has been scheduled for late April and May of this year. Unless the GOE is sufficiently affluent to finance its way through the inefficiencies of political management (In which case, why is foreign aid necessary?) restructuring is the most immediate concern here.

## F. Status of the Research Activities

### 1. Background

Our research activities began late in 1979 with the organization of a research team. As our work was the first empirical studies to be conducted under field conditions with functioning insurers, we had first to create the insurers (except in Panama) and second, create a methodology and a data base. As a result, our work concentrated on Panama and upon empirical and methodological issues in 1980 and 1981. During 1981 and 1982 we were confident enough of our methodology to begin to undertake the initial field work first in Bolivia and then in Ecuador. At the end of 1982, our data base for Bolivia is adequate to undertake analysis with a substantial degree of confidence. In Ecuador, another year or two of data gathering is required before the time series data base is adequate for complex linear programming models to be applied with a moderate degree of confidence.

Thus, it may be fairly said of our pioneering research into agricultural insurance that the first stage was a learning process for the team. We first had to refine the research objectives contained in the AID-IICA Grant into empirically researchable issues within the context of the countries and within the constraints imposed by both data limitations and political sensitivities. Our second task was to design methodologies that would produce both theoretical insights as well as policy-relevant information to guide the development of the insurers. Once we learned what questions to ask, how to ask them, and what the answers mean, we were in a position to begin to produce information, data, and policy analysis that is relevant beyond the national context in which they were developed, particularly to other countries and to donors considering initiating programs. The timing of the creation of this new research technology has been serendipitous. Many countries in the Western Hemisphere and around the world are facing a new more difficult financial situation which necessitates restructured agricultural credit systems and more effective risk management practices. With the initial development stage behind us, the project staff is in a position to assist other countries in their study of the feasibility and justification of insurance and to build administratively, financially, and technically efficient insurers.

## 2. The Data Base

The data base was designed to address a related set of issues which were identified as being important to determining if agricultural credit insurance is a viable rural income stabilization policy. As we a priori hypothesized that the effects of the introduction of agricultural insurance would be manifested at several levels, we designed our data set to provide information to analyze.

- a. Farm level effects of insurance.
- b. Ex-post evaluation of farm production and income when insurance was used to induce new technologies.
- c. The farmer's attitude toward insurance.
- d. The effects of insurance on loan recovery and the administrative costs of credit.
- e. The long-term impact of insurance on bank growth.
- f. Alternative management policies impact upon the development of a viable insurer.

The data collected for these studies was based upon the data required to operationalize models of socio-economic and financial behavior of individuals and institutions. While these analyses are mostly quantitative, they are enriched with insights derived from anthropological field research and survey research. Of particular interest to the research was the congruency between the behavior predicted by our models and the actual reactions of farmers.

The data file of the project currently includes:

- a. Farm surveys among insured and non-insured farmers in Bolivia (1979-80, 1980/81 and 1981/82), Panama 1980/81) and Ecuador (1981/82);
- b. Historical annual data on yields, production, prices, and trade, among other variables, for the main products in most countries of Latin America for the period 1960-1980;
- c. Time series monthly and daily information of selected weather variables for several meteorological stations in Bolivia and Costa Rica for the period 1950-1980.
- d. Selected variables (premiums, indemnities, and coverage) of the insurance portfolios of the programs in Israel (1967-1980); USA (1950-1980), Costa Rica (1970-1981) and Panama (1976-1982).
- e. Disaggregated information for each insurance policy issued between 1986/77 and 1981/82 by the Agricultural Insurance Institute of Panama (ISA), including approximately 5,000 records.
- f. Sample information for insured and non-insured loans issued by the Agricultural Development Bank of Panama (BDA) between 1975 and 1980, including 1700 records;
- g. Financial structure of development banks in Latin America providing credit to agriculture for the year 1975-1980 and,
- h. Various statistical and programming models.

These data generated in the countries and released to IICA by governmental and international organization are cleaned, organized and stored at IICA's Computer Center in San Jose. The Center has IBM-360/40 equipment and appropriate software which includes SAS (for statistical and econometric analysis) and MPSX (for the solution of mathematical programming models). Because the IICA facilities are of limited capacity to solve large models or when working with large data files, the project has recently gained access to the University of Costa Rica and CATIE's large and modern computer centers.

### 3. Farm Level Studies of Credit, Insurance and Technical Assistance

In Panama, farm level studies were carried out in two similar but climatologically distinct districts, Bugaba in Chiriqui Province and Guarare in the Azuero Peninsula. In Bugaba, we found that farming is not a hazardous undertaking, therefore in our model, the debt default constraint is not binding even at the 5% risk level (in fact, it became marginally so only at the .00001% level). Under these conditions there would be slight demand for insurance and, if taken, would have only a marginal impact on farm income. In fact, premiums would be three times indemnities. It need not be said that the insurance would not have been bought under a voluntary program with the present premium rates.

In contrast, on the typical farm (about 5 hect.) in the Guarare district, insurance has a substantial impact on the level and stability of farm income. Insurance in this drought-prone area accounts for a 50% income differential.

Agricultural credit insurance is viable only so long as farmers are charged an actuarially fair premium that does not contain transfer payments to other areas and zone. In our research, it was quite notable that in the first area, the insurance was resisted while actively sought in the latter. Clearly farmers can evaluate their risks and make implicit loss cost calculations to compare with the premiums they are charged. This, in turn, for the insurer implies that premiums must be charged on the most disaggregated basis possible and as close to actuarial fairness as feasible. It also seems to suggest that relatively small farmers whose operations are exposed to substantial climatological risks can usefully incorporate insurance into their overall risk management strategy. This finding appears to modify the argument that farmers, especially small, diversified, semi-commercial operators, have adequate traditional risk management techniques to make insurance unnecessary and redundant. Our findings are to be contrary.

A second series of farm level surveys were conducted in Cocle and Los Santos on very different types of farm operations. The farmers surveyed were commercial irrigated tomato producers with production contracts with a nearby processing plant. Thus, the producers were unlikely to be affected by drought (unless the river dried up). Likewise, the production contracts removed the price risk. Under such conditions would crop credit insurance be useful? The first year that insurance was offered, 540 hectares out of 684 hectares were insured; the following year 860 hectares of the 876 hectares planted were insured. One can quickly see the reason for the widespread acceptance of insurance under what appear to be exceptionally secure production conditions.

The production cost of tomatoes is about \$1,500 per hectare (plus a substantial infrastructural investment which must be maintained and amortized) compared to \$340 (sorghum) and \$500 (rice) per hectare for the Bugaba and Guarare farmers. A single failure of the tomato crop could easily leave them heavily indebted to the bank and perhaps produce the loss of their irrigation equipment.

The motives for purchasing insurance by the Panamanian tomato farmers of Cocle and Los Santos are different than their smaller less commercial colleagues in Bugaba and Guarare. They appear to have sought insurance to manage the severe financial risk of capital intensive production by poorly capitalized enterprises. Their colleagues in Guarare sought to protect their much small investments from the ravages of weather. In the final analysis, it appears from our Panama data that farmers:

- a. Can understand and usefully utilize an actuarially fair crop credit program to manage climatological risk and its concomitant financial risk;
- b. As farmers move from subsistence to semi-commercial and capital intense commercial production, insurance becomes increasingly useful

Our research in Panama demonstrated that semi-commercial farmers operating under reasonably adverse conditions as well as commercial farmers utilizing capital-intensive technology could usefully adopt insurance as part of their risk management program. Left unanswered is the utility of insurance as part of a credit and technology package to help move farmers with an adequate resource base (land and climate) but unable to accept the financial risk of moving into commercial production.

To field test the utility of insurance for this class of farmer, we selected a group of potato farmers in the Cochabamba Valley. This area, Melga-Rodeo, is fairly typical of semi-commercial highland agriculture and is exposed to significant risks of drought and frost at critical periods of the vegetative cycle. Farm sizes were quite small averaging 1.3 hectares per insured farmers. These farmers, as well as an uninsured control group, were surveyed for three years. In summary, the results of the credit-technology-insurance package were impressive. An increase of about 25% in the amount of credit extended to farmers with an insurance guarantee was introduced along with a new "technology package" (principally improved seeds and agrochemicals). This raised average yield in a good year (1980/81) from 9,613 Kg/hect to 14,680 Kg/hect. Net income increased 4 fold due to the higher percentage of first grade potatoes.

The following cycle (1981/82) was a poor one in which the insurer paid heavy indemnities. While the yields of insured producers with modern technology fell more sharply than those of uninsured producers with more traditional technology, the insured producers still produced 1,400 kg. more than their colleagues. This experience also demonstrates once again that traditional technologies perform adequately under adverse conditions while modern technology is far more susceptible to less than optimal conditions. It is, however, precisely this "low level equilibrium" that we are attempting to break through with the introduction of the credit-technology-insurance package.

The net production incomes of non-insured farmers increased with respect to the previous year rising from Bolivian Pesos (\$B) 3,445 to \$B8,246 while insured farmers' incomes fell from \$B15,052 to \$B5,393, before insurance indemnities. When insurance indemnities are added to the total net income, insured farmers earned \$B9,312 compared to \$B8,246 for their uninsured colleagues. However, if the two years are averaged out uninsured farmers had an income of \$B5,846 while insured farmers' average income was \$B10,223 before indemnities and \$B12,182 after indemnities. If this pattern continues in future good and bad cycles, it argues that technology adoption can be profitable despite dramatic declines in income a frequent as one year in two, and even more so if insurance is included. A resume of these effects can be seen in Table No. 4, on page 20.

Table No. 4: RESOURCE USE, YIELDS, AND INCOME FROM POTATO PRODUCTION IN MELGA AND RODEO, BOLIVIA;  
1979 to 1982.

(current Bolivian Pesos per hectare)

VARIABLE	TRAD. TECHNOLOGY; NO INSURANCE			IMPR. TECH.; INSURANCE		FARMERS INSURED IN 1980/81, BUT NOT IN 1981/82
	1979/80 n = 148	1980/81 n = 51	1981/82 n = 59	1980/81 n = 38	1981/82 n = 33	
<u>TOTAL PRODUCTION COST</u> (Including interest and, for insured groups, insurance premiums.)	31,987	35,145	37,276	44,590	47,961	33,567
<u>TOTAL YIELD</u>	7,760	9,613	6,797	14,680	8,198	7,252
<u>GROSS INCOME</u>	36,881	38,590	45,522	59,642	53,353	51,854
<u>NET PRODUCTION INCOME</u> before insurance benefits.	4,894	3,445	8,246	15,052	5,393	18,287
<u>INSURANCE BENEFITS</u>	---	---	---	---	3,920	---
<u>NET INCOME</u>	4,894	3,445	8,246	15,052	9312	18,287

N.B.: A more extensive analysis of this situation is attached as Annex C. During this period, the Bolivian Peso varried from 25 to the US Dollar to over 300 to 1.

An unintended, but a most fortuitous, hybrid group emerged in our sample frame. A small group who were insured in 1980/81 but not in 1981/82 produced net incomes of \$B18,287. In a relatively poor year, incomes exceeding those either group in both of the two years in the sample frame. These incomes were achieved by modest reductions in amount of labor, organic fertilizer, insecticides and fungicides. The biggest cost reduction, the financial cost appears to have been eliminated (see the attached Table No. 5). Of course, the financial cost was not eliminated as farmers paid an opportunity cost of 30-40%, which is either the interest rate farmers could earn by investing these funds or alternatively the rate charged by informal lenders. Interestingly here is that farmers either used "mattress money" or borrowed from informal lenders to continue using a slightly modified new technology to produce yields slightly larger than their insured neighbors. We have, therefore, a clear example of adoption then adaptation where farmers have accurately evaluated the marginal return derived from each component of the package and adjusted their use to maximize returns.

Several interesting, if very tentative, conclusions can be drawn from this study. First, insurance is useful in helping induce technology adoption, which in turn provides higher than average incomes, even if the technology fails to produce as much net production income in poor years as traditional. Second, the new technology is first adopted, then adapted and used on a self-financed basis. Third, farmers incomes, while not optimal when compared to the small group in the last column of Table No. 5, are far more predictable when insurance is used to level income fluctuations. It clearly helps provide a steady predictable income stream. Finally, in our field work, the insurer had to assume many non-insurance functions such as obtaining storage and marketing facilities. This, on the one hand, dramatically raised costs but, on the other, clearly demonstrated that insurance is most useful when employed to manage yield variation a part of an integrated incomes stabilization policy.

#### 4. Future Research Issues

Our work and experience still has not been able to answer several questions which are crucial to the long-term viability of agricultural insurance. These questions form the agenda for the next phase of our work.

a. The administrative costs of pilot projects are inevitably high. As the project's insurers have grown, the per unit administrative costs have declined markedly. However, in the largest project insurer, Panama, an additional administrative cost reduction of about 50% is required for the insurer to be "self-sustaining": That is, the point at which the administrative costs are borne by premiums, not subsidies. Considerable effort will have to be devoted to innovative program design and management techniques to half administrative costs and thus relieve the insured of excessive charges for administration and the government of having to subsidize these administrative costs. The tasks becomes easier as farmers gain experience with insurance and realize that the program is a permanent feature of the agricultural sector and that their long-term interests are served by being able to obtain coverage year after year.

b. The pilot phase of the project has been characterized by intensive technical assistance for both management and field staff. This level of

assistance probably cannot be sustained over the long term due financial considerations as well as to the fact the small pool of trained agricultural insurance experts are spread over an increasingly large number of countries. Scarce and expensive expertise can most usefully be channeled to new emerging insurers. It probably cannot and should not become a permanent part of the insurers. Thus, insurers, will be "graduated" and will receive less intensive but more specialized periodic technical assistance than was formerly available through a resident technician. Can these insurers attract and retain enough high quality people to compensate for the continuity provided by the resident technician? The long-term viability of these insurers depends to a significant degree upon the quality of human resources they are able to recruit and train to utilize and improve the complex technology developed and installed by the technical assistance program. Future research must focus upon identifying, recruiting, training, managing, supervising, and motivating the personnel required for the success of these insurers.

c. Can we design insurers that can over the long-term cope with catastrophic losses? The project's time horizon is quite short; we have only been in existence for about four agricultural cycles. Yet, in each of the project countries we have had severe catastrophic losses. In fact in the same year, Panama and Ecuador have lost a major part of their rice due to drought in the former and floods in the latter. The loss in Panama was the second consecutive large loss. While it is to be expected that pilot project with extreme concentrations of risks will be far more subject to heavy losses than a well diversified program, some of the phenomena occurring in the short life of the project were so widespread that they would have increased losses exponentially for a large scale program. This four year period, based on aggregate data, appears to be atypical but we do not know at this stage with what frequency large losses occur, and thus cannot yet accurately estimate premiums and more importantly the reserves required to meet these losses. As a result, it is clear that future work and research needs to be focused upon developing an actuarial data base, and additional actuarial techniques which account for the unique lack of statistical independence between losses in agriculture. Likewise, creative methods of refinancing insurers after disasters have to be developed if they are to be viable over the long-term.

d. Finally, while within any given country there may be an inadequate spread of risk for an agricultural insurer to manage without an enormous reserve, those risks may be manageable through the international reinsurance markets. To date, reinsurers have shown a cautious interest and slight actual involvement. Reinsurers have as much difficulty determining reinsurance premiums as insurers have in setting adequate underlying rates to cover catastrophic losses. Whether these individual country risks can be aggregated and successfully managed through international reinsurance need careful systematic exploration as the long-term success of agricultural insurers depends upon an effective international risk spreading device. The methodological and statistical problems of measuring covariances of losses in a reinsurance portfolio are formidable. However, if the international reinsurance markets are to be involved over the long-term, portfolios that produce acceptable results are necessary.

V. REASONS FOR AMENDMENT

It became evident early that the implementation schedule was optimistic. The data expected from Mexico was hard to extract and then turned out to not fit the project's needs. Data that might have been available from Costa Rica, Puerto Rico, or in a very few other nations outside the region was similarly inappropriate.

This meant that we were even more dependent on creating new insurers and waiting for them to produce results. But, the time and difficulty involved was significantly underestimated. For example, it was necessary to convince several successive governments to first sign and then re-sign ASBA's charter. The delay in Ecuador was the greatest with the insurer not being created until three years after commencement of the project.

During the delays, the staff at IICA and here in Washington kept working; promoting the insurers, but consuming funds that were originally intended for the insurers. Prudence was demonstrated in the use of available funds, but inflation was strong during the period and continuing fixed costs could not be avoided.

VI. ISSUES

There are three important issues facing this project. The first, and most obvious, is whether the project should be extended or discontinued. The second has to do with the relationship between financial viability and the structure of the insurers themselves. And the last, is the choice of implementation vehicles. These are treated below.

A. The Extension Issue

The three basic options for this project, discussed below, are to terminate it, to move immediately to the previously planned second stage, or to extend the current first stage.

1. Termination: Should the project be terminated now?

This project is unique, there being none like it in any other development agency, bi- or multilateral. It is being followed by development, agricultural, and insurance professionals and by government leaders around the world. It promises to provide most of the anticipated benefits to farmers and lenders. It has led to some spin-off programs and has affected the shape of other programs in developed and developing countries alike. It fits well with AID's concern for agriculture as a source for food and employment. It fits well with AID's traditional interest in agricultural production credit. It has not been demonstrated to be infeasible, but it is extremely difficult to put into operation. It represents the kind of challenge that AID can handle so well.

This crop credit insurance project is consonant with the four keystones of AID's development strategy. First, it provides for significant technology transfer as LDC citizens are trained in the "how to's" of crop and other insurances. Second, it provides for institution building as the crop credit insurance company itself is established and as linkages are built with other national and international private and public agencies. Third, it strengthens LDC private sectors since the organization model now being developed emphasizes the private sector, and since already existing, international, private sector reinsurers are being recruited to support the catastrophe financing needs of the insurers. Finally, it engages the host countries and other development agencies in a unique policy dialogue as the governments must not only decide whether the economic and political benefits are sufficient to warrant the support required, but must also understand the performance and finance constraints which require the participation of both private companies and government agencies in a manner which we have labeled a "partnership of the sectors."

Given the real accomplishments and the continued promise of the project, termination seems inappropriate.

2. Second Stage: Should we go immediately to the second stage project?

The second stage (CCI II) was originally conceived as simply an increase in the first. It would continue to be centrally financed and managed. But, now that we have some field and operating knowledge, we feel that the USAID missions should pick up responsibility for local financing as well as a large share of the management responsibilities. We have discussed this with the missions and they are not adverse, but can not do so immediately. It will take time to work this cost into their budgets. Options of grant vs. loan as well as the very promising PL480 and 222A options need to be considered. Perhaps more importantly, time needs to be allowed for dialog to develop between the field and Washington on this.

It was also assumed that the decision to go on could be based on the completed research as well as on the successful pilot insurers. This not the case now and committing to CCI II project at this time seems premature.

The understanding of the importance of the private sector and of reinsurance presented above was not developed until the project had progressed considerably. At present, two of the insurers (CONASA and ISA) are classical government agencies and are not now operating nor can they be expected to operate free of moral hazard for an extended period of time unless their structure is reformed. This should be negotiated with the governments and implemented now as a condition for new funding rather than delayed until after the beginning of CCI II.

Given the need to bring the missions on board, to complete the research, and to negotiate the transformation of the insurers, it does not seem best to proceed immediately to CCI II.

We have argued that IICA is not the proper instrument for the first task. The second has a great impact on the effectiveness of the first as it provides not only leverage, but also enhances communications and make a project truly regional. Because this task sometimes involves the administrator in confrontations with the client, IICA has written us that it is no longer willing to provide this service. This is understandable, if IICA is understood to be in a conflict of interest position. The third function could be carried out at IICA, although there have been problems with technical and physical support (i.e., computers), cost, communication, and professional association. IICA has expressed an interest in continuing this function. But, to separate it from the first two would be to lose certain economies of scale as well as the heuristic benefits derived from the interactions of the economists and the nascent insurance professionals. Also, only part of the work of the economists deals with measuring the value of the project outputs. These people must also help to design systems that will increase the viability of the insurers and competence of its managers. The risk portfolio analysis performed in Panama is an example of this. If these scientists were to work in isolation, the insurance people would not learn from them and their own work would lose in relevance. Intimate collaboration is desired.

In the past few years; insurance companies, brokers/consultants, and reinsurers; have developed basic skills in this area. They have expressed a desire to provide technical assistance services, which not only provides a consulting profit but also allows them to position themselves in developing markets where they can be useful.

What is proposed here is that the project be continued at IICA until the current August 31, 1983 termination date and that the contract for its continued management after that date be immediately opened for proposals from professional insurers, reinsurers, and insurance consultants.

## VII. DETAILED PROJECT DESCRIPTION AND BUDGET

The goal and purpose level objectives remain essentially the same. The goal is still to increase total agricultural production and LDC farmer welfare; the purpose to develop viable crop insurers which protect LDC farmers and their sources of credit.

The project outputs remain the same with one exception-- a regional, public sector reinsurer (ALARA) will not be designed. Rather, a system utilizing the already existing international commercial reinsurers will be promoted. The other outputs are:

- A. Have three pilot insurers ready to be expanded to national level operations;
- B. The financial and technical feasibility and the economic efficiency of LDC crop insurance programs will be conclusively demonstrated or disproved;

To recapitulate, multi-peril crop credit insurance schemes involve heavy administrative expenses and very large loss exposures. LDC small farmers usually can not pay the full cost of these programs. This prevents the private sector from operating on its own and necessitates the entry of the public sector. The entry of government as financier and manager solves some of the financial problems, but it introduces social/political decision making and impedes access to commercial reinsurers. This prevents poor governments from having viable programs. When governments step back to the role of financier and regulator and allow private companies to manage the program, connections can again be made to the reinsurers and financial viability becomes more likely.

C. The Implementing Vehicle:

IICA was originally chosen to implement this project because of its involvement in agriculture, because there were no trained, international crop credit insurers anywhere, and because of internal AID time constraints. Also, IICA was seen to have entree at Ministries of Agriculture, which would be useful.

Fairly early in the process it was understood that this was more of an insurance project than an agriculture project. The fact the reference professionals inside IICA for the project staff were agriculturalists rather than insurers has left the staff professionally isolated and has limited their ability to aid the insurers. The fact that IICA refuses to hire insurance professionals ("they are not professionals and can not be classified") makes it all the more unlikely that the proper kind of advice be provided. (The project did have one insurance professional, but he quit. He is now available as a part time consultant.)

The description of the importance of structure on viability and of the resulting need to move towards the three tier, "Partnership" model as implementing organization with an ability to work with the private sector. IICA does not have this. It is a government institution, controlled by and serving other governments. It can not push politically unacceptable ideas; this is not in its own best interest. It can not argue against "Brute Force" paternalism and in favor of elegant cooperation when the Minister of Agriculture, who sits on IICA's Board, stand to be the immediate loser in any self-sacrificing effort to introduce the private sector.

In using IICA to implement this project, we are asking a competent technical (agricultural) and political organization to implement a financial and different kind of technical (insurance) project. If we were trying to improve potato genetic material, for example, we would not hire missile scientists or professional insurers.

The implementation of this project has involved three basic tasks:

Provide insurance technical assistance;

Administer the grant funds used by the national insurers; and

Measure the marginal benefits and costs of crop insurance.

This, of course, must be disastrous in a financial agency such as an insurance company (or a bank). The first place where one notices the effect of replacing "bottom line" with social/political decision making is with the commercial reinsurers. They are in the business of spreading risk -- geographically and over time. They do this efficiently and with a small profit margin -- Lloyds prides itself on returning 96¢ of every premium dollar over the long run. Crop insurers that try to use reinsurers as subsidy sources rather than as risk spreaders will find themselves unwelcome or will quickly lose any standing that they may have had. This is unfortunate because these are powerful institutions that already exist and that are capable of providing help if only the insurers would refrain from trying to latch onto unintended subsidies. The loss of the discipline of the "bottom line" is to be regretted.

We need government's participation. We need it to subsidize part of the high administrative expenses of small farmers. We need it to provide some protection when the very large losses occur. But, we would like to avoid the results of unrestrained social/political decision making. Can this be accommodated?

There are two basic models for a government to provide financial services to its citizens. The first, with two boxes labeled "Government" and "Farmers", is called the "Brute Force" model. Here government says that it is strong enough to overcome any problem and will simply bulldoze its way through with money. This model has no insulation between government and the citizens. When the hazards are catastrophic (e.g., draught for crop insurers, old age for social security systems), government's financial strength runs out quickly.

The second model, inserts the private companies as risk taking, insulators in the middle. Government retreats to the second level where it can be a reinsurer, a subsidizer of administrative expenses, and a regulator of corporate behavior. This, as was mentioned earlier, is the "Partnership of the Sectors" model. With it in place, the commercial reinsurers can come back in since they can trust that the private companies desire to avoid unnecessary losses.

With the privates in place, the development banks and agencies can also come in. To date, they have been staying out because they realize that they too will be vulnerable to the same kind of "milking" as the reinsurers. (See Annex B for the World Bank's Position Paper). The development banks and agencies could help spreading risk by taking retrocessions from the reinsurers. They could also make loans to the governments to finance their subsidy and guarantee operations. If the reinsurers and the development banks could safely enter, the insurance systems would have a high probability of becoming financially viable.

A government insurance system that isn't viable will not die. It will hire people and go through the motions. Because it will not have adequate funds (i.e., this is the definition of not viable) it will not pay losses nor provide other services. It will only serve as an employment agency producing an intangible, fictitious product. Compared to something basic and tangible such as road building, this would be a waste.

3. Extension: Should the project be extended until we are ready for CCI II?

Extending the project would require an additional 16 months, that is, until December 31, 1984, plus an increased authorization of \$1,735,000. During this time, we would prepare and review the PID and PP for CCI II, which will provide the funding for the central TA activities. We will assist in the preparation and review of assistance agreements in each of the three countries (If funding can not be worked out between the missions and the host governments, it should be included in CCI II. However, the first and best option would seem to be to fund at the mission level.)

B. Finance and Structure of the Insurers:

The two basic facts-of-life for multi-peril crop credit insurers are these:

1. The risks covered are catastrophic (i.e., statistically dependant within one country or region, or even wide areas of the world.). If one farmer suffers from a draught, many will suffer; and
2. The size of the risk is enormous. (The value added to the Latin American GNP was approximately \$60 billion in 1981.)

If the programs are designed to serve LDC farmers (small scall commercials and up), then there are two more facts-of-life to consider.

3. Administrative costs will be high in the absolute sense (because of, e.g., poor transportation/communication facilities) and relatively (because of the small policy size); and
4. Small, poor farmers will be hard pressed to pay any premium.

These factors combine to make it impossible for any private insurer to provide crop credit insurance on its own to small, LDC farmers. Using the international, commercial reinsurers, it is possible to spread the risks and overcome the effects of the first two factors mentioned above. The impact of the second two factors could be overcome by a private insurer if it chose to serve primarily large farmers and ignored our target groups.

The meaning of all this is that government must participate in any multi-peril crop insurance program that is going to be successful. But, government management brings with it a fifth fact-of-life.

5. The imperatives of politically managed systems are, and must be, social/political. The financial discipline of the "bottom line" is last.

C. Underwriting knowledge will be developed and disseminated; and

D. Approximately 50 personnel will be trained in various aspects of crop credit insurance management.

The inputs will be changed to allow for increased project funding. The effect of the changes can be summarized in Tables Nos. 5 through 8, beginning below.

Table No. 5: TOTAL ADDITIONAL BUDGET, LAC CROP CREDIT INSURANCE PROJECT

ITEM	1983*	1984	TOTAL	PERCENTAGE
<u>COUNTRY PROGRAM GRANTS</u>				
Panama	135.0	165.0	300.0	
Bolivia	90.0	130.0	220.0	
Ecuador	85.0	152.0	237.0	
Total country grants	310.0	447.0	757.0	43.6
<u>IMPLEMENTING AGENCIES</u>				
Personnel costs <u>1/</u>				
Technical Staff	144.5	217.0	361.5	
Support staff	15.3	23.0	38.3	
Total personnel	159.8	240.0	399.8	23.0
Administrative costs <u>2/</u>	40.0	60.0	100.0	5.8
Operating costs				
Travel & per diem	60.0	90.0	150.0	
Consultants	30.0	50.0	80.0	
Data management	20.0	40.0	60.0	
Other	20.2	33.0	53.2	
Total operating	130.2	213.0	343.2	19.3
Total implementing agencies	640.0	960.0	1,600.0	92.2
<u>SUPPORT RSSA (USDA'S FCIC)</u>	50.0	85.0	135.0	7.8
<u>TOTAL PROJECT COSTS</u>	690.0	1,045.0	1,735.0	100.0

All figures \$ 000.

1/ Detailed in Table No. 6.

2/ Estimated at 24.7% of personnel costs.

\* This budget covers the last 8 months of CY 1983 only.

Table No. 6: PERSONNEL COSTS OF IMPLEMENTING AGENCIES 1/  
(all figures \$000)

POSITIONS	POST	1983*	1984	TOTAL
<b>TECHNICAL STAFF</b>				
Project director	Costa Rica	27.6	42.6	70.2
Financial administrator	Costa Rica	22.3	34.5	56.8
Research coordinator	Costa Rica	27.5	42.4	69.9
Associate researcher <u>2/</u>	Panama	20.0	40.6	60.6
Associate researcher <u>3/</u>	Bolivia	9.7	-	9.7
Crop insurance advisor	Bolivia	14.4	21.6	36.0
Crop insurance advisor	Ecuador	23.0	35.3	58.3
Total		144.5	217.0	361.5
<b>SUPPORT STAFF</b>				
Bilingual secretaries (2)	Costa Rica	5.0	7.6	12.6
Secretary	Panama	4.0	6.0	10.0
Secretary	Bolivia	2.7	4.0	6.7
Secretary	Ecuador	3.6	5.4	9.0
Total		15.3	23.0	38.3
<b>TOTAL PERSONNEL COSTS</b>		159.8	240.0	399.8

1/ Includes salary and benefits.

2/ Starts July 1, 1983.

3/ Until August 31, 1983.

\* This budget covers the last 8 months of CY 1983 only.

Table No. 7: FUNCTIONAL COST ANALYSIS 1/  
(all figures \$000)

<u>FUNCTION</u>	<u>1983*</u>	<u>1984</u>	<u>TOTAL</u>	<u>PERCENTAGE</u>
<u>PROJECT COORDINATION AND TECHNICAL SUPPORT</u>				
Personnel costs	42.1	65.0	107.1	
Administrative costs	10.6	16.2	26.8	
Travel & per diem	20.0	32.0	52.0	
Consultants	12.0	20.0	32.0	
Other direct costs	4.0	6.6	10.6	
Total	88.7	139.8	228.5	13.2
<u>OPERATIONAL STRENGTHENING OF THE CROP INSURERS</u>				
Personnel costs	44.5	71.7	116.2	
Administrative costs	11.1	17.9	29.0	
Travel & per diem	12.0	16.0	28.0	
Other direct costs	8.2	13.2	21.4	
Subgrants	294.5	424.7	719.2	52.7
Total	370.3	543.5	913.8	
<u>DEVELOPMENT AND TRAINING OF CROP INSURANCE PERSONNEL</u>				
Personnel costs	32.0	48.0	80.0	
Administrative costs	8.0	12.0	20.0	
Travel & per diem	12.0	18.0	30.0	
Consultants	6.0	12.0	18.0	
Other direct costs	4.0	6.6	10.6	
Subgrants	15.5	22.3	37.8	
Total	77.5	118.9	196.4	11.3
<u>RESEARCH AND DEVELOPMENT</u>				
Personnel costs	41.2	55.3	96.5	
Administrative costs	10.3	13.9	24.2	
Travel & per diem	16.0	24.0	40.0	
Consultants	12.0	18.0	30.0	
Data Processing	20.0	40.0	60.0	
Other direct costs	4.0	6.6	10.6	
Total	103.5	157.8	261.3	15.0
<u>TOTAL IMPLEMENTING AGENCIES</u>	640.0	960.0	1,600.0	92.2
<u>SUPPORT RSSA (USDA'S FCIC)</u>	50.0	85.0	135.0	7.8
<u>TOTAL PROJECT</u>	690.0	1,045.0	1,735.0	100

1/ Includes country program grants as well as expenditures by the implementing agency.

\* This budget covers the last 8 months of CY 1983 only.

Table No. 8: COUNTRY PROGRAM GRANTS  
(all figures \$000)

COUNTRY	1983*	1984	TOTAL
<u>PANAMA</u>			
Personnel costs	57.5	74.6	132.1
Operating costs	38.5	57.4	95.9
Equipment	39.0	33.0	72.0
Total	135.0	165.0	300.0
<u>BOLIVIA</u>			
Personnel costs	30.0	48.7	78.7
Operating costs	34.0	48.7	82.7
Equipment	26.0	32.6	58.6
Total	90.0	130.0	220.0
<u>ECUADOR</u>			
Personnel costs	48.0	76.0	124.0
Operating costs	24.7	33.8	58.5
Equipment	12.3	42.2	54.5
Total	85.0	152.0	237.0
<u>TOTAL COUNTRY GRANTS</u>	310.0	447.0	757.0

\* This budget covers the last 8 months of CY 1983 only.

#### VIII. PROJECT ANALYSIS

The technical, social, economic, environmental and other analysis remain unchanged and are still valid. The basic cost/benefit and viability hypothesis still remain to be conclusively demonstrated. The types of benefits anticipated are being observed, but we have not yet been able to adequately measure whether the degree to which they occur is sufficient to overcome the costs of a full scale program.

#### IX. IMPLEMENTATION ARRANGEMENTS

##### A. Implementation Plan

The basis on which this project will be implemented can best be seen in the following list of activities.

### Research and Development

1. Conclude present LP modeling research to measure the impact of crop credit insurance on farmers and bankers. Target date: 8/83.
2. Develop financial management tools to assist insurers in underwriting, actuarial, and portfolio management. Target date: 6/84.
3. Develop insurance management tools to assist the insurers in loss control/adjustment, staffing and field management, and risk portfolio and data management. Target date: 6/84.
4. Improve field operations through revised manuals for underwriting, loss adjustment, and agronomic and veterinary diagnosis. Target date: 10/84.
5. Train management and staff to use the items developed above. Target date: concurrent.
6. Senior project management will produce a final evaluation and report. Target date: 10/84.

### Country Programs

#### Panama

1. Evaluation of financial and operating structure and prognosis of ISA. Target date: 8/83.
2. Policy dialogue with GOP to implement changes recommended from evaluation. Required changes anticipated: capital structure, range of risks insured, function of ISA (becomes a reinsurer), participation of private insurers, and legal structure. Target date: 6/84.
3. Policy dialogue with USAID/P to parallel above and to consider increased mission participation in managing and financing the Panamanian portion of this project. Target date: 9/84.
4. Implementation of tools developed by R & D program, and evaluation of their utility. Target date: 9/84.

#### Ecuador

1. Evaluation of financial and operating structure and prognosis of ISA. Target date: 5/83.
2. Policy dialogue with GOE to implement changes recommended from evaluation. Required changes anticipated: capital structure, range of risks insured, function of CONASA (becomes a reinsurer), participation of private insurers, and legal structure. Target date: 11/83.

3. Policy dialogue with USAID/E to parallel above and to consider increased mission participation in managing and financing the Ecuadorian portion of this project. Target date: 12/83.
4. Implementation of tools developed by R & D program, and evaluation of their utility. Target date: 9/84.
5. Upgrade quality of management, and central office and field staffs through training and incentive programs. Target date: 12/83.

#### Bolivia

1. Evaluation of financial and operating structure and prognosis of ASBA Mutual. Target date: 12/83.
2. Policy dialogue with PL 480 Commission to recapitalize depleted reserves and implement changes recommended from evaluation. Required changes anticipated: capital structure, and range of risks insured, Target date: 6/84.
3. Policy dialogue with USAID/B to parallel above and to consider increased mission participation in managing and financing the Bolivian portion of this project. Target date: 9/84.
4. Implementation of tools developed by R & D program, and evaluation of their utility. Target date: 9/84.
5. Upgrade quality of management, and central office and field staffs through training and incentive programs. Target date: 6/84.

#### Other Countries

1. Assist Honduran, Dominican, and Colombian private sectors develop programs and to obtain support from their respective governments and, except for Colombia, the Mission. Target date: commence 6/83.

#### Project Management

1. Select and place a contract for the continued project management and implementation with a private insurance consulting, management, or other firm. Target date: 9/83.

#### B. Evaluation Plan

Evaluation of all major second quarter project activities will be programmed for 1984. As the project purpose is to develop viable multi-peril crop credit insurance organizations to protect LDC farmers and their resources, the evaluation will consist of a team of insurance professionals and an agricultural economist. The insurance professionals will test and report on the viability of the insurers: Are they functioning efficiently? Have they learned insurance technology? Can they apply it to rating (setting premiums),

underwriting, and adjusting agricultural losses? Can they successfully manage their risk and financial portfolio? Are their managements able to obtain quality reinsurance? these basic conditions must be met by any insurer irrespective of the they insure and thus consitute the test of "viability".

As the three insurers are developing under sometimes quite adverse conditions in LDC's, additional factors must be evaluated:

Are they reaching their target populations?

Are administrative costs steadily declining?

Will they be able to mount nationwide programs serving a substantial portion of the agriculture sector?

Will they require continuous administrative and premium subsidies, or can these be phased out?

Have arrangements been made to provide the required subsidies necessary for the insurers to reach smaller, poorer farmers who can not be served on a commercial basis?

The second focus of the evaluation is to determine if the insurance is in fact protecting farmers and their sources of credit. A second, or independent, opinion will be provided by an agricultural or development economist through a review of the surveys of and visits to insured and uninsured farmers in the regions where the project operates.

The evaluation will require about 4 person months of work; \$40,000 has been allocated to the RSSA budget for this purpose.

X. ANNEXES

Annex A is the amended Log Frame.

Annex B is a recent publication of the World Bank, Agricultural Insurance, Policy Note No. 5

Annex C is an evaluation of the impact of multi-peril crop credit insurance on Bolivian faramers, The Interaction of Credit, Insurance, and Relative Prices on Technology Adoption.

**PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK**

Life of Project:  
From FY 78 to FY 94  
Total U.S. Funding \$ 110,000  
Date Prepared: \_\_\_\_\_

Project Title & Number: LAC Crop Credit Insurance Systems (598-0579)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS																																																																																																								
<p>Program or Sector Goal: The broader objective to which this project contributes:</p> <p>Increase total agricultural production and LDC farmer welfare</p>	<p>Measures of Goal Achievement:</p> <ul style="list-style-type: none"> <li>-Increased production and consumption of food products by farmers.</li> <li>-Farmers' income stabilized and increased.</li> </ul>	<ul style="list-style-type: none"> <li>-Project research component</li> <li>-Crop insurers' reports</li> <li>-AID evaluations</li> <li>-LAC/DR/RD supervisors</li> </ul>	<p>Assumptions for achieving goal targets:</p> <ul style="list-style-type: none"> <li>-Small and medium farmer food production continues to be an important host country priority in Latin America.</li> <li>-International donors and host governments will continue to support other programs designed to improve the performance of the small and medium farmer sector.</li> </ul>																																																																																																								
<p>Project Purpose:</p> <p>To develop viable multi-peril crop credit insurance organizations which protect LDC farmers and their sources of finance.</p>	<p>Conditions that will indicate purpose has been achieved: End of project status.</p> <ul style="list-style-type: none"> <li>-Established policies and procedures for the management of crop insurers.</li> <li>-A sound operating and financial, medium term plan for each insurer demonstrating viability.</li> <li>-Acceptance by private banks of insurance as collateral for loans.</li> <li>-Proposals submitted to national governments for improved crop insurance legislation.</li> <li>-An international technical assistance group experienced in crop insurance management.</li> <li>-Applications from 5 countries for assistance developing new programs.</li> </ul>	<ul style="list-style-type: none"> <li>-Project research and reports</li> <li>-Final Project Report to AID</li> <li>-Conferences, reports and publications</li> <li>-External auditor reports on insurers financial statements</li> <li>-AID evaluation reports</li> <li>-Technical assistance applications</li> </ul>	<p>Assumptions for achieving purpose:</p> <ul style="list-style-type: none"> <li>-Continuing favorable government attitude towards agricultural insurance</li> <li>-Increasing farmers understanding and acceptance of crop and live-stock insurance</li> <li>-Commitment of private banks to provide credit to small and medium farmers</li> </ul>																																																																																																								
<p>Outputs: Feasibility and acceptance of crop insurance demonstrated; projects ready to expand to national level; personnel trained; underwriting technology developed; research into management, costs, and benefits, effect on families completed; Panama reinsured, negotiation begun for Bolivia and Ecuador; financial programs involving mission (PL 480, Sec. 222A of FAA), development banks &amp; reinsurers developed; project experience disseminated</p>	<p>Magnitude of Outputs:</p> <ul style="list-style-type: none"> <li>-Three pilot projects will have insured at least \$15 million in credit for approximately 10,000 farmer-years</li> <li>-Forty country and ten international technicians will be trained.</li> <li>-Underwriting knowledge for insuring a total of 10 crops in three countries will exist</li> </ul>	<ul style="list-style-type: none"> <li>-Project research data and reports</li> <li>-Final Project Report to AID</li> <li>-Crop Insurers reports and statements</li> <li>-AID Evaluation Reports</li> <li>-Crop Credit Insurance Advisor's reports to LAC Bureau</li> <li>-Training programs material and reports</li> <li>-Reinsurance contracts</li> <li>-Technical assistance applications</li> </ul>	<p>Assumptions for achieving outputs:</p> <ul style="list-style-type: none"> <li>-Increased farmers understanding and acceptance of crop and live-stock insurance.</li> <li>-Suitable personnel recruited</li> </ul>																																																																																																								
<p>Inputs:</p> <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td></td> <td align="center">4/83</td> <td align="center">1983</td> <td align="center">1984</td> <td align="center">Total</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Subgrants to crop insurers</td> <td align="right">1,781</td> <td align="right">330</td> <td align="right">447</td> <td align="right">2,538</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Technical assistance R&amp;D</td> <td align="right">2,210</td> <td align="right">330</td> <td align="right">513</td> <td align="right">3,053</td> <td></td> <td></td> <td></td> </tr> <tr> <td>RSSA</td> <td align="right">384</td> <td align="right">50</td> <td align="right">85</td> <td align="right">519</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total AID funds</td> <td align="right">75</td> <td align="right">690</td> <td align="right">1,045</td> <td align="right">6,110</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Local contribution for premium and operating subsidy, capital stock and reserves</td> <td align="right">2,065</td> <td align="right">875</td> <td align="right">875</td> <td align="right">3,815</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Total funds disbursed</td> <td align="right">6,440</td> <td align="right">1,565</td> <td align="right">1,920</td> <td align="right">9,925</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Local contingent liability for cat. loss</td> <td align="right">6,835</td> <td align="right">1,875</td> <td align="right">3,200</td> <td align="right">11,910</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Grand Total</td> <td align="right">13,275</td> <td align="right">3,440</td> <td align="right">5,120</td> <td align="right">21,835</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Technical assistance staff</td> <td align="center">9</td> <td align="center">9</td> <td align="center">9</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Insurers tech. &amp; admin. staff</td> <td align="center">30</td> <td align="center">34</td> <td align="center">40</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>TOTAL</td> <td align="center">39</td> <td align="center">43</td> <td align="center">49</td> <td></td> <td></td> <td></td> <td></td> </tr> </table>										4/83	1983	1984	Total				Subgrants to crop insurers	1,781	330	447	2,538				Technical assistance R&D	2,210	330	513	3,053				RSSA	384	50	85	519				Total AID funds	75	690	1,045	6,110				Local contribution for premium and operating subsidy, capital stock and reserves	2,065	875	875	3,815				Total funds disbursed	6,440	1,565	1,920	9,925				Local contingent liability for cat. loss	6,835	1,875	3,200	11,910				Grand Total	13,275	3,440	5,120	21,835				Technical assistance staff	9	9	9					Insurers tech. & admin. staff	30	34	40					TOTAL	39	43	49					<p>Implementation Target (Type and Quantity) (\$000)</p>	<ul style="list-style-type: none"> <li>-Final Project Report to AID</li> <li>-Crop insurers reports and statements</li> <li>-External auditors reports on insurers financial statements</li> <li>-AID auditors reports</li> </ul>	<p>Assumptions for providing inputs:</p> <ul style="list-style-type: none"> <li>-Grant contract in force</li> <li>-Subgrants contracts in force</li> </ul>
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AGRICULTURAL INSURANCE

POLICY NOTE NO. 5

Prepared by:

Economics and Policy Division

Agriculture and Rural Development Department

March 25, 1983

## POLICY NOTE ON AGRICULTURAL INSURANCE

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## POLICY NOTE ON AGRICULTURAL INSURANCE

Summary

i. This policy note outlines the World Bank position on agricultural insurance, which includes crop insurance, crop credit insurance and livestock insurance. This note has been drafted in response to staff interest in the subject, the recent establishment of agricultural insurance programs by governments in several developing countries and its encouragement by several United Nations agencies and bilateral donors.

ii. The economic and political benefits theoretically realizable from agricultural insurance include a) welfare benefits from stabilized consumption, b) production benefits from the increased use of capital in agriculture, c) system benefits from risk transfer, d) patronage benefits from government involvement in the payment of indemnities, and e) underwriting profits.

iii. Welfare and economic benefits of agricultural insurance have not been rigorously identified or quantified in any developing country, while in developed countries they are ambiguous. These problems may explain why there are no private insurance markets for agricultural risks except for limited coverage (primarily against hail, frost and fire) in developed temperate zone agriculture. Hence, comprehensive or all-risk insurers are usually government owned and subsidized.

iv. A critical problem in justifying agricultural insurance is that the chain from crop or enterprise yield variability and farm household consumption variability is long and not necessarily direct. For example, agricultural prices frequently are a greater cause of producer income instability than are agricultural yields; yet price risks are not insurable while yield risks theoretically are. Also, there are many partial substitutes for insurance available to farm households and to institutions serving agriculture.

v. Prerequisites for insurance include actuarial estimates of losses, and institutional capacity to deliver insurance services. Institutional essentials include management and administration, financing and information. Agricultural insurance programs have many institutional elements in common with agricultural credit programs, but probably greater vulnerability to failure. Poor credit program performance can create a "demand" for agricultural insurance by government, and raises questions about the potential viability of such insurance. Pressure to require insurance for borrowers from official farm credit agencies is one expression of such demands.

vi. Agricultural insurance is not considered suitable for funding by external loans in view of the absence of empirical evidence that it is economically justified. It is also considered unsuitable because of institutional difficulties that characterize many agricultural insurance initiatives, and their similarity with problems often found in official farm credit systems. In so far as the Bank is concerned, direct project

experience with agricultural insurance is lacking; its approach to risk in agricultural project design remains ambiguous. Useful steps for the Bank that are consistent with the objectives of insurance include agricultural sector risk reviews and the development of information systems and data bases on agricultural risks. Bank support for research may also be appropriate.

## POLICY NOTE ON AGRICULTURAL INSURANCE

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POLICY NOTE ON AGRICULTURAL INSURANCE

I. Introduction

1.01 Agricultural insurance is a generic term for crop insurance, crop credit insurance, livestock insurance and similar forms of insurance coverage directly related to agricultural production. Crop insurance indemnifies farmers against crop failures and the destruction of their crops. Crop credit insurance protects agricultural lenders against the inability of their borrowers to repay because of diminished liquidity resulting from crop failure or destruction. Livestock insurance reimburses owners for the untimely loss of stock.

1.02 The purpose of this policy note is to provide guidance for Bank staff in understanding the feasibility and mechanics of agricultural insurance, and its relation to husbandry practices and measures designed to promote agricultural innovations. This note was drafted in response to heightened interest in this financial service by projects staff. This interest reflects the recent establishment of agricultural insurance corporations under state auspices in several developing countries, the initiation of several donor-supported projects, increased pressure on agricultural credit systems and a greater attention to risk and risk management in the development literature.

1.03 The World Bank <sup>1/</sup> has never embarked on an agricultural insurance project, but it has been associated with agricultural insurance systems through other types of projects in several countries. Because of its lack of direct involvement, the Bank has not had any policy position on agricultural insurance. However, a position is now required for two reasons. First is the rising interest in crop insurance in developing countries and the possibility that the establishment of such programs could constitute a significant claim on governmental financial resources. For instance, in Mexico agricultural insurance has become a form of social insurance and an important transfer payment mechanism. Second, Latin American pilot projects with which the United States Agency for International Development (AID) and the Interamerican Institute for Cooperation on Agriculture (IICA) are associated are beginning to produce research results. The Bank may wish to support this type of research because its results and implications could provide the basis for Bank assistance to countries considering the establishment of agricultural insurance programs. Such assistance could either support or discourage agricultural insurance, depending upon the nature of the research results and their applicability to the developing countries that may be considering the establishment of such programs.

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<sup>1/</sup> The World Bank includes the International Development Association. References to the Bank also apply to IDA.

## II. Background

2.01 The appeal of agricultural insurance is related to the risk associated with the adoption of new agricultural technologies by small producers who are risk averse, and who have a low capacity to bear risk. Insurance is also attractive to many governments and developers as an enhancement to agricultural credit programs, for the potential it may contain as a vehicle for income transfers to the rural poor, or as a means of supporting commercial producers of strategically important agricultural commodities. Crop insurance also appears to offer a means by which donors and governments could increase their control over cropping patterns, agricultural investment and rural populations.

2.02 Emphasis on agricultural insurance has come from the Special Programs on Insurance of the United Nations Conference on Trade and Development (UNCTAD). Agricultural insurance is merely one aspect of the larger designs of this program, which has provided technical assistance to governments seeking to build up local insurance industries through changes in regulatory policy. Measures advocated have stressed the retention of local business within the country and other ways to limit premium remittances abroad. Technical assistance has also been provided for drafting regulations and legislation, and for managing regulatory agencies and nationalized insurance and reinsurance corporations.

2.03 The Food and Agriculture Organization of the United Nations (FAO) has long been active in promoting agricultural insurance. It has sponsored conferences and workshops on this topic, and has sent missions to several countries to provide technical assistance and to assist in exploring the feasibility of establishing crop insurance programs. The FAO Monthly Bulletin of Agricultural Economics and Statistics has carried occasional articles generally supportive of the concept of agricultural insurance. FAO published A Manual on Crop Insurance for Developing Countries in 1974. Its author, P.K. Ray, while working for FAO and continuing into his retirement, has been the most prolific writer in this field in the English language. His principal work, Agricultural Insurance, was published in 1967, and an expanded second edition appeared in 1981. (See listings in the Bibliography.)

2.04 Crop insurance has been promoted by AID with support from the Federal Crop Insurance Corporation of the United States Department of Agriculture. AID has provided technical assistance to insurance activities and promoted crop insurance in developing countries at conferences. In Ecuador, Panama and Bolivia, it has funded through IICA so-called pilot projects and research to monitor their operations. At one time AID considered the possibility of establishing a Latin American reinsurance corporation to support national crop insurance activities.

2.05 Mutual livestock insurance has existed in central Europe for many centuries, and specific-risk coverage for crops also has a long history. While specific-risk contracts for hail, fire and frost are readily available from private insurers in a number of countries, well-functioning private markets for all-risk contracts have never developed. All-risk crop

insurance is cited by Ray as first being offered in 1898 by a private company in the United States, but early attempts were generally abandoned by insurers in response to unfavorable loss experience. <sup>1/</sup> The unfavorable economic and agricultural conditions of the 1930s appeared to diminish substantially the prospects for a reliable market for all-risk crop insurance. Partly in response to considerations such as these, the institutional arrangements that now characterize all-risk programs were initiated in the late 1930s with the establishment of government programs in Japan and the United States.

2.06 All-risk coverage from the National Agricultural Insurance Association (NAIA) is compulsory for Japanese cereal farms larger than 0.3 hectares. Voluntary programs are available for other enterprises but participation is limited by lack of farmer interest. Only about 20 percent of farmers eligible for fruit production coverage obtain cover, for example. The program of the Federal Crop Insurance Corporation in the United States is entirely voluntary and relatively small. More than 90 percent of the harvested acreage insured by FCIC during the 1970s was under nine major crops. However, FCIC coverage protected less than 10 percent of the total harvested acreage under these nine crops.

2.07 Government crop insurance programs in Japan, the United States and other high-income countries do not as a rule in charge premiums sufficient to cover their costs. Government subsidies to the crop insurance system in Japan, for example, amounted to about two-thirds of its total costs as of the late 1970s. Over the period 1948-1978 in the United States, premiums collected approximated indemnities paid by FCIC and amounted to about 5.4 percent of the amount of insurance protection provided, but administration of the program was subsidized. This pricing behavior, the low penetration achieved by the subsidized voluntary programs in Japan and the United States, and the failure of private insurers to provide coverage suggest that little or no market generally exists for all-risk contracts at premium rates sufficient to allow private insurers to offer such protection.

2.08 Crop insurance in developing countries is largely a recent initiative. Insurance providing protection against diminished crop yields exists or is being established in about 20 middle- and low-income countries (see Annex 1). The performance of developing country programs has generally been unsatisfactory from an institutional and financial point of view. Only those programs that remain quite small or operate in unusual circumstances are financially self-sustaining on a commercial basis. Small programs that have reportedly demonstrated financial success have included a private company insuring the yields of white tobacco farmers in Zimbabwe, and insurance for sugar cane on Mauritius. Special conditions that contribute to the success of the Mauritian case include a high degree of organization in the sugar industry and reliance on commercial sources for reinsurance, which imposes discipline. In spite of its generally unsatis-

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<sup>1/</sup> P.K. Ray. Agricultural Insurance. 2nd ed. Oxford: Pergamon Press, 1981. pp. 162 ff.

factory financial performance elsewhere, agricultural insurance offers governments the possibility of expanding benefits to rural people. In light of these considerations, the increase in interest makes crop insurance a subject in need of review and policy debate by donors and governments.

2.09 Another reason for heightened interest in crop insurance is the realization that many agricultural credit projects have failed to perform satisfactorily in financial terms. Weaknesses in loan collection by financial intermediaries lending project funds to farmers are especially noteworthy. The effects of risk may be one reason for loan recovery problems, since considerations of the likely impact of risk on farmer cash flow are generally not incorporated in the design of credit projects supported by external donors such as the Bank. If risk is a cause of poor performance of agricultural credit systems, mechanisms to absorb or diffuse risk are attractive to the sponsors of agricultural credit projects. Insurance appears to provide such a mechanism. From one point of view, insurance can restore or enhance discipline in farm credit systems. However, it can also be seen as reducing the pressure for discipline by assuming and disguising or "laundering" the losses of agricultural credit systems.

### III. The Benefits of Agricultural Insurance

3.01 The agricultural insurance literature cites several categories of potential benefits from providing coverage. Some are purely economic, but the non-economic are probably more important in practice in official programs. One category is welfare benefits from income transfers through the insurance system. A second major category is production benefits from the role of insurance in changing cropping patterns towards higher value crops and in intensifying input use. A third class of benefits may be characterized as "system benefits" resulting from the positive influence of insurance on other activities. These include the support it can provide for agricultural credit portfolios, the organizational purpose it can infuse in agricultural extension, and the cushion it provides for commerce by evening out income flows over time and hence stabilizing the purchasing power of agriculturalists as consumers.

3.02 Two further categories of benefits, or reasons for establishing agricultural insurance programs, are not extensively dealt with in the literature. These are benefits that accrue to insurers in the form of surpluses, and patronage benefits from government programs. Surpluses, however, appear to be negative in most developing countries. Subsidies are generally required to offset administrative costs, and in some instances also actuarial losses, from crop insurance. Patronage benefits characterize most official programs because premium collections plus investment income to the insurer fail to cover the costs of providing insurance, giving officials the opportunity to allocate the subsidized benefits. In practice, the nature of insurance and of the payment of indemnities to insureds experiencing loss has the effect of linking welfare, patronage, and production benefits very closely. Programs stressing one of these objectives inevitably produce secondary effects on the other objectives.

### Welfare Benefits of Stabilized Consumption

3.03 People who are risk-averse derive a welfare benefit whenever the inter-temporal instability of their consumption stream is reduced. Insurance can have particularly striking stabilization benefits when it makes possible the maintenance of near normal consumption levels following calamities. It enables beneficiaries to purchase protection through the payment of relatively modest premiums in normal and good years to provide compensation in bad years. For each insured individual it stabilizes income and consumption via inter-temporal transfers. Among a group of insureds, insurance provides interpersonal transfers: those not affected by calamity contribute to the insurance fund, while indemnity payments from it are made to those suffering loss.

3.04 In agriculture, access to liquidity in time of distress is especially important because it permits farmers to reestablish their operations and fulfill their obligations towards creditors without drastically reducing consumption levels. When yield variability is a major source of income and consumption variability, welfare benefits from crop insurance could be substantial.

### Production Benefits

3.04 As a consequence of stabilized incomes and consumption levels, risk-averse farmers may be induced to take production decisions they would not otherwise take which involve higher average returns along with higher risks. They may increase investment in fertilizers or other current inputs, shift to higher value and more risky crop varieties, and invest more in fixed capital. They may also increase their specialization in production, emphasizing crop or livestock enterprises which provide the highest average return. Thus, crop insurance appears to offer the potential of promoting higher production levels and accelerating the modernization of traditional agriculture.

### System Benefits

3.05 System benefits comprise other classes of benefits, and their definition incorporates concern for multiple impact and feedback characteristics. One feedback cycle cited in the literature is the role of crop credit insurance in maintaining the creditworthiness of borrowers and the liquidity of lenders, which strengthens the financial system and a range of systemic relationships in financial markets. Another dimension of crop insurance frequently mentioned is its potential for stabilizing income flows of entire rural communities, not simply the incomes of those indemnified. The "spread effect" postulated in this case occurs as those who receive indemnities for losses use the money received. For example, increases in deposits with local financial institutions enhance or safeguard these institutions' supply of loanable funds, facilitating the flow of local economic activity. Expenditure of indemnities stimulates local trade and production, contributing to or protecting employment. In

the absence of insurance indemnities, local financial institutions might have fewer resources for lending, and might allocate these to lower risk borrowers in a way that increases the concentration of wealth and income. Local trade and employment might decline far more, at least temporarily, in response to drops in consumption and investment occasioned by losses of income from crops or livestock.

### Patronage Benefits

3.06 Patronage and other political benefits from agricultural insurance provided by government agencies may take several forms. One is the public relations advantages accruing to the government of the day from providing or increasing access to a useful or popular service. A second is the opportunity to increase employment in government agencies, whether through appointments based on qualifications or on political allegiance, quotas, friendship, or relationship by blood or marriage. The opportunity for corruption is a third form of patronage benefit. The establishment and funding of a transfer payment mechanism which may be manipulated to increase political goodwill towards those in power is a fourth.

3.07 A role for government in agricultural insurance is especially appealing because of the tremendous risk bearing capabilities of government through its power to tax and its monopoly control over the national currency. Government is believed to represent the largest collectivity within a nation, and its fiscal powers give it a tremendous advantage in risk bearing. Government provision of unsubsidized insurance, however, would not fully exploit the patronage potential of crop insurance. Most of that potential arises in practice from providing services at less than cost: subsidizing insurance beneficiaries is an almost universal feature of government agricultural insurance programs. Premium rates, risk exposure and administrative costs are seldom related in an actuarially viable way, especially in developing country programs where farmers are considered too poor to pay full costs or where transfer payments to insureds are a major objective.

3.08 Agricultural insurance, like agricultural credit, is a political-ly attractive vehicle for subsidy and patronage because the costs can be widely spread and their accounting delayed in time, whereas the benefits can be highly concentrated and immediate. A special attractiveness of agricultural insurance as a vehicle for patronage, for example, arises from the fact that agricultural producers subject to highest risk are often those in marginal agricultural areas. Insurance programs can be structured to transfer resources to high risk, poor producers from relatively low risk, wealthy producers through compulsory participation in insurance programs, supplemented by contributions from taxpayers through budgetary subsidy for insurance. Alternatively, benefits may be restricted to large producers who are organized politically.

### Profits from Insurance Underwriting

3.09 Benefits from agricultural insurance programs accrue to insurers in the form of profits. Agricultural business could be useful as an additional source of funds to the insurance industry and in diversifying insurance portfolios, either within a single insurance company or through reinsurance markets.

3.10 Profits from crop insurance portfolios have traditionally been realized only from specific-risk cover restricted to a limited number of hazards, mainly hail and fire. The absence of private contracts covering other agricultural risk probably indicates that offering this protection is a losing proposition, although crop insurance might be used as a loss leader to attract profitable contracts for farm machinery, buildings or life cover. All-risk crop insurance would presumably be especially difficult for private markets to provide in the agricultural production environments found in tropical and semi-tropical areas. In addition the effective demand for such protection could be small because agricultural insurance on commercial terms may not be affordable for many producers. Hence, to the extent there is pressure for the provision of agricultural insurance in developing countries, it tends to be for insurance subsidized by government, including government contributions to insurance funds or to administration costs.

### Problems in Determining Benefits of Agricultural Insurance

3.11 The welfare and production benefits of agricultural insurance, which are those most attractive to development technicians, have not yet been rigorously identified and measured in any developing country. The data from developed countries having more experience with agricultural insurance under subsidized programs have generally failed to provide incontrovertible examples of the existence of these benefits. Even the most fundamental question, the extent to which variations in their crop yields are responsible for changes in consumption by farm households, has not been documented by empirical research.

3.12 This question arises because the chain leading from crop yield variability to consumption variability is long and not necessarily direct. First, income from an individual crop depends on both yield and prices. In areas where price variation is usually a far more important source of income risk than yield variation, such as in high rainfall zones and under irrigated conditions, farmers would be unlikely to pay a high premium for insuring a relatively minor risk.

3.13 Second, farmers may be able to reduce income variability resulting from unstable yields in ways which achieve the same result as crop insurance but at lower cost. For example, they can diversify their cropping patterns into enterprises with relatively uncorrelated yields; they may adjust cropping patterns, techniques of production or sowing dates to early season weather conditions; or they could stabilize farm income by buying insurance for specific risks other than yield, such as fire, health, and accidental death of animals if it were offered.

3.14 Third, consumption may be stabilized while agricultural income varies where the household has nonagricultural income sources which are less than fully correlated with agricultural income. Members of the household may deliberately shift to such occupations in poor years. Producers may stabilize consumption by using reserves of cash, gold, jewelry, financial assets, livestock, stocks of food, feed or producer durables; or by using credit. Friends or relatives may provide disaster-related assistance; while government may offer food distribution or public works programs. If insurance substitutes can help to stabilize consumption at a lower cost than crop insurance, farmers generally will not be interested in purchasing crop insurance.

3.15 In practice, insurance is at most a complement to or partial substitute for a number of measures that are commonly applied by governments to assist farmers suffering losses from natural disasters. These include drought and flood relief grants in cash and in kind, reconstruction loans, the rescheduling of agricultural debt from official and possibly also from private institutional lenders, the opening of public lands for grazing, and the subsidized distribution of food and animal feed. In addition, governments commonly assist with loss prevention activities ranging from construction of containment structures for rivers to provision of animal health services. Comparison of these measures with insurance requires a comprehensive listing of the costs and benefits of each, within the framework of the limitation in the scope of response provided by each. Flood control and emergency evacuation and shelter operations carried out by army engineers during a disaster, for example, could hardly be equated with insurance benefits.

3.16 Loan guarantee funds may produce certain results that insurance could deliver but with simpler administration. However, the performance of loan guarantee programs run by government institutions in developing countries has often not been widely or well documented, suggesting that caution may be in order when approaching them as a viable, low-cost means of accommodating agricultural risks. The role of lending institution reserves and of special rediscounting facilities offered by central banks should also be more closely examined as risk-accommodation devices to cushion agricultural lenders and their borrowers in adversity. To be effective, any alternative designed to assist lenders must be regarded by lenders as dependable and cost effective.

3.17 Welfare and production benefit considerations suggest that the strongest case for crop insurance could be made in monocrop regions where weather risks are very high, where informal and formal credit institutions are poorly developed, where risk-accommodating social institutions are weak, and where alternative employment or income earning opportunities are limited. Unfortunately, many initiatives in crop insurance, some of which were promoted to test its feasibility, are not located in these kinds of areas.

3.18 As of the early 1980s there has been no empirical analysis that would justify "pure" agricultural insurance in developing countries based on welfare or production benefits. Pure insurance refers to insurance on

its own, not as part of a package with other risk management services. In actuarial terms, a pure premium rate (for pure insurance) equates long run indemnities with long run premium charges, but excludes remuneration for the costs of insurance administration or for underwriting profits. Even if yields and consumption patterns were shown to be tightly linked, and if welfare and production benefits were empirically verified, proposals for the establishment of agricultural insurance programs would not necessarily be valid unless accompanied by detailed estimates of the costs of insurance provision and identification of its secondary effects including those that may be negative. The promotion of agricultural insurance should be viewed as one of several alternative means of helping farmers adjust to risks. Only if insurance is an efficient means of performing this function could a rigorous argument be made for its implementation. Experience suggests that in most cases the market test of efficiency -- i.e., profit to a competitive insurer -- will not justify agricultural insurance, requiring more complex assumptions and analysis.

#### IV. Prerequisites for Agricultural Insurance

4.01 The prerequisites for a successful insurance program may be classified into two categories. The first relates to the characteristics of the objects being insured and of the perils for which coverage is provided. This category of prerequisites largely involves actuarial science and insurance principles, and the relationships between the protection provided and the costs of that protection which make a risk eligible for insurance coverage. Basic criteria for insurability can be summarized as measurability of the loss, in time and amount, and the determination of its cause. The chance of loss must be reasonably predictable; this is based on the mass and homogeneity of units exposed to risks and on the randomness and independence of their occurrence. The probability of claims should not be highly covariant among insured units, and therefore not potentially catastrophic for the insurer. (These terms and their technical definitions are further treated in Annex 2.)

4.02 Two additional characteristics that are not prerequisites according to the theory of pure insurance but which are important to the generation of insurance contracts are financial affordability and an insurable interest. Affordability applies to the capacities of the insurer as well as of the insured. The insurable interest criterion determines to whom coverage is provided.

4.03 These technical considerations are fundamental and cannot be evaded. Institutional requirements for agricultural insurance are more within the range of variables that a development assistance agency can influence through project and sector activities. Institutional arrangements determine the legal, moral and administrative environment in which insurance claims are made and adjustments are paid. The best actuarial expertise and knowledge of agriculture used in the design of agricultural insurance programs will not result in self-sustaining insurance programs and insurers unless there are satisfactory institutional

arrangements. Indeed, there is much to suggest that institutional problems loom larger than actuarial and agricultural challenges in the operation of agricultural insurance in many countries.

4.04 Three major types of institutional requirements appear essential to the successful operation of agricultural insurance. These include innovative and effective management and administration, appropriate financing, and adequate information. To a certain extent these three requirements are interrelated, suggesting that the conditions for success are more restrictive than might appear from a simple listing of criteria.

#### Management and Administration

4.05 Trained personnel with insurance experience and an understanding of techniques for marketing services among small farmers are essential to the success of an agricultural insurance scheme. Management tasks consist of designing and marketing insurance packages which are attractive to farmers, and ensuring that the insurance portfolio is of a quality sufficient for viable and continued operations. Administrative tasks include the timely and just settlement of claims, and the implementation of internal controls within the insurance organization. Timeliness in processing claims is especially important in agricultural insurance because of the perishable nature of crops and because of moral hazard.

4.06 One special aspect of insurance management and administration consists of procedures to minimize moral hazard, which is the possibility of fraudulent actions by insureds. These procedures may include deductibles, co-insurance clauses, measures such as agricultural extension that are designed to create confidence between the insurer and the insured, and other services that reduce risk or that assist risk management by the insured. Provision of these services may be costly and complex, however, leading back to the requirement for trained personnel.

#### Financing

4.07 Appropriate financing for agricultural insurance programs must begin with the demand for insurance. Effective demand is reflected in the number of farmers willing to pay the insurance premium and submit to other conditions specified by the insurer. Willingness to buy insurance is determined by the appropriateness of the services offered relative to the situation of the insured, and also to the ability to pay premiums. Once a demand for insurance is demonstrated an effective premium collection mechanism must be established. In many countries experimenting with crop insurance, premium collection is effected through banks providing loans which are automatically reimbursed by the insurance fund in the event of insured loss. In certain countries premium collection is handled through the fiscal or taxation system, but this is thought by many experts to involve moral hazard and a confusion of insurance with social welfare. An inappropriate collection technique used in one compulsory insurance program was the deduction of the insured's premium from the indemnities the

insured receives. This expedient indicated a lack of effective demand for insurance and resulted in low levels of premium collection and excessive losses.

4.08 A third financing requirement is a sufficient fund from which to pay indemnities. Without adequate funding it is not possible to pay indemnities on a timely basis, and pressures will arise for the introduction of rationing mechanisms such as delaying tactics and interpretations of insurance contracts by the insurers in ways which may appear unfair or inadequate to insureds. Where insurance is provided by the government, initial funding has to come from the same source, possibly with external assistance. Further funding is dependent upon the maintenance of satisfactory relationships between premium and investment income on the one hand, and indemnities and expenses on the other. The use of reinsurance markets may help an insurer write more business than would be prudent without recourse to the larger reserves of these markets, and is especially important because of the covariance often found in agricultural risks with their catastrophic exposure implications for insurers. Reinsurance for government schemes can also help the government define the maximum probable loss it may incur from crop insurance, as reinsurance markets can absorb the excess between government's loss and the larger total loss. Government's overall maximum probable loss includes the consequential loss of reduced tax revenues resulting from diminished agricultural production, and the simultaneous loss of infrastructure as well as crops destroyed by the same event, such as a typhoon.

#### Information

4.09 Actuarial calculations for agricultural insurance require a data base which may appear formidable relative to the data collection performance of many developing countries. The design of viable insurance packages for which there is an effective demand requires reliable data covering long periods for the crops and areas to be covered. Without this information it is difficult to relate premium rates to local loss experience. Good data are also required to minimize the moral hazard, defined as intentional acts by insureds to create losses, or pretending to create losses.

4.10 With or without moral hazard, information problems appear pervasive. Data should cover crop yields and damage caused by the events which are insured against. Collection of this data can be extremely difficult because of the heterogeneity of farmers and the land they operate, and because of the problems of distinguishing yield variations caused by insured hazards from those caused by poor farming practices, negligence and other adverse influences within the control of cultivators. Data base management may be greatly assisted by good land records, which minimize transactions costs and permit better administration of insurance marketing and claim adjustment.

4.11 Monitoring and evaluation of insurance performance is essential to the perfection and maintenance of the agricultural insurance data base and to the effective management of the insurance operation. Experience must be quantified and analyzed so that the actuarial basis of insurance contracts is more precisely understood. Monitoring and evaluation includes a broad range of information collection and analysis procedures. These include management information systems and internal controls within the insurance organization, studies of farmer behavior, techniques of risk management, and technical problems associated with moral hazard and with adverse selection, defined as a situation in which only high risk applicants seek coverage.

4.12 There is a trade-off between information and reserves in insurance design and administration. Better information decreases the risk of the insurer, which in turn reduces the reserves required to support a given portfolio of risks. Said in another way, any given level of reserves can be used to support a larger portfolio when information regarding risk is improved. Hence, efficient insurance markets generate relatively large amounts of information and are supported by comprehensive data bases on risks. Economic rationality suggests that the introduction of new coverage be accompanied by relatively large reserves, and that the ratio between reserves and coverage outstanding declines as the market for the new coverage matures because the accumulation and use of information based on experience reduces risk to the insurer.

4.13 One attempt to address the information problem of evaluating yields on individual farms is the area-yield approach, which is used in Sweden. Ray reports that Sweden is divided into about 400 compensation districts based on the homogeneity of yields and of yield deviations. <sup>1/</sup> All farmers are required to participate in the national program, and premiums are collected through levies on the sale of agricultural produce. The program seeks to respond to total risks, not simply to the loss of a single crop. When yield declines, as measured by sample surveys of the National Central Bureau of Statistics, are extensive enough across crops within a district to reach insured levels, indemnities are paid to all farmers in the district, regardless of the extent to which their individual cropping patterns vary from the regional norm and regardless of the severity of any losses they suffer.

4.14 The area yield approach not only avoids certain information problems but is wholly immune to moral hazards arising from individual farmers acting alone. But it has several major disadvantages. The utility gains to farmers from area-yield coverage are reduced by the loose relationship between indemnification and loss. Farmers who suffer more severe losses than the norm for the district will be undercompensated, while those who suffer less loss or no loss are unnecessarily compensated. The lower the level of covariance within a district, the more likely that the insurance will not be regarded as efficient by farmers, and that it will distort farmers' incentives away from efficient resource use. Farmers' dissatisfaction with the area yield system tends to produce

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<sup>1/</sup> P.K. Ray. Agricultural Insurance. 2nd ed. Oxford: Pergamon Press, 1981. pp. 124-126.

pressures for reduction in the size of compensation districts, and also makes the system more vulnerable to political interference, especially where participation is compulsory. On balance, it is not clear that area-yield insurance programs contain inherent long-run economies.

#### Insurance Prerequisites and the Absence of Private Contracts

4.15 The prerequisites for successful agricultural insurance programs may be summarized from a slightly different perspective through an examination of the causes of the general absence of private agricultural insurance markets, especially for all-risk or comprehensive multi-risk contracts. Insurance may fail to emerge because of information problems related to yield assessment, incentive problems, and covariance.

4.16 Information problems consist of the difficulties and costs of measuring the probability distributions of expected yields and of determining yield shortfalls in specific situations. The great variation in soils, farm operators and micro-climates within relatively small areas imposes substantial information costs on insurers. Even if this information is available in a form that is sufficiently refined to permit accurate rate making (i.e., the establishment of the premium for a given type of contract) by insurers, yield shortfalls often occur and claims must be adjusted frequently. Claim adjustment may involve servicing relatively widely dispersed risk units. It also encounters "bunching" problems and consequent staff utilization problems arising from the seasonality of production and of insured events. Marketing and administration of crop yield insurance often require field inspections shortly after planting to verify area planted and to ensure that germination and spacing are adequate for coverage. These inspections permit the insurer to distinguish between risks related to poor husbandry practices, such as improper spacing or the use of inferior seeds, that are not insurable, from insurable risks arising from weather or disease, for example. Inspection may also be required to confirm the time coverage begins, which is generally the point at which replanting to recover from an early failure is no longer feasible. These information requirements generate costs that in private markets must be reflected in premiums.

4.17 Incentive problems contribute to the absence of private crop yield insurance markets through moral hazard and adverse selection. Moral hazard is reflected in the possibility that insured farmers would be less diligent than uninsured farmers in terms of husbandry practices. While this hazard can be reduced by arrangements in which insureds bear a portion of the loss, as through deductibles and other forms of partial indemnification, these measures also make insurance protection less attractive. This tends to contribute to adverse selection. Relatively high premiums are the insurance industry's response to these problems.

4.18 High covariance of risk is reflected in the simultaneous occurrence of loss among insured units. The possibility that many farmers in an area would suffer an insured loss at the same time effectively makes local crop yield insurance markets infeasible. Regional or national markets may

therefore be required to spread risks sufficiently to offset their covariance. But even at the national level in developed countries private markets have not readily developed for comprehensive agricultural insurance, although specific risk coverage for hail, fire and frost is available. The costs imposed by information problems associated with yield assessment, incentive problems and covariance appear to require premiums of a level that elicits little effective demand from farmers. Hence, government intervention characterizes most all-risk or comprehensive multi-risk agricultural insurance markets.

#### Responses to Absent Prerequisites

4.19 In situations in which a sufficient data base is not available, there are usually several alternative courses of action. The most obvious consists of activities designed to construct a data base by compilation and analysis of historical information and the establishment of systems to provide reliable data in the future. Technical assistance for the purpose of establishing crop reporting systems, for example, may precede by several years the decision to implement agricultural insurance. Pilot schemes, having the essential characteristic of potential and purposeful abandonment if prospects for viability cannot be sufficiently demonstrated, may also be a useful means of generating data on new risks. However, abandonment may not be practical in donor-supported activities or where political patronage is important to local sponsors.

4.20 Another option when data is deficient is "judgment rating", which is the establishment of premium rates based on the imperfect information available and the judgment of technical specialists and program managers. The criteria for insurability in their pure form as described in Annex 2 are very rigorous. But rate making involves "art" as well as actuarial science in judgment rating. Broad averages may be used to calculate the probable extent of losses and to set premiums high enough to cover costs and produce a surplus. As loss experience is accumulated, judgment rates will become more refined and accurate.

4.21 Judgment rating may be used in the early years of agricultural insurance activities, but historical experience suggests that government insurance programs can easily suffer severe financial losses as a result of underestimating insured events. In the United States, for example, the federal crop insurance program was launched in 1939 with a fund of \$500 million. In the first years of this program overall annual loss ratios, calculated as indemnities paid divided by premium earned, ranged from 150 to almost 250 percent. This resulted in severe limitations on the scope of the program and additional funding requirements. Hence, a large initial insurance fund would appear to be appropriate where the outcome of insurance activities cannot be very accurately determined in advance, or if that is not possible a high degree of conservatism is required — possibly in the use of a small abandonable pilot program, provided that this form is politically acceptable and bureaucratically feasible.

V. Credit and Compulsion as Elements of Insurance Design

Agricultural Credit and Insurance

5.01 An indication of the institutional capacity to implement agricultural insurance programs may be found in experience with agricultural credit provided by public sector agencies. The link between credit and insurance is based on environmental and institutional similarities. The insurance and credit target groups may be identical or largely overlapping. At least some agricultural insurance schemes will be proposed to support or to be operated in conjunction with government agricultural credit programs. Both agricultural insurance and credit operations involve not only a large number of relatively small accounts, but also a dimension of time in the operation of the program and a requirement for trust and confidence between those providing the service and those using it.

5.02 Servicing a large number of small accounts makes large demands on financial housekeeping, which consists of keeping accounts up to date and providing useful information for managerial purposes. If an existing credit scheme is not characterized by good housekeeping -- as many are not -- the design of an insurance program should identify the causes of this problem in the credit program and provide measures to ensure that such problems will not be replicated.

5.03 Repayment performance over the medium or long run is a useful barometer of confidence in credit programs. If borrowers have learned that wilful nonrepayment and other devices to circumvent the regulations of credit schemes are rewarding and relatively risk-free, as is often the case, it seems reasonable to assume that this legacy will introduce a moral hazard into insurance activities. In other words, the poor performance of a credit scheme can increase the costs of the insurance business, especially when both are provided by the government.

5.04 A typical pattern found in agricultural credit programs consists of below-market rates of interest, difficulties by official lenders in recovering loans, and a desire by private institutional or formal lenders to avoid extensive involvement as lenders to agriculture in general and to small farmers in particular. In these circumstances there may be a demand for agricultural insurance by lenders seeking to reduce their risks and improve their loan collection performance in rural financial markets. Collections could possibly be increased by instituting credit insurance and making indemnity checks payable through the lending bank, as in Mexico, where the farmer and the lending bank are co-beneficiaries. Dependable agricultural insurance might also induce banks to lend more to agriculture by reducing the risk per unit of currency loaned to that sector. In this respect insurance serves a collateral function.

5.05 Some of the potential gains claimed by advocates of insurance as an efficient complement to credit would arise from the function of insurance reserves. Reserves provide economies of scale in lending, and could be especially useful where the official farm credit mechanism does

not have external reserves that can be effectively tapped. This could be the case when a centralized official agricultural lender is thinly capitalized, has a high loan to total assets ratio, and lacks routine arrangements for refinancing or borrowing from the national treasury. It could also be the case when the system consists of a number of banks that are not well linked to outside sources of liquidity that could be relied upon when loan collection is difficult due to crop failures in the service areas of affected banks. Reserves could expand the capacity to lend, reducing the per unit cost of reserves held by the insurer. Reserves could lead to economic gains to the extent that incremental lending is employed productively.

5.06 Responding to the institutional demand for agricultural insurance would not necessarily lead to economic gains, however. Risks would simply be transferred to another agency that would face the same problems of covariance, moral hazard and yield assessment. The institutional mechanism required for administering insurance would parallel the banking system without necessarily creating any economies of specialization. Quite possibly it would expand the uneconomic use of patronage benefits to those receiving credit, who are generally the relatively better off farmers. The selection of insurance risks and credit rationing both reflect a larger common problem, because insurance and other types of contracts traded in financial markets are partial substitutes. For example, banks affected by the covariance problem reschedule debt, or tolerate default by adjusting the volume of new lending. Foreclosure, if it is politically or legally possible, is generally a last resort; it may not be attractive strategically when events characterized by high covariance depress the entire local economy.

#### Compulsion and Insurance

5.07 Many of the problems associated with agricultural insurance and attempts to finance the establishment and operation of official agricultural insurance programs in developing countries have led to advocacy of compulsory insurance. Compulsory insurance is not necessarily required of all farmers, although that was attempted unsuccessfully in one country; usually it applies only to those receiving loans from official sources or supported by official funds. It may be accompanied by differential premium rates that reflect differences in loss experience or expected loss experience among borrowers. Compulsion is used to increase the volume of policies sold and lower per unit administrative expenses. It is seen as a means of avoiding adverse selection, and it may be promoted as a method of raising revenues for government agencies from farmers who are not subject to land or income taxes.

5.08 The economic case for compulsion is that it can permit lenders to make larger loans or to accommodate higher risk borrowers, especially where repayment discipline may be hard to enforce, either because of institutional or political arrangements or because the borrower's own self-interest provides no incentive to purchase insurance. While the economic and financial cases for compulsion may be appealing, they should be placed in

an appropriate institutional context. For example, will insurance be administered effectively? If subsidy is involved, are the likely beneficiaries deserving of subsidy on economic or social grounds? Will patronage considerations overwhelm the integrity of claim adjustment procedures?

5.09 In one country, compulsory crop insurance was recently introduced with a total premium equal to 11 percent of loan value. Resistance from bankers, who had their interest rate spread reduced as a result of an obligation to pay a portion of the premium, was muted by their dependence on central bank funds. Farmers also objected to having to pay a share of the premium equal to three percent of loan size. Farmers in one area suffered a bad year, but yields were not reduced to the level guaranteed by the insurance. Infuriated with the refusal of the insurance authority to provide indemnities in spite of their obvious loss, and disgruntled with being required to take out coverage, these farmers organized a mass refusal to repay their loans. As a result of this and other expressions of discontent, government officials responsible for crop insurance decided that some changes in premium structure were in order, and reduced the farmers' rate while increasing the portion of the total premium subsidized by the government. The government subsidy will benefit only those farmers using officially funded credit, who are a minority of all farmers. This vignette shows how mismanagement and politicization easily enter into compulsory insurance, and also suggests some of the negative system benefits that can arise when compulsion is present. One effect is that farmers may be less willing to use credit from officially-funded sources, and less enthusiastic about repaying amounts they do use.

## VI. The Role of the World Bank

6.01 In view of the increasing interest among governments and the development community in the subject of risk and the possibilities for its accommodation through agricultural insurance, it is important that the World Bank should take a position. Its position should identify those activities related to risk and agricultural insurance with which it is willing to be associated, and the terms of its possible participation in these activities. Accordingly, the major policy conclusion here is that agricultural insurance is not generally suitable for funding by the World Bank. However, there are related activities, primarily of an informational nature, which the Bank could usefully assist.

### Bank Funding for Agricultural Insurance Is Not Yet Appropriate

6.02 There is virtually no basis at present on which to build a case for economically efficient and financially viable agricultural insurance projects. The prerequisites for agricultural insurance are generally deficient, there are few private markets for even limited crop or livestock coverage in developing rural areas, and there is no research that convincingly demonstrates its economic benefits. Until changes in these

preconditions are created, and the economic case for agricultural insurance as a production-enhancing activity is clearly apparent, this activity is generally not suitable for World Bank funding through project or structural adjustment formats.

6.03 Those advocating agricultural insurance as a useful developmental tool bear the burden of proof that agricultural insurance is an appropriate activity for a developing country or a legitimate area for Bank financing. Advocates should address specific remedies to the deficiencies noted above, in addition to quantifying the expected costs and benefits. Establishment of pilot or experimental agricultural insurance projects should generally be avoided by the Bank because of the low probability that economically or financially unsuccessful pilots would in fact be abandoned in the light of bureaucratic considerations and political consequences arising from the patronage elements of agricultural insurance.

6.04 While there are virtually no empirical studies that suggest that agricultural insurance projects or components in other rural projects could be economically justified, several studies are underway in conjunction with projects initiated by AID. Analysis of results from these activities may provide a basis for further consideration of agricultural insurance as an intervention suitable for Bank support.

6.05 The generally bad financial experience with agricultural insurance in developing countries that have such programs suggests that additional financial resources for these programs, or for their replication in countries which have not adopted this activity, would not contribute to the development of institutions which would be viable and self-sustaining over the long run. The use of several of these agricultural insurance programs as highly subsidized instruments for transfer payments and as vehicles of political patronage further suggests that this would be a difficult area for Bank operations. Concern for efficient allocation of economic resources, institutional development and financial self-sufficiency is easily overwhelmed in these circumstances.

6.06 The Bank's capabilities in dealing with risk in agriculture are woefully inadequate as of the early 1980s. The Bank has little technical expertise which it could offer for the initiation or expansion of agricultural insurance activities. The Bank has not participated directly in any crop insurance projects, nor (with the exception of a 1975 review of sugarcane insurance in Mauritius and a Kenyan program that subsequently collapsed) has it analyzed in detail any of the crop insurance programs which may be associated with World Bank projects, as in Mexico. In addition, the World Bank has had almost no other contact through its projects with insurance as a development tool. The Bank has also not dealt systematically with risks in agriculture in its project appraisal methodology except on a very generalized level, using sensitivity and switching value analysis in the economic justification of projects. A noteworthy area where risk has an impact on the performance of Bank-supported projects is found in rural credit. Even in this area, however, Bank appraisal methodology uses farm budgets incorporating normal year assumptions without specific allowances for the impact of risk on the operations of farmers using project funds.

### Steps to be Taken

6.07 In response to the recognition of the impact of risk on developing country agriculture, and as a prelude to possible participation in agricultural insurance should suitable opportunities arise, renewed efforts will be made to incorporate risk analysis into the design of agricultural credit projects. This decision should extend beyond the customary sensitivity measures applied at the project level. It should be directed towards evaluation of the impact of adverse events on the funds available to subborrowers for the repayment of loans obtained from agencies using project funds. This analysis can be based on the farm budgets that underlie credit projects and provide lending decision models for participating credit agencies. Incorporation of risk impact in project design will provide experience in dealing with the raw material of agricultural insurance as well as an opportunity to make credit projects more realistic.

6.08 The Bank could assist developing country governments with measures which would provide them with a better basis for evaluating the suitability of proposals for agricultural insurance schemes. Crop reporting systems, for example, would constitute such a tool by generating better information about the types and impact of risk facing farmers. Better crop reporting systems could also contribute to the efficiency of commodity markets and to the more effective implementation of food security policies.

6.09 Sector risk reviews could help to identify causes of variability in both farm incomes and crop yields, and could examine the behavior and institutions associated with risk assumption, sharing and transfer by rural people. A central issue is the extent to which yield variations are in fact a major destabilizing influence on consumption by farm households. Where price variations are more important sources of destabilization than yield variations, risk reviews could concentrate on the process of price formation and alternative means of accommodating this source of consumption volatility. A second important question is how traditional risk sharing mechanisms are capitalized and their robustness in risk accommodation. A third issue is the extent to which declines in crop yields are in fact responsible for low levels of repayment performance by farmers indebted to lenders implementing agricultural credit projects. From this type of enquiry, alternative means of accommodating risk associated with poor collection performance could be examined. Sector risk reviews could point to measures that would enhance risk management and risk bearing capacities, and to ways of reducing risk. However, data problems, specifically reporting inaccuracies and the absence of long time series, would probably make economically rigorous analysis difficult, although information generated less systematically could still be quite useful for agricultural project design.

6.10 The orientation of sector risk reviews must be broad in scope. They should never be simply feasibility studies for agricultural insurance. Insurance would, of course, constitute an important consideration in reviews of risks in the agricultural sector, and the broad variety of types

of insurance that could assist with risk management should be examined. These include life insurance for members of farm families; specific risk insurance such as for hail, flood, frost or fire; accident insurance, especially relating to the use of farm machinery; certain forms of live-stock insurance; insurance on items procured with loans, such as vehicles or livestock; and many more. Special insurance skills would have to be tapped by the Bank for evaluation of these alternatives.

6.11 There appears to be a strong case on intuitive grounds for considering first those types of insurance that are relatively simple to design and administer, such as life insurance, that would have a material impact on reducing the risk to which farms and farm households are subjected. Crop yield insurance does not have the merits of simplicity in design and administration as it is multi-risk, and it may not be a good strategic choice if crop yields are a less important source of farm family income variability than is apparently often assumed by advocates of crop yield programs. Issues of affordability also point towards relatively simple types of coverage if insurance is to be feasible. The relative insurability of cash crops and of food crops could also be considered in reviews of agricultural risks.

6.12 The Bank should continue to gather experience with agricultural insurance activities through research. Opportunities may exist for Bank involvement in research oriented towards programs developed under the AID-supported projects in Latin America and the Caribbean. Any decision to participate in research dealing with agricultural insurance will be taken with the understanding that useful results may require several years to generate and analyze, as cropping cycles provide only one or two opportunities per year for the generation of relevant data. Thus, any research commitment must extend over a period of several years, during which the moratorium on Bank involvement in this activity as discussed in the preceding section would be in force.

6.13 The Bank will maintain continuous liaison with AID, FAO, IICA, UNCTAD and other development agencies involved in agricultural insurance or in the promotion or study of such insurance as a development tool. Part of this dialogue could consist of discussions of this policy note, which should be circulated to other agencies for comment and discussion. Attendance at conferences dealing with agricultural insurance should also be provided for, and the results of these conferences should be made available to the interested audience within the Bank.

6.14 This policy note should be reviewed periodically to provide a continuing opportunity for discussion within the Bank of the role and potential role of agricultural insurance, and of the Bank's ability to participate usefully in this development intervention. This process would help to refine the position outlined here and to introduce modifications appropriate in the light of experience. For this purpose, a systematic review of insurance activities associated with Bank projects should be undertaken and major agricultural insurance schemes in developing countries should be monitored and evaluated. This review would seek to develop a typology of agricultural insurance activities, a clearer understanding of

their objectives, and the nature of their performance. The role or potential role for private insurance mechanisms and for the international reinsurance market should be included in any reviews undertaken. Special emphasis should be accorded the relationship between agricultural credit and agricultural insurance. This link deserves careful consideration because of the Bank's considerable support for agricultural credit and because of the conceptual connection between rural credit projects and measures to accommodate the risk of participating farmers.

POLICY NOTE ON AGRICULTURAL INSURANCE

Countries with Agricultural Insurance Programs

A. The countries listed below have comprehensive or catastrophic risk insurance programs. A catastrophic risk program is one which protects against a hazard with significant potential for catastrophe. Drought and hurricanes are examples; hail and fire are not. The catastrophic risk programs are included because they are as difficult to manage as comprehensive programs and can be readily converted into full comprehensive programs.

Developing Countries

Bangladesh	A wheat, rice and jute pilot program began in 1977.
Bolivia	Started offering policies at the end of 1980; has reinsurance.
Brazil	State programs in Sao Paulo and Minas Gerais, and a limited federal program.
Chile	A private sector, limited-risk program without subsidy was recently established; has reinsurance.
Costa Rica	Clients are primarily large rice farmers.
Cyprus	Has had programs since the 1960s.
Ecuador	Offered its first policies in April 1981
India	Has two pilot schemes. The first, based on area yield, insures rice, peanuts and cotton. The second, based on individual yield, insures cotton.
Israel	Government/private sector program; has reinsurance.
Mauritius	Insures sugarcane against typhoons; no subsidy; has reinsurance.
Mexico	One million small farmer clients.
Panama	Recently established program covers a large number of rice farmers.
Philippines	Recently established compulsory program for rice farmers borrowing from government-sponsored supervised credit programs. Non-borrowers may elect to purchase coverage.

- Sri Lanka        Mandatory coverage for rice farmers.
- Sudan            Institutional structures exist for insuring cotton on the Gezira Scheme and a variety of crops in other areas.
- Thailand         Cotton pilot program started in 1977.
- Venezuela       The insurer was legally created and generously funded in 1980, but not in operation at the end of 1981.

Other Countries

- Canada           Run by provinces with federal funding.
- France           Has disaster relief coverage on top of existing hail insurance.
- Japan            Main focus on rice.
- South Africa     Cooperative initiated and managed; government provides limited financial assistance; has reinsurance.
- Spain            Consortium of insurance companies sells the insurance, but government subsidizes reinsurers.
- Sweden           The only national area yield system.
- United States    Restructuring under the Federal Crop Insurance Act of 1980 to emphasize retailing of FCIC coverage by private sector agencies.

B. Crop Insurance programs of various types are in planning or pilot stages in Colombia, Dominican Republic, Indonesia, Iraq, Jamaica, Kenya, Korea, Malaysia, Madagascar, Morocco, Pakistan, Taiwan, and Zambia.

Sources: Adapted from "All-Risk Update," Federal Crop Insurance Corporation, United States Department of Agriculture, February 1982. Information in Part A pertaining to Sudan and in Part B regarding Iraq, Jamaica, Madagascar and Zambia, obtained on an informal basis, has not been substantiated.

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POLICY NOTE ON AGRICULTURAL INSURANCE

Criteria for Insurability

1. The criteria for insurability underlie the standards and considerations employed by the insurance industry in evaluating the technical feasibility of offering cover. Risks are eligible for insurance coverage to the extent they are measurable, characterized by mass and homogeneity, random, independent and predictable, and do not subject the insurer to catastrophic exposure. Coverage is written when it is financially affordable to the insured and when an insurable interest exists.

2. Measurability denotes that the time of loss and its cause can be specified, and that the amount of loss can be assigned a monetary value. Damage by hail is measurable by these criteria. Insurance of a minimum crop yield, on the other hand, may not completely meet these criteria because of the possibility that causes and the time of loss cannot be effectively measured.

3. Mass and homogeneity enable actuaries to construct premium rates, a process known as rate making. Mass designates large numbers of exposure units. Large numbers are required so that randomness can contribute to predictability through the operation of the theory of probability, sometimes called the law of large numbers. The criterion of mass presents no fundamental problem for insurance against agricultural loss because farmers are numerous and lands and herds are vast within the agricultural economies of most countries.

4. Homogeneity denotes that risks must be similar to each other, so that each has an equal probability of loss from an insured hazard. In practice, some tolerance is allowable. The requirement is not that insured risks be identical, but that risks be of such a character that pooling is possible. In other words, the sample to which probability is applied through the quotation of a given premium rate must be similar to the one from which the probability was calculated and the rate developed. Homogeneity also implies that past loss experience constitutes a basis for predicting future loss experience, i.e., that risks are homogeneous over time as well as among insured units. The importance of microclimates and their impact on preferred cropping patterns and yields requires the classification of risks by groups so that an acceptable degree of homogeneity is obtained. However, groups must be large enough so that valid statistical inferences are possible. Over time, changes in agricultural technology can also compromise homogeneity by altering the underlying risk.

5. Randomness and independence determine the extent to which losses are lumpy or evenly distributed, and hence the nature of exposure to which the insurer is subjected. Randomness requires that the occurrence of loss must be fortuitous, i.e., a matter of chance. If losses are not accidental, in the sense of being fortuitous, statistical theory cannot yield accurate inferences about their probabilities. Randomness implies that both the timing and the extent of loss should be outside the control of the insured, which in practice requires that the insured cannot fully know the

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outcome of an insured event. Insureds often can control to some extent the timing of loss, which limits the amounts and type of coverage that can be provided. Intentional loss is described as a moral hazard in insurance terminology, and is also uninsurable. Randomness is not necessarily compromised by the inevitability of an event. Life insurance indemnifies against an inevitable event, but one for which the timing is random.

6. Independence means that the occurrence of an insured event to one risk unit does not alter the probability of loss to other, similar risk units. Independence enables insurers to avoid catastrophic losses, defined as the occurrence of a single very large loss or the simultaneous occurrence of losses to a very large number of exposure units. Catastrophic losses threaten the adequacy of reserves held by the insurer for the purpose of meeting loss claims. As catastrophic exposure increases, the task of relating the cost of coverage and the probable exposure to loss becomes increasingly difficult.

7. Independence may pose problems for insurance against agricultural loss because certain events, such as drought, disease or locusts, tend to affect large numbers or risk units simultaneously. However, in a changing agriculture, the lack of complete independence may in fact make a contribution to reducing loss. This occurs if losses to a small number of insured units reduce the probability of their occurring to other insured units because others at risk take steps to lower the probability of the event. Examples consist of planting trees as windbreaks to reduce storm losses, improving water supplies to contribute to animal health, and constructing firebreaks.

8. Insurance markets adjust for the lack of independence through reinsurance mechanisms. Reinsurance involves the reallocation of risks by the ceding of risks among insurers, including reinsurance companies that assume the risks of insurers by performing a pooling function. Reinsurance typically involves ceding some portion of risk, and the mechanisms by which risk is shared may be classified as horizontal and vertical. Horizontal mechanisms involve the ceding of risks above certain ceiling or threshold levels, while vertical mechanisms involve pro-rata participation in insured losses of all sizes. Horizontal mechanisms are designed to finance large losses, permitting the insurer who obtains reinsurance by ceding risks to underwrite more risks that could be prudently accommodated on the basis of its own reserves. Reinsurance reallocates the division of responsibility in the insurance industry, enhancing insurance availability by spreading risks. The problems posed by geographical concentration of risk units and the size of the insurer's exposure to any one event are diffused by reinsurance. In agriculture, these problems are frequently addressed by government as an entity able to bear large risks by virtue of its size, taxing power and control over the money supply.

9. The qualities of mass, homogeneity, randomness and independence permit the application of statistical procedures to loss experience so that the extent of future losses is predictable. Predictability is based on

probability theory and applies to the class of insured risks as a whole rather than to the outcome of an identified single risk unit, which will either suffer loss or not suffer loss.

10. Insurance contracts are based on insurable interests and financial affordability. Insurable interest arises from a risk to which the insured would otherwise be subjected. Insurers regard an insurable interest as existing when the party bearing the risk would suffer a reduction in net worth as a result of the occurrence of the risk. On the part of the insured, insurability requires financial affordability in the sense that the insured is able to pay the costs of obtaining insurance protection. In most cases this implies that the costs of obtaining insurance are reasonable in relation to the loss for which protection is sought. If potential losses are trivial or if the costs of insurance protection are disproportionately large, insurance is not generally possible for all practical purposes.

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The Interaction of Credit, Insurance  
and Relative Prices on Technology Adoption

Faustino Ccama\*  
William M. Gudger\*  
Carlos Pomareda\*

1. Introduction

The adoption of input and management intensive technologies is advocated primarily as a way to increase small farmers' income. Nevertheless, the diffusion and adoption process has been rather slow and costly. Uncertainty in yields and prices and farmers' attitudes towards risk have been recognized as important factors to inhibit borrowing, investment and hence the adoption of technology.<sup>1</sup>

Uncertainty in yields is understandably a limitation for technology adoption. It is well demonstrated that under uncertainty, economic optimum use of improved seeds and fertilizers could well be at zero levels; hence the justified use of traditional technologies. If yield uncertainty was managed through a well understood crop insurance program, farmers would be more willing to adopt. Yet, farmers, as conservative and as suspicious as they are of government programs, may still doubt before taking insurance, even when this is offered at a very low (subsidized) premium.

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The existence of crop insurance guarantees income if there is a crop disaster. Therefore, it offers a compensation only when yields are below expected levels. In such case, insurance indirectly offers protection against price risk, as the crop coverage is calculated on the basis of an expected price. However, in spatially isolated markets and in the case of non perishable products, insurance that induces technical adoption and results in higher yields (and acreages planted) may contribute to lower incomes because of excess supply which lower market prices. In such case, if there is not crop loss, insurance does not offer any guarantee of price.

A third point relates to the area substitution effect induced by insurance. Increased income expectations on the insured, presumably riskier and more profitable crop, could result in area expansion at the expense of other less profitable, but also less risky crops. Yet, if there are no disasters, the expansion of the insured crop to be sold at a lower than anticipated price may have a pervasive effect on farm income. This would be the case because of lost opportunities on other crops for which prices have increased because of a decline in production

2. Crop Credit Insurance (CCI) in Bolivia

CCI was offered first in Bolivia for potato production among farmers in Cochabamba in 1980/81.<sup>2</sup> The public sector insurer (ASBA) offered protection to the credit issued by the public

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bank (BAB) for the production of potatoes under the technology recommended by the government institute of agricultural technology (IBTA). Without insurance BAB would have not issued the credit; but also without insurance and credit, farmers would have not used IBTA's technology.

The insurance program guarantees that if crop failure occurs, the farmers' debt with BAB is paid by ASBA. The indemnities are for the amount disbursed by BAB, and for other investment covered by farmers (such as organic fertilizer) plus a compensation that the farmer receives for the value of this time (priced at the market wage).<sup>3</sup> Hence, under total loss the farmer would receive not the value of the harvest, but the total value of this labor and other costs. His debt will be paid to the bank.

The area where the program was developed and implemented in 1980/81 and 1981/82 is not atypical of highland-semicommercial agriculture in Latin America. It should not be taken by any means as representative of a backward underdeveloped agriculture in remote places in Bolivia. The area is serviced by a paved road and some of the farms are less than 30 minutes of walking distance from this road, however others are faraway.<sup>4</sup> Average temperatures are mild; however, over the past 11 years the average minimum has been 23°F (-4,5°C); hence the probability of frost and hail are significant. The average annual rainfall (over 17 years) is of 713.5 mm.; yet periods of long drought are possible. The combined effects of drought and frost expose the

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crops to high yield risks; yet the severity varies among farms depending on their altitude and the direction of the winds.

The average size of crop land is of 1.3 hectares<sup>5</sup> per farm; of which potatoes account for approximately 56 percent of the area. Potatoes (*Solanum Andigenum*) are grown by all farmers. Other important crops are broad beans (*Vicia Faba*), barley (*Hordeum Vulgare*), wheat (*Triticum sp*), oca (*Oxalis Tuberosa*), papaliza (*Ullucus Tuberosum*), and onions. Potatoes are produced for home consumption (20%) and as a cash crop. Very few farmers grow onions, the most profitable and most (price) risky crop. In the area of Melga, Cochabamba, some of the farmers can have two potatoes crops. If they have access to irrigation an early potato crop (misca) can be farmed. The misca potato crop is grown in part in the winter, making it susceptible to frost. The rain-fed cycle of potato, October-May (año) is the most important, making up to 64% of the total area planted to potato. The experimental credit insurance has been offered only for rain-fed potato plantings.

### 3. Credit Insurance Research

This study was undertaken as part of a comprehensive 'research in situ' about agricultural credit insurance in Latin America carried by IICA with USAID finance. The research has addressed to issue of farm level effects of insurance (Hazell and Arcia, 1982) as well as the managerial aspects and financial viability of insurance (Pomareda, 1982; Arcia, 1982) and the

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impact on the administration of bank credit (Pomareda, 1982). In the case of Bolivia, the farm level analysis had the explicit purpose of evaluating the combined effect of credit, insurance, prices and technical assistance on the adoption of technology and farmer's income. This was made possible by data obtained over three years among insured and non-insured farmers.

The surveys' samples are summarized in Table 1. A quite unfortunately lack of planning in the sampling procedures did not allow a more symmetric set. In 1980, 148 farmers were surveyed to determine their characteristics before the beginning of the insurance program. Out of the original sample 48 farmers were insured and surveyed in 1981; 51 did not opt for insurance but were surveyed and 49 farmers were lost. The most interesting translocation of farmers among groups took place in 1982. From the 48 insured farmers in 1981, 15 took insurance for the second time, 7 did not take insurance<sup>6</sup> and 26 were lost. The following paragraphs describe the main results of the surveys, providing a comparative analysis of performance of groups over time.

The 1979/80 crop cycle was described by farmers as a fair year. Rainfall was close to average and opportune. Freezing temperatures occurred for very short periods of time, not at critical points in the crop cycle. Nevertheless, as shown in Table 2, yield of potatoes was rather low in comparison with other parts of the world (CIP, 1981). Low yields are the result of using

a traditional technology, typified mainly by a low quality seed; and very spare use of chemicals for controlling nematodes and diseases; however, farmers used relatively high levels of organic and chemical fertilizers.

The improved technology was introduced in the 1980/81 crop cycle. This was described as a good year and practically no farmers reported major crop failures; neither ASBA pay indemnities. In comparison with the previous year, farmers using the traditional technology reported yields that were 24% higher, although there were not significant changes in the levels of input use. Gross income was higher, but due to increased input prices, net income declined considerably.

The 'new' technology was typified fundamentally by an increased amount of seed of improved quality<sup>7</sup>; slightly less organic fertilizer and more chemical fertilizer, insecticides and fungicides. An important component of production costs was the interest cost of credit and the insurance premium. The impact of the technology on yields was dramatic as these were of 14,680 kg/ha. compared with 9,613 kg/ha, obtained by farmers using the traditional technology. Net income was, therefore, more than four times that received by farmers using the traditional technology. An important determinant of this larger income was the increased proportion of grade 1 potatoes, sold at a higher price.

Up to this point the benefits of the program (in a good year) were unquestionable. Nevertheless, it must be recalled that stability of prices was to a great extent arranged by the rapid move of ASBA's staff to contact truckers who purchased the excess production. This allowed the producers to sell their marketable surpluses without delay and at a fair price. As shown in Table 3 however, the potato prices in 1981 were lower than in the previous year.

The 1981/82 crop cycle was a poor one. ASBA insured 98 producers and received premiums for B/429,000<sup>8</sup>. In comparison with 1980/81, when no indemnities were paid, this last year ASBA's indemnities added to B/315,000 hence showing a lost ratio of 0.73. The relatively poor year was reflected in a decline in yields of insured and non-insured producers with a more severe impact on the first group. Yield of potatoes of non-insured producers using the traditional technology declined by 29.3 percent; but that of insured producers using the modern technology declined by 44.1 percent. This affirms the assertion that modern technologies perform more poorly than traditional ones under "less than optimal weather conditions."

The significant drop in yields was apparently compensated for by a large increase in market prices. This increase was due to inflation on one hand and to a decline in supply on the other. Interestingly, the net income of non-insured producers increased with respect to the previous year, while that of insured producers

declined. Furthermore, the net income of insured producers was (on the average) increased by almost 40 percent by the insurance indemnities and thus providing the insured farmers with net income after indemnity payments of B/9,312 compared to B/8246. Obviously, if the impact of disasters on crop yields would have been more serious, insured farmers would have received larger benefits from insurance and hence their incomes would have been larger and the ones of non-insured producers would have been smaller.

A group of producers that in 1980/81 participated in the program, decided to invest their own resources (go on their own) for the 1981/82 crop year hence they did not insure their investment and did not borrow from BAB. Their performance on potato production is shown in the last column of Table 2. In comparison with insured farmers, the independent group reported smaller amounts of all inputs except for chemical fertilizers.<sup>9</sup> This could be indicative of a learning process through which they identified a larger marginal productivity of chemical fertilizers than that of other inputs. These farmers apparently saved in all inputs, but their main reduction in cost was from not paying interest on borrowed funds and the insurance premium.<sup>10</sup>

The total yield obtained by independent producers was between that of non-insured and insured farmers; but because of the important reduction in costs, their net income was almost double that of the insured producers. A tentative conclusion from this

Table 1. Structure of the Samples among Insured and not Insured Farmers.

		1979/80	1980/81	1981/82
not insured	traditional technology	148	51	59
	modern technology		-	7
insured	modern technology	-	48	33
Total		148	99	99

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Table 2. Resource Use, Yields and Income from Potato Production among Insured and not Insured Farmers 1979-80 - 1981-82

Variable	Non-Insured Farmers with Traditional Technology		Non-Insured Farmers with Traditional Technology				Insured Farmers				Farmers Insured in 1980/81 but not insured in 1981/82 (7)	
	1979/80 (100)		1980/81 (51)		1981/82 (59)		1980/81 (48)		1981/82 (33)			
	Unit	ZB	Unit	ZB	Unit	ZB	Unit	ZB	Unit	ZB	Unit	ZB
<b>Production Cost</b>												
Yunta (kg/cta)	22	2453	23	3435	24	3649	25	3795	27	3952	18	2748
Labor (H/1)	134	10296	113	10647	150	14087	142	13282	144	13551	99	9317
Seed (Carpa)	16	7322	8	7462	11	6321	12	9211	14	10775	13	10176
Organic fertilizer (carpa)	223	8406	254	9744	176	6779	207	7856	211	8126	151	5613
Chemical fertilizer		2835		3196		3200		4600		3721		4143
Insecticides and Fungicides		175		778		945		2790		1957		1104
Other						195		3056		5847		466
<b>Total Cost</b>		31987		35145		37276		44590		47511		43567
<b>Income</b>												
1	100 (32.14)	17481	3759 (34.11)	18751	2453 (36.09)	22494	6588 (-1.88)	32940	2980 (36.35)	27277	2942	26978
2	1474 (31.88)	11875	3097 (32.72)	17388	2459 (36.18)	16254	4386 (29.88)	17544	2856 (34.84)	18873	2967	19617
3	1376 (24.18)	7129	2325 (24.18)	6973	1393 (20.49)	6282	2726 (11.57)	8178	1364 (16.64)	6151	1117	5038
4	396 (5.10)	396	432 (4.49)	432	492 (7.24)	492	980 (6.67)	980	998 (12.17)	998	276	276
<b>Total</b>		27100 (100.00)		9613 (100.00)		6797 (100.00)		14680 (100.00)		8198 (100.00)		7257 (100.00)
Gross Income		36881		38591		45572		59642		53353		51854
Net Income before Indemnities		4734		3441		8246		15052		5352		18287
Insurance Indemnities						0		0		3520		0
<b>NET INCOME</b>		4894		3445		8246		15052		9322		18287

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Table 3. Areas, Prices and Net Income per Farm over Time

	1980	1981		1982	
		Insured	non-Insured	insured	non-Insured
<u>Areas Planted</u>					
potatoes <sup>1/</sup> (año)	0.48	0.78	0.55	0.82	0.62
broad beans	0.23	0.17	0.20	0.21	0.14
<u>Prices B/kg</u>					
<u>potatoes</u>					
1°	5.80	5.00		9.17	
2°	4.80	4.00		6.61	
3°	3.80	3.00		4.51	
discard	1.00	1.00		1.00	
broad beans	5.71	5.71		11.24	
<u>Farm Net Income<sup>2/</sup></u>					
potatoes	1244	11453	2964	7497	4797
broad beans	n.a	613	622	2918	2212
barley	n.a	1450	466	949	813
other crops	n.a	487	1927	2369	1875
total	n.a	14003	5979	15723	9697
Price index <sup>3/</sup>	100.00				
Farm net real income	n.a				

<sup>1/</sup> Some farmers in this area, that have access to irrigated land, can have an early produce (misca) and a dry farming (año).

<sup>2/</sup> Includes only agricultural income, and income due potatoe misca is excluded. The following crops were included in computing net income: potatoes (año), broad beans, barley, wheat, oca, papaliza and onion.

<sup>3/</sup> Period May year t/May year t+1

later analysis is that the IBTA technology recommended to farmers may induce excess use of inputs even when expected income risk is reduced through insurance.

4. Conclusions

Several interesting, but tentative, conclusions can be drawn from this study. First, input intensive technology dramatically increases potato yields in highland rain-fed agriculture in relatively good years such as 1980-81. Even in poor years (1981-82), the yields of farmers using input-intensive technology are slightly higher than those of traditional technology. The adoption of this technology was greatly facilitated by the existence of the credit-technology-insurance package.

Secondly, farmers showed a willingness to continue utilizing most of the technology even when official credit was not available. We assume that farmers either invested their own "mattress money" or borrowed from informal lenders. In either case due to a lack of data we have not been able to calculate an opportunity cost for this investment. Thus, the income of farmers in column 7 of Table 2 is overstated, we would estimate by 30-40%, which is either the interest rate farmers could earn by investing these savings in non-agricultural activities or, alternatively, the interest rate charged by informal lenders.

Third, our data seems to indicate that the credit-technology-insurance package offers sufficient incentive to expand the area

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planted to potatoes by 20%-30%. Thus, this "package" would appear a useful policy to increase production and productivity in crops whose yields are insufficient to meet demand. Conversely we would expect little to be gained (for the farmer) by offering insurance for crops produced in adequate quantities to meet demand. The consumer, however might benefit from lower prices.

Although our data set is quite limited, it would appear that CCI when properly implemented is useful as an income stabilization policy. Farmer's incomes are far more predictable under insurance than without it. One would consequently expect that in an actuarially fair insurance scheme that insured farmers would enjoy higher net incomes in bad years (due to indemnity payments) although non-insured farmers would receive larger net incomes in good years. The choice then for the farmers is to decide between dramatic income fluctuations by not insuring or, alternatively, opt for a steady income stream by using insurance to transfer some of the profits the farmer would have realized in good years to bad years in which his income is not sufficient to meet his debt obligations. The latter alternative would appear to us to be preferable as it promotes more rational financial decision making both on the part of the farmer and the lenders.

Finally, CCI is only one of the financial services needed by farmers to effectively manage production risk. In the absence of timely delivery of inputs or of effective marketing and price policies, CCI may have only a marginal impact on the

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stability of farm incomes. We conclude, based upon our Bolivian data, that the greatest utility can be realized when CCI is part of an integrated income stabilization policy which addresses the interrelated problems of yield variability, price risk, and marketing margins. In the near future, we are hopeful that this research, presently being carried out in Panama, Ecuador and Bolivia will enable us to systematically explore the interrelationships of the various elements of an integrated rural risk management program.

End Notes

<sup>1</sup>It should be recognized that in many cases, the credit is just not available while in other situations small farmers are not willing to borrow.

<sup>2</sup>In terms of areas, potatoes account for 56 percent of the area (average of 3 years among insured and not insured farmers).

<sup>3</sup>Given the conditions of Bolivian highlands, the reservation wage is probably well below the market wage.

<sup>4</sup>Some of the farmers are located far from the paved road, and at high altitude, such as in the area of "Cóndor Puñuna."

<sup>5</sup>1 hectare = 2.4 acres

<sup>6</sup>These farmers did not receive credit from BAB. Also insurance was not provided to farmers without BAB credit.

<sup>7</sup>Much resistance was shown by farmers to the new seed and the requirement for it not be produced outside the Cochabamba valley.

<sup>8</sup>Fifty percent was paid by farmers and fifty percent by a government subsidy.

<sup>9</sup>Also in comparison with producers using the traditional technology, the independent producers used a larger amount of seed and this was of better quality, (partially reflected in a slightly larger price per 'carga' (1 carga = 92 kgs).

<sup>10</sup>This assumes that farmers used their own savings from the previous year, but no opportunity cost was assigned to this money. In any event these farmers save their money under the mattress and not at BAB (and probably not at a commercial bank either).

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Table 2. Resource Use, Yields and Income from Potato Production among Insured and not Insured Farmers 1979-80 - 1981-82

Variable	Non-Insured Farmers with Traditional Technology		Non-Insured Farmers with Traditional Technology				Insured Farmers				Farmers insured in 1980/81 but not insured in 1981/82 (7)	
	1979/80 (148)		1980/81 (51)		1981/82 (59)		1980/81 (40)		1981/82 (33)			
	Unit	₪B	Unit	₪B	Unit	₪B	Unit	₪B	Unit	₪B	Unit	₪B
<b>Production Cost</b>												
Yunta (DS/yta)	22	2453	23	3435	24	3649	25	3795	27	3992	18	2748
Labor (DS/l)	136	10296	113	10640	150	14087	142	13282	144	13501	99	9317
Seed (Cargas)	10	7322	8	7402	11	8321	12	9211	14	10775	13	10176
Organic fertilizer (cargas)	223	8406	254	9744	176	6779	207	7856	211	8128	151	5613
Chemical fertilizer		2835		3146		3300		4600		3721		4143
Insecticides and Fungicides		675		778		945		2790		1997		1104
Other						195		3056		5847		466
<b>Total Cost</b>		31987		35145		37276		44590		47961		33567
<b>Income</b>												
	<u>Kg (%)</u>	<u>₪B</u>	<u>Kg (%)</u>	<u>₪B</u>	<u>Kg (%)</u>	<u>₪B</u>	<u>Kg (%)</u>	<u>₪B</u>	<u>Kg (%)</u>	<u>₪B</u>	<u>Kg (%)</u>	<u>₪B</u>
1°	3014 (38.84)	17481	3759 (39.11)	18795	2453 (36.09)	22494	6588 (44.88)	32940	2980 (36.35)	27327	2942	26978
2°	2474 (31.88)	11875	3097 (32.22)	12388	2459 (36.18)	16254	4386 (29.88)	17544	2856 (34.84)	19876	2967	19612
3°	1876 (24.18)	7129	2325 (24.19)	6975	1393 (20.49)	6282	2726 (18.57)	8178	1364 (16.64)	6152	1117	5038
4°	396 (5.10)	396	432 (4.49)	432	492 (7.24)	492	980 (6.67)	980	998 (12.17)	998	226	226
<b>Total</b>	7760(100.00)		9613 (100.00)		6797 (100.00)		14660 (100.00)		8198 (100.00)		7252 (100.00)	
Gross Income		36881		38590		45522		59642		53353		451854
Net Income Before Indemnities		4894		3445		8246		15052		5392		18287
Insurance Indemnities		0		0		0		0		3920		0
<b>NET INCOME</b>		4894		3445		8246		15052		9312		18287

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