PD-AAR-101

RURAL CREDIT INSURANCE IN LATIN AMERICA

ANNUAL REPORT 1982 SUMMARY

IICA
Inter-American Institute for Cooperation on Agriculture
Crop-Credit Insurance Project

THIRD ANNUAL REPORT

– SUMMARY –

AGRICULTURAL CREDIT INSURANCE IN LATIN AMERICA

1982

Performed under United States Agency for International Development

Grant Number AID/LAC-IGR-1297

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1. CREDIT INSURANCE – AN OVERVIEW OF FOUR YEARS OF WORK

The first stage of the Agricultural Insurance Project is coming to a close as the August 1983 termination date draws near. Thus, 1982 is the last full year of operation for the pilot phase of a three stage project. It is appropriate to summarize what the project has accomplished, and what we have learned about Agricultural Insurance that will be of benefit to the development community in general and to international donors and countries considering in embarking upon new Agricultural Insurance Programs in particular. From the perspective of four years of work, several conclusions stand out in stark relief.

a. Agricultural Insurance is a viable rural income stabilization policy, albeit one whose design and operation requires complex technology and sophisticated management. It is now quite clear that the team that has been recruited and trained during this phase can successfully work with the countries of the hemisphere to establish technically viable insurers which provide positive benefits to farmers and lenders by stabilizing the incomes of the farmers and increasing the agricultural lending banks' rates of recovery while decreasing the administrative costs of loans. Once established, insurers' management must learn, and learn quickly during the pilot project, a complex set of techniques to insure the viability of the institution. To do so, a heavy input of technical assistance is essential.

b. Successful management requires at a minimum innovative use of usually inadequate data for rate making. Likewise, agricultural insurance is a catastrophic cover and there is no statistical independence of losses; on the contrary, droughts, floods, and hurricanes destroy production in large areas and, not infrequently, the production of entire countries. This requires careful planning of the portfolio of insured risks to achieve the maximum temporal, geographical, and ecological risk spreads across the widest number of classes of crop and livestock production activities. To do so, management needs to avail itself of sophisticated portfolio management techniques that systematically explore the relationships between premium rates, degrees of concentration, covariances within the portfolio, historical performance, and administrative costs. The greatest danger for a new dynamic management is to fall into the "fallacy of large numbers". More is not always better in agricultural insurance. A smaller portfolio of well balanced risks is far more advisable as is a slow experimental approach to new classes of business; otherwise the insurer runs the risk of unsustainable losses. Thus, it is clear that the first requirement of a successful program is resourceful, innovative management with access to technical assistance. If this can not be guaranteed, then it may be wiser to utilize development resources in other less complex projects. If it can, there are significant benefits for farmers and lenders alike to be derived from setting up an agricultural insurance program.

c. Third, it is clear from four years of work that our initial conception of Agricultural Insurance as a public sector program to help move technology and credit to small marginal farmers was flawed. Agricultural Insurance probably can not operate successfully in the public sector and it can not usefully serve marginal producers except at unsustainably high costs. Agricultural Insurance is most viable when it is not operated as a public sector program. We have, simply put, discovered no way to protect the insurer from politically motivated decision-making on the crucial issues of premium rates and what risks are insured.

d. While it is legitimate for a government to seek insurance protection for productive activities it considers in the public interest, it is destructive if the insurer can not reject certain risks or can not set an adequate premium. A public sector insurer has a high probability of becoming a mechanism for transfer payments (as in fact it has in some countries), sometimes to dilute responsability for the failure of other public institutions. Far less expensive ways of making transfer payments are available. This however does not imply either that there is no useful role for government or that agricultural insurance has no relevance for public policy. Through

a partnership of public and private sectors, government can utilize agricultural insurance for development purposes by offering to cover part of the premium and administrative costs which would make actuarially fair insurance not too expensive to be adopted. In return private sector management can be more flexible and innovative as it is less bound by both legislative mandates and politically motived decision-making.

e. Agricultural Insurance is of limited use to subsistence farmers who can not enter market-oriented production. Besides being extremely expensive to serve for the insurer and lender alike, they frequently do not produce a sufficient cash income to repay their loans, let alone an insurance premium. Agricultural producers who have the physical resources and the inclination for market-oriented production can usefully utilize insurance to lever adequate loans to adopt more productive technology without being exposed to the catastrophic financial risks that a major loss would imply. Likewise, small scale commercial farmers can usefully adopt insurance to prevent a loss that would force them back into subsistence farming. The same holds true for livestock producers who want to upgrade their herds by purchasing more productive livestock. Thus, agricultural insurance is not equally useful to all farmers; however, as a financial instrument it is extremely useful to small scale, usually inadequately capitalized farmers seeking to upgrade their technology who are restrained by the risk of a ruinous catastrophic loss.

f. If agricultural insurance is not useful for all groups of farmers, neither it should be used to manage risks arising from other than yield variability. Should the variability of farm incomes arise from price risks or other factors (including institutional weaknesses such as late delivery or credit and inputs), agricultural insurance will have only a slight impact. Even in circumstances where dramatic yield variations are produced by frequent widespread drough or innundations, agricultural insurance may not be as cost effective as irrigation and drainage. Likewise, livestock insurance is not a substitute for an animal health program. Agricultural insurance is most useful as a stabilization policy when large losses are relatively infrequent (thus permitting an acceptable low premium), unpredictable, and incontrallable. Its greatest benefit is realized when agricultural insurance is used to manage stochastic yield variability arising from climatological factors or uncontrollable plagues within the framework of a broader stabilization policy.

g. Farmers are sophisticated risk managers who can understand agricultural insurance and can usefully adopt it. After an initial trial, our research indicates that farmers and livestock producers quickly learn the intricacies of their policies and can make quite accurate assessments of the adequacy of their premium. Adoption of insurance is relatively smooth except in those cases where the premium is high due to excessive administrative costs or the premium is used to transfer resources from one crop, group or region to another. This transfer is quickly detected by the insureds. Likewise, insurance has little appeal to farmers who have a less expensive risk management tool in the form of loan cancellations or refinancing at the same or a lower interest rate. When these practices are halted and lenders make loans based upon credit worthiness and riskiness and actively try to recover loans, agricultural insurance is actively sought. However, when insurance is made obligatory either by lender or the government, as a means of compensating for capital lost due to poor bank management practices, it is actively resisted. Likewise, lenders have strongly resisted varying interest rates for insureds who are considerably less risky than uninsureds. In circumstances where lenders do not discriminate among insured and uninsured and frequently grant loan forgiveness or refinance loans, it is unfair and counterproductive to make agricultural insurance mandatory.

2. COUNTRY PROJECTS

2.1. Project Activities in Bolivia

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 Potosí and Tarija; ASBA now has offices in four major agricultural departments, La Paz, Cochabamba, Potosí 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 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 Tittle III. Under the terms of the 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. 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.

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 by AID/Washington to lay the basis for an expansion of 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.

2.2. Project Activities in Panama

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. The agricultural and livestock portfolios are well balanced and highly dispersed. 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 percent of coverage. For ISA to cover all administrative expenses from premium incomes and not require subsidies, these costs must be lowered to 1.5 percent -- 2.0 percent of coverage. The recent computarization, financed through the IICA-ISA agreement, promises to contribute significantly to reducing the costs of manual accounting, policy emission, and record keeping.

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 percent and 7 percent while livestock premiums vary from 2.5 percent and 6 percent. During the first six cycles of insurance, the overall loss ratio was 0.94 percent. 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.

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. 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 percent of the agricultural portfolio and 38 percent 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.

Second the large weight of rice must be balanced with other crops not presently included in the portfolio and with an increase in the livestock portfolio. This portfolio has produced much better overall results.

Table 1. ISA OPERATIONAL SUMMARY 1976-1982

	1976-1977	1977-1978	1978-1979	1979-1980	1980-1981	1981-1982	TOTAL
TOTAL PORTFOLIO							
Coverage ($)	25 898	1 129 579	2 636 498	8 131 592	13 114 208	13 449 904	38 487 679
Number of Policies	9	351	809	2 114	2 722	2 785	8 790
Indemnities	1 588	17 784	102 462	194 642	402 143	969 270	1 687 889
Net Premium	1 165	58 723	113 815	331 567	519 579	761 812	1 786 661
Loss Ratio	1.36	0.3	0.9	0.59	0.77	1.27	0.94
AGRICULTURAL INSURANCE							
Coverage ($)	25 898	1 130 433	1 887 511	4 575 710	6 806 637	8 894 768	23 320 957
Hectares Insured	122	5 410	7 307	13 988	16 183	18 328	61 338
Number of 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
LIVESTOCK INSURANCE							
Coverage ($)			748 987	3 555 862	6 307 571	4 605 136	15 217 556
Number of Head Insured			3 392	11 677	18 969	13 885	47 923
Number of Policies			284	830	1 276	989	3 379
Indemnities			8 731	64 191	112 130	215 301	400 353
Net Premium ($)			10 074	61 937	163 318	304 862	540 191
Loss ratio			0.87	1.04	0.69	0.70	0.74

Table 2. PANAMA – ISA PORTFOLIO STRUCTURE 1981 – 1982 ($)

INSURED ACTIVITY	Coverage	Premium	Indemnity	Loss Ratio	% of Agr. Portfolio	% Livestock Potfolio	% Total Portfolio
RICE	5 080 265	251 545	184 193	.7322	57	–	38
CORN	1 545 080	77 151	54 710	.7091	17	–	11
SORGHUM	1 107 285	54 104	323 645	5.982	12	–	8
TOMATO	689 078	46 650	85 130	1.825	8	–	5
BEANS	25 060	1 273	6 596	5.181	.3	–	.2
ONIONS	448 000	26 224	99 691	3.802	5	–	3
TOTAL	8 894 768	456 947	753 965	1.6500	100	–	65.2
FEEDER CATTLE	1 020 569	52 537	34 236	.6517	–	22	8
SEMEN BULLS	603 632	54 340	51 930	.9556	–	13	4
BREEDING STOCK	2 920 683	185 047	127 099	.6868	–	–	63
OTHERS	60 252	12 937	1 600	.1237	–	1	.4
TOTAL	4 605 136	304 861	214 865	.7048	–	100	34.4
GRAND TOTAL	13 499 904	761 808	968 830	1.272	100	100	100

Third, sorghum has produced losses every year except the first year, 1977-78, and has an overall historic loss ratio of 2.58, thus probably can not be insured at an acceptable premium and should be eliminated from the portfolio unless it is grown with irrigation.

Clearly ISA's major problem is located in its agricultural portfolio. A correlation analysis the losses of ISA's agricultural portfolio (Table 3) shows that rice losses are strongly correlated with sorghum, bean and tomato losses, and have a weak positive correlation with corn. In fact, of the ten correlations only one is negative (corn with beans) and one insignificantly positive (corn with tomatoes). All the rest range from weak positive (rice with corn) to almost perfect correlations of 1 (rice with tomatos).

The time series data upon which this analysis is based is only five years for corn and sorghum, four years for rice, and three years for tomatoes and beans. However, it clearly shows the problem of attempting to achieve an adequate risk dispersion within a small country. The data reflects only the correlation of the incidence of losses and not the correlation of the severity of loss. The loss ratios in Table 2 suggest that while many crops are hit simultaneously, the severity of the losses will enable the insurer to successfully manage the portfolio. The losses appear to be sufficiently infrequent to permit unsubsided premiums when the structure of the portfolio is modified and several premium rates are adjusted.

Table 3. LOSS CORRELATION COEFFICIENT BY CROP

1977 – 1982

	Rice	Maize	Sorghum	Bean	Tomato
RICE	1.0000 (.0000)	.15144 (.8486)	.54731 (.4527)	.71604 (.4919)	.99830 (.0371)
MAIZE		1.0000 (.0000)	.32449 (.5942)	-.60665 (.5850)	.06250 (.9602)
SORGHUM			1.0000 (.0000)	.82114 (.3867)	.99428 (.0681)
BEAN				1.0000 (.0000)	.75550 (.4548)
TOMATO					1.0000 (.0000)

The number in parenthesis is the probability that the correlation coefficient is equal to zero.

Based upon our four years of work in Panama, some very tentative conclusions can be offered.

First, administrative costs can probably be lowered to a point where they can be borne by premiums through economies of scale, automation, and careful management of expensive field operations.

Second, our research (see the research section of this report) shows that farmer and lender alike benefit from agricultural insurance. There is reason to believe, but no conclusive proof as yet, that a credit and insurance package is no more expensive to operate than credit without insurance.

Third, it would appear that it is possible to assemble all-risk portfolios that will produce acceptable loss ratios even in small countries. Traditional insurance principles of careful selection, maximum dispersion and premiums which reflect the actual experience are a prerequisite to a viable insurer. Likewise, new more sophisticated portfolio management strategies that systematically explore the correlation of elements of the portfolio are required to achieve long-term viability.

Fourth, due the very widespread nature of agricultural losses and the lack of statistical independence of losses, both a large reserve and heavy reinsurance are required for the long-term viability of the insurer. Unless insurers are well capitalized and are able to obtain reinsurance, it is highly likely that a major loss will destroy them.

Fifth, our experience clearly indicates that a carefully designed and monitored pilot project is of great value. The technology is complex and the risks show great variances even at a disaggregate microlevel as small as a single farm. Thus, a period of intensive observation and learning is required to understand the nature of the risks confronted before launching a large scale program. Countries which ignore these considerations and launch large scale insurance programs covering only one or very few crops court disasterous losses.

2.3. Project Activities in Ecuador

The Ecuadorian insurer, CONASA, 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 Carchí, rice in Guayas and two types of corn: hard corn on the coast and soft corn grown in the moutains. In addition, livestock insurance was initiated, mostly of registered dairy stock.

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 much more adverse than expected, as shown in Table No. 4.

While a net loss of 954 000 Sucres is not serious, the implied risk premium of 19 percent for potatoes and 9 percent for rice will make it difficult indeed for farmers 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.

CONASA's capital structure has changed only slightly during 1982. The total paid-up capital is 10 750 000 Sucres of which the Banco Nacional de Fomento has contributed 4 000 000 Sucres and the Ministry of Agriculture 6 150 000 Sucres. The Government thus owns about 95 percent of the company. The remaining 5 percent 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.

Table 4. CONASA 1982 EXPERIENCE

Insured Activity	# of Policies	ECUADORIAN SUCRES			
		Coverage	Premiums	Indemnities	Loss Ratio
Potatoes – Carchí	37	4 515 950	270 957	861 186	318%
Rice – Guayas	50	13 075 816	653 790	1 140 646	175%
Hard Corn – Coast	14	1 362 600	54 538	54 150	99%
Soft Corn – Mountains	13	1 071 000	42 272	22 428	53%
Cattle	29	6 122 500	281 725	178 500	69%
TOTAL	143	26 147 860	1 303 282	2 256 910	173%

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 number 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 analize sufficient data to permit us to set adequate premium rates and develop the administrative systems to reach large numbers of highly dispersed producers.

3. RESEARCH ACTIVITIES

3.1. Introduction

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 Panamá) and second, create a methodology and a data base. As a result, our work concentrated on Panamá 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.

3.2. 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 analize.

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 individual 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 Panamá (1976-1982).

** A complete data file and a research report will soon be available. Due to its length, we will issue it separately.

e) Desaggregated information for each insurance policy issued between 1976/77 and 1981/82 by the Agricultural Insurance Institute of Panama (ISA), including approximately 5000 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 years 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 have 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.

3.3. 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 Chiriquí Province and Guararé 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 percent risk level (in fact, it became marginally so only at the .0001 percent 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 3 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 Guararé district, insurance has a substantial impact on the level and stability of farm income. Insurance in this drought-prone area accounts for a 50 percent income differential.

As we noted earlier in this report, 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 risk can usefully incorporate insurance into their overall risk management strategy. This finding appear to modify the argument that farmers, especiall 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 Coclé 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 widspread 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 Guararé 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 Coclé and Los Santos are different than their smaller less commercial collegues in Bugaba and Guararé. They appear to have sought insurance to manage the severe financial risk of capital intensive production by poorly capitalized enterprises. Their collegues in Bugabá and Guararé sought to protect their much small investments from the ravages of weather. In the final analysis, it appears from our Panamá data that farmers:

1. Can understand and usefully utilize an actuarilly fair crop credit program to manage climatological risk and its concomitant financial risk.

2. As farmers move from subsistence to semi-commercial and capital intense commercial production, insurance becomes increasingly useful.

Our research in Panamá demonstrated that semi-commercial farmers operating under reasonably adverse conditions as well as commercial farmers utilizing capital-intense 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 percent 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/hec 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. Yields of insured producers with modern technology fell 44 percent while uninsured producers with more traditional technology declined 29 percent, demonstrating 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 incomes of non-insured farmers increased with respect to the previous year rose from B/2.923 to B/7.784 while insured farmers' incomes fell from B/14.996 to B/8,928, of which about 1/2 was insurance indemnities. However, if the two years are averaged out uninsured farmers had an income of B/5.353.50 while insured farmers' average income was B/9.613 without indemnities and B/11.962 with indemnities. If this pattern continues in future good and bad cycles, it argues that technology adoption can be profitable despite dramatic declines in income as frequent as one year in two.

An unintended but a most fourtuitous hybrid group emerged in our sample frame. A small group who were insured in 1980/81

Table 5. RESOURCE USE, YIELDS AND INCOME FROM POTATO PRODUCTION AMONG INSURE AND NON INSURED FARMERS, 1979-80 – 1981-82 PER HECTARE

VARIABLE	NON INSURED FARMERS WITH TRADITIONAL TECHNOLOGY						INSURED FARMERS WITH IMPROVED TECHNOLOGY				FARMERS INSURED IN 1980/81 BUT NOT INSURED IN 1981/82	
	1979/80 (n = 122)		1980/81 (n = 48)		1981/82 (n = 58)		1980/81 (n = 38)		1981/82 (n = 33)		(n = 7)	
PRODUCTION COST	Unit	$b	Unit	$b	Unit	$b	Unit	$b	Unit	$b	Unit	$b
– Oxen (Days)	24	2 565	23	3 455	25	3 685	25	3 797	27	3 992	18	2 748
– Labor (Days)	141	10 567	112	10 571	151	14 197	142	13 339	144	13 501	99	9 317
– Seed (Cargas)	10	7 262	8	7 528	11	8 324	12	9 191	15	11 438	33	10 176
– Organic Fertilizer (Quintales)	234	8 813	264	10 128	186	7 160	212	8 059	244	8 627	151	5 613
– Chemical Fertilizer	–	2 818	–	3 157	–	3 296	–	4 436	–	3 721	–	4 143
– Insecticides and Fungicides	–	676	–	828	–	946	–	2 970	–	1 997	–	1 104
– Interest and Premium	–	–	–	–	–	–	–	3 034	–	5 847	–	–
– Other	–	–	–	–	–	130	–	–	–	–	–	466
TOTAL COST		32 761		35 667		37 738		44 646		49 123		33 567
YIELD AND INCOME[1]	Kg (%)	$b	Kg (%)	$b	Kg (%)	$b	Kg (%)	$b	Kg (%)	$b	Kg (%)	$b
1°	2 793 (37.60)	16 199	3 759 (39.11)	18 795	2 453 (36.09)	22 494	6 588 (44.88)	32 940	2 980 (36.35)	27 327	2 942 (40.57)	26 978
2°	2 541 (34.20)	12 197	3 097 (32.22)	12 388	2 459 (36.19)	16 254	4 386 (29.88)	17 544	2 856 (34.84)	18 876	2 967 (40.91)	19 612
3°	1 660 (22.34)	6 308	2 325 (24.18)	6 975	1 393 (20.49)	6 282	2 726 (18.57)	8 178	1 364 (16.64)	6 152	1 117 (15.40)	5 038
4°	435 (5.86)	435	432 (4.49)	432	492 (7.24)	492	980 (6.67)	980	998 (12.17)	998	226 (3.12)	226
TOTAL YIELD	7 429 (100.00)		9 613 (100.00)		6 797 (100.00)		14 680 (100.00)		8 198 (100.00)		7 252 (100.00)	
GROSS INCOME		35 139		38 590		45 522		59 642		53 353		51 854
– Net Income Before Indemnities		2 378		2 923		7 784		14 996		4 230		18 287
– Insurance Indemnities		–		–		–		–		4 698		–
NET INCOME		2 378		2 923		7 784		14 996		8 928		18 287

1 The figures below refered to the quality grades of potatoes.

but not in 1981/82 produced net incomes of B/18.287. In a relatively poor year incomes exceeded those of a good year, 1980/81. These income were achieved by modest reductions in amount of labor, organic fertilizer, insecticides and fungicides. The biggest cost reduction, 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 percent, 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 very similar to their insured neighboors.

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 income in poor year as traditional technology. Second, the new technology farmers first adopt, then adapt and continue to use it 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 factilies. 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 as part of an integrated incomes stabilization policy.

3.4. 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 very 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 percent 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 technical assistance probably can not 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 larger number of countries. Scarce and expensive expertise can most usefully be channeled to new emerging insurers. It probably can not 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 can not 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 metodological 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.

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