*REPORT TO THE CONGRESS*

*BY THE COMPTROLLER GENERAL OF THE UNITED STATES*

# The Federal Crop Insurance Program Can Be Made More Effective

The Federal crop insurance program would provide little economic relief in the event of widespread crop failure.

The program is ineffective primarily because guarantees and premiums, set on a county or areawide basis, are excessive for some producers and too low for others.

GAO recommends that the U.S. Department of Agriculture and Federal Crop Insurance Corporation develop personalized rates and guarantees on the basis of individual producers' annual yield data for a successful crop insurance program.

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DECEMBER 13, 1977

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report summarizes our observations on the effectiveness of the Federal crop insurance program.

Our principal observation concerns the need to develop a more personalized crop insurance program with production guarantees and premium rates based on the farmer's prior yield history. The Federal Crop Insurance Corporation's manager concurred with the principles of individualizing rates and coverages and indicated that the Corporation would move toward attaining these goals.

We made this audit pursuant to the Government Corporation Control Act (31 U.S.C. 841) and the Federal Crop Insurance Act (7 U.S.C. 1513).

We are sending copies of this report to the Acting Director, Office of Management and Budget; the Secretary of Agriculture; and the Chairman, Board of Directors, Federal Crop Insurance Corporation.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

# THE FEDERAL CROP INSURANCE PROGRAM CAN BE MADE MORE EFFECTIVE

## D I G E S T

Federal crop insurance indemnities would provide little economic relief to the Nation's agricultural producers in the event of widespread crop failures. GAO believes that a major change in basic program operations is necessary if the Federal Crop Insurance Corporation's insurance program is to attain widespread acceptance. Under the current program, production guarantees and basic premium rates are set on a county or areawide basis.

GAO believes that a personalized crop insurance program would provide a more attractive and salable insurance program which would stimuate greater producer participation. Further, because personalized insurance is actuarially sound, it should benefit the Corporation's financial operations. (See pp. 35 and 36.)

## MINIMAL ECONOMIC PROTECTION

In crop year 1974 the Corporation provided about $1.2 billion of protection on agricultural crops. This coverage was less than 3 percent of the $40.1 billion derived from agricultural crop sales in the 39 States with Federal crop insurance. In 1976 coverage was about $2 billion. GAO estimated that in 1974, when adverse weather conditions caused widespread damage, producers suffered production losses on five major crops valued at $6.9 billion, of which an estimated $420 million was incurred by insureds. The Corporation paid insured producers about $49.8 million, or 12 percent of the estimated value of their lost production. (See pp. 7 and 8.)

When insurance indemnities reimburse producers for their direct production expenses, adverse economic effects are significantly reduced.

During 1974 production costs on the five crops ranged from $89 to $238 an acre. The Corporation's per-acre coverage for these crops ranged from 25 to 37 percent of these costs. (See p. 8.)

## CONTINUING LOW PRODUCER PARTICIPATION

A high level of participation is essential to a sound insurance program. The Federal crop insurance program has not attained a high degree of national acceptance and participation from agricultural producers. In 1964 the Corporation insured about 7.1 percent of the harvested acres of nine major crops. Although the total insured acres of these crops had increased significantly by 1974, the Corporation still insured only 7.5 percent of harvested acres since total harvested acres had also increased. (See p. 12.)

## CAPTITAL ERODED DUE TO ADMINISTRATIVE EXPENSES

The Corporation's invested capital was increased from $60 million to $150 million in fiscal year 1977. Capital reserves for the insurance program have fluctuated due to cycles of good and bad crop years and the amount of insurance sold. For crop years 1948-76 premiums exceeded indemnities by about $20 million. But capital has consistently dwindled because the insurance fund has had to absorb some $88 million of administrative and loss adjustment expenses not covered by annual appropriations.

## MORE PERSONALIZED RATES AND COVERAGE ARE NEEDED

A producer's yields deviate from year to year because of variations in nature and the producer's management practices. The annual deviation is indicative of the insurance risk because yield deviations below the production guarantee result in indemnities. There are both erratic (high-risk) and consistent (low-risk) producers in any group; thus, insurance rates should reflect these risks. However, the Corporation's basic premium rates are the same for all insureds in a given area. (See pp. 17 and 18.)

Because the Corporation sets production guarantees and basic premium rates for most crops on the basis of the estimated productive capability of land areas and countywide loss history, production guarantees and rates are too high for some producers and too low for others. Establishing the same production guarantee for all producers in the area encourages greater participation by those producers whose average yield is at or below the average yield of the group. (See p. 20.)

A 1970 task force appointed by the Secretary of Agriculture suggested a more personalized insurance program. The Corporation has experimented on a limited basis with such a package. One Corporation study tentatively concluded that policy cancellations could be reduced and loss history improved by offering more personalized production guarantees and premium rates. (See pp. 26 and 27.)

GAO TEST OF A SYSTEM TO PROVIDE PERSONALIZED RATES AND GUARANTEES

GAO tested the feasibility of a personalized insurance package for 152 insured cotton producers in one county. Because GAO's test considered the risk of erratic production, individual rates and guarantees varied significantly from those provided by the Corporation, but total premiums and indemnities were comparable. For the majority of the producers, guarantees increased and rates decreased, indicating that such a system of personalized rates and guarantees would probably increase participation in this county. (See pp. 28 and 29.)

While generally agreeing with the advantages of providing a more personalized insurance package, Corporation officials contended that reliable yield data could not be obtained for most crops. GAO believes that sufficiently reliable production data can be obtained from producers. The 1970 task force appointed by the Secretary of Agriculture to study the Corporation reached the same conclusion. (See pp. 27 and 35.)

Therefore, GAO recommends that the Secretary of Agriculture and the Corporation's Board of Directors develop a personalized crop insurance program with production guarantees and premiums based on the producer's prior yield history. (See p. 36.)

The Corporation manager concurred with the principles of individualizing insurance rates and coverages and indicated that the Corporation would move toward attaining these goals.

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## ABBREVIATIONS

| | |
|---|---|
| ASCS | Agricultural Stabilization and Conservation Service |
| FCIC | Federal Crop Insurance Corporation |
| GAO | General Accounting Office |
| USDA | U.S. Department of Agriculture |

## GLOSSARY

| | |
|---|---|
| Coverage | The dollar value of the insurance protection. |
| Indemnity | An insurance loss payment. |
| Premium rate | Premium expressed as a percentage of the coverage. |
| Production guarantee | The number of units (such as pounds or bushels) insured. |

# CHAPTER 1

## INTRODUCTION

Crops are subject to many natural hazards over which producers have no control. As a result of weather, insects, and disease, thousands of crops are totally or partially destroyed even in the best production years. The typical producer has a major investment in his growing crops. Direct operating costs for machinery, fertilizer, seed, fuel, insecticides, irrigation water, and labor are high and have been increasing. Often the loss of a crop results in financial difficulties. When crop failures or heavy losses come in a series of years--a not uncommon situation--financial distress and failures are common.

Agricultural revenues are a major factor in national income, and crop catastrophes often necessitate Government grants, loans, or other assistance to affected producers. Any stabilizing factor, such as crop insurance, favorably affects the prosperity of the country as a whole and reduces the need for emergency relief measures.

Two Department of Agriculture programs--an insurance program and a direct-payment program--offer thousands of the Nation's agricultural producers some protection against loss of income when their crops are damaged or destroyed by natural causes.

## INSURANCE PROGRAM

The crop insurance program is administered by the Federal Crop Insurance Corporation (FCIC). The program's purpose is to promote the national welfare by improving the economic stability of agriculture through a sound system of crop insurance. For crop year 1/ 1948-76 FCIC provided about $17.5 billion of protection. During the same period premiums were about $963 million, while indemnities were about $943 million. The 1976 program provided almost $2 billion of coverage on 23 crops against practically all natural causes of loss. Crop insurance is not available in all counties or necessarily for all major crops in a county. Under existing legislation and implementing regulations, FCIC can limit or refuse insurance in any county or area or on any farm on the basis of the insurance risk involved.

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1/Generally crop year means the period within which the insured crop is normally planted and normally harvested. It is designated by reference to the calendar year of normal harvest.

The Federal Crop Insurance Act of 1938 (7 U.S.C. 1501) (1970) created FCIC as an agency of the U.S. Department of Agriculture (USDA). Capital stock was to be subscribed by the U.S. Government, thus providing that FCIC would be a wholly owned Government corporation. The Corporation's invested capital was increased from $60 million to $150 million in fiscal year 1977. The additional capital was needed because of heavy insured losses for crop years 1976 and 1977. Over time capital reserves for the insurance program have fluctuated due to cycles of good and bad crop years and the amount of insurance sold.

The act authorizes FCIC to set premiums at rates sufficient to cover claims for crop losses and to establish as expeditiously as possible a reserve for unforeseen losses. Operating and administrative expenses are provided by annual appropriation and are not provided for in the premiums. The act authorizes annual appropriations not to exceed $12 million, for these purposes, plus an additional amount payable from premium income within limits prescribed in annual appropriations. In addition, direct costs in connection with loss adjustments are declared to be nonadministrative or nonoperating expenses and thus payable from premium income.

For the period July 1948 through September 1976, FCIC spent about $53.2 million from premium income for operating and administrative expenses and an additional $34.6 million from premium income for the cost of loss adjustment. Premiums for crop years 1948-76 exceeded indemnities by about $20 million.

Therefore, capital has consistently dwindled because the insurance fund has had to absorb some $88 million of operating and administrative and loss adjustment expenses not covered by annual appropriations.

For crop year 1976, FCIC offered insurance in 39 States and in 1,464 of the 3,066 counties in the United States. Appendixes I and II show where crop insurance was available and what crops were insured during crop year 1976. The results of FCIC's financial operations since 1948 are shown in appendixes III, IV, and V.

## FCIC organization

The Secretary of Agriculture supervises the administration of the crop insurance program through a five-member board of directors. Two are usually high-level USDA officials, two are from private industry with experience in insurance, and the fifth is FCIC's manager. The board determines overall policies and approves the terms and conditions of insurance

contracts offered. Appendix VIII lists the principal officials responsible for the program during the past few years.

FCIC has a headquarters office in Washington, D.C.; a National Service Office and Actuarial Division in Kansas City, Missouri; 4 regional underwriting offices; 14 regional sales and service offices serving individual States or groups of States; and about 315 local offices serving individual counties or groups of counties.

FCIC's local offices served 1,464 counties with a 1976 insurance program, an average of 4.6 counties per office. However, the average number of counties served by individual offices ranged from 1 to 16. FCIC's sales and service operation varies. In most cases it operates its own offices, although most sales and service personnel are employed on a part-time basis. In a few counties, employees of USDA's Agricultural Stabilization and Conservation Service (ASCS) service FCIC insurance contracts. ASCS has about 2,700 county offices. Commissioned insurance agents are used almost exclusively in two States covered by one sales and service office.

## DIRECT-PAYMENT PROGRAM

The direct-payment program for crop years 1974-77 was authorized by the Agriculture and Consumer Protection Act of 1973 (Public Law 93-86, 87 Stat. 221). It is administered by ASCS through county committees. The program covers five crops--upland cotton, wheat, corn, grain sorghum, and barley. A similar program for the 1976 and 1977 rice crops was authorized by the Rice Production Act of 1975 (Public Law 94-214, 90 Stat. 183). Both programs will expire at the end of the 1977 crop year.

Although not geographically limited, only producers with acreage allotments for these crops are eligible for program payments. The payments are made to alleviate losses due to drought, flood, or other natural disasters or conditions beyond the producer's control. The program is, in effect, a free insurance program. Coverage for these crops is also available under FCIC's insurance program.

## PROPOSED LEGISLATION

The President's budget for fiscal year 1976 indicated that legislation to expand the FCIC program--as a substitute for the direct-payment program--would be sent to the Congress. It said that this change would place disaster protection on a sound financial basis and shift most of the cost from the

taxpayers to the primary beneficiaries--the agricultural producers. The proposed legislation was introduced in May 1975 but was not enacted.

In a May 1976 report to the Congress, 1/ we discussed the two programs. The report

--pointed out inconsistencies in the direct-payment program,

--described the FCIC insurance program and the proposed legislation which would expand the crop insurance program and repeal the direct-payment program, and

--set forth several options as to the Federal role in protecting agricultural producers from serious crop losses.

In the report we said that while we believed the proposed legislation had considerable merit, certain matters would have to be dealt with in the legislative process if the expanded FCIC program was to give producers essentially the same protection they enjoy under the ASCS direct-payment program.

There are a number of options for assuring that the agricultural industry has protection against crop losses resulting from natural disasters. These options are not mutually exclusive, and any policy chosen may involve some combination of the individual options. The options generally fall into two broad categories.

--The current programs could be continued, with or without modifications. The direct-payment program could be changed to improve the equity among producers, to avoid excessive payments, and to eliminate the overlap between it and the crop insurance program.

--The crop insurance program could be made available nationwide and the direct-payment program terminated. A premium subsidy might be a part of a national crop insurance program.

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1/"Alleviating Agricultural Producers' Crop Losses: What Should the Federal Role Be?" (RED-76-91, May 4, 1976).

Several legislative proposals related to the crop insurance program have been introduced in the 95th Congress. 1/ Some would provide for an expanded crop insurance or crop protection program which would essentially replace the direct-payment program; some would provide for premium subsidies; and some would require that individualized insurance be studied.

This report presents information about FCIC operations which the Congress may find useful in determining the Federal role in agricultural disaster protection.

## SCOPE OF REVIEW

We interviewed officials of FCIC's National Service Office and the Actuarial Division at Kansas City and the underwriting office at Oklahoma City, Oklahoma. We reviewed internal audit reports, crop insurance regulations, contract files, correspondence, actuarial files, and other data at the Actuarial Division and National Service Office in Kansas City. We obtained data from the Bureau of the Census and the Bureau of Labor Statistics. We used studies of Federal crop insurance made by third parties.

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1/Bills introduced as of Sept. 1, 1977, include Senate bills 319, 497, 788, 955, 986, 1575, and 1746 and House bills 1490, 2838, 3574, 4194, 4229, 4289, 4877, 5011, 5085, 5560 7111, 7269, and 8858.

## CHAPTER 2

## FCIC IS NOT A VIBRANT ECONOMIC FORCE

The Federal Crop Insurance Corporation would provide little economic relief in the event of widespread crop failures. In crop year 1974, when adverse weather conditions caused widespread production losses, FCIC coverage was only 2.9 percent of the value of crop sales in the 39 States with crop insurance. Losses on the five crops covered by the Agricultural Stabilization and Conservation Service's direct-payment program were estimated at $6.9 billion, of which an estimated $420 million was incurred by FCIC insured producers. FCIC's crop year 1974 indemnities on these five crops were only $49.8 million--less than 1 percent of total losses and less than 12 percent of the estimated losses incurred by policyholders. Payments under the direct-payment program for 1974 crop losses were $557 million, or some 11 times greater than the insurance indemnities.

Consistent and widespread participation is essential for FCIC to have any significant stabilizing effect on the Nation's agricultural economy in the event of widespread crop failure. Although the number of insureds varies among crops, counties, and States, FCIC has not attained a high degree of national acceptance and participation from agricultural producers. In crop year 1974, FCIC insured only about 6.6 percent of the acreage planted with 18 major crops.

Available studies indicate that farmers do not buy crop insurance mainly because the guarantees are too low and/or the premiums are too high. During 1974 production costs for the five crops covered by the direct-payment program ranged from $89 to $238 an acre. FCIC's per-acre guarantee for these crops ranged from 25 to 37 percent of total production costs.

For these reasons, FCIC's present insurance plan is inequitable and therefore unattractive to many producers. A plan providing more personalized rates and guarantees, as we recommend in chapter 3, could be more equitable and attractive to producers and should therefore increase program participation. Some internal FCIC program evaluations also tend to recognize the need for more personalized rates and guarantees.

### FCIC OFFERS MINIMAL ECONOMIC PROTECTION

The minimal economic protection which FCIC provides is illustrated by comparisons of the values of FCIC

--insurance coverage and crop sales,

--indemnities and production losses, and

--insurance coverage and production expenses.

Crop sales

The value of crop sale compared with the value of Federal crop insurance coverage provides one measure of the negligible economic protection that FCIC would provide in the event of a widespread crop failure. FCIC's 1974 coverage of $1.2 billion was only 2.9 percent of the $40.1 billion derived from crop sales in the 39 States with crop insurance. These States accounted for about 97.2 percent of total nationwide crop sales; thus, Federal crop insurance is offered in the principal agricultural States. However, insurance is not available for all crops or in all counties in these 39 States. FCIC's coverage value was only 4.1 percent of the value of crop sales in 98 randomly sampled counties where crop insurance was offered. FCIC's coverage ranged from 0.4 to 16.3 percent of crop sales in the 39 States and from 0 to 29.8 percent in the 98 sample counties.

Crop year 1974 production losses

A comparison of FCIC's 1974 indemnities with the value of 1974 production losses provides another indicator of FCIC's lack of success in meeting its goal of stabilizing agricultural income to promote the general welfare of the Nation.

During the 1974 growing season, adverse weather conditions in major agricultural regions caused widespread production losses. For the five crops covered by the ASCS direct-payment program, we estimated the value of production losses on acres actually harvested at $6.9 billion. (This does not include significant additional acreage planted with these five crops but not harvested. We could not estimate the value of lost production on this acreage.) Of the $6.9 billion, an estimated $420 million was incurred by FCIC policyholders. FCIC indemnities to insured producers of these five crops totaled about $49.8 million--only 12 percent of the value of the lost production on harvested acres, as shown in the following table.

1974 Production Shortfalls Reimbursed

BY FCIC Indemnities

| Crop | Harvested acres | Yield per acre below normal | Estimated value of production deficiency | Estimated deficiency on FCIC insured acres | FCIC indemnities | Percent of insureds' deficiency reimbursed by FCIC |
|---|---|---|---|---|---|---|
| | (000 omitted) | | ----------(000 omitted)---------- | | | |
| Cotton | 12,547 | 70 lbs. | $ 375,908 | $ 16,615 | $ 6,886 | 41.44 |
| Wheat | 65,459 | 4.6 bu. | 1,216,490 | 162,645 | 15,834 | 9.74 |
| Corn | 65,194 | 23.7 bu. | 4,558,039 | 215,595 | 23,995 | 11.13 |
| Grain sorghum | 13,917 | 14 bu. | 545,546 | 15,821 | 1,812 | 11.45 |
| Barley | 8,281 | 7.3 bu. | 164,428 | 9,471 | 1,290 | 13.62 |
| Total | | | $6,860,411 | $420,147 | $49,817 | 11.86 |

## Amount of production expenses protected

Comparing the value of FCIC's insurance coverage with production expenses also indicates the minimal economic protection FCIC offers. The act limits Federal crop insurance coverage to 75 percent of a farm's average yield, or the per-acre investment in the crop in the area, whichever is less. If in the event of widespread disaster insurance indemnities reimbursed producers for their direct production expenses, adverse economic impact from crop losses would be significantly reduced. However, the value of FCIC's insurance coverage was only 2 percent of agricultural production expenses in the 39 States and only 3 percent in the 98-county sample.

Our data relates FCIC coverage value to production costs incurred by uninsured as well as insured producers to show the overall lack of protection provided to producers on their investments in crops; but, even for those relatively few insured producers, the protection is marginal. The Department of Agriculture's Economic Research Service, in compliance with section 1 (27)(B) of the Agriculture and Consumer Protection Act of 1973 (87 Stat. 237), prepared a report on the cost of producing selected crops in 1974. These average costs per acre, when compared with FCIC's 1974 average per-acre coverage value, show that an insured producer's investment costs were substantially greater than the value of FCIC's coverage.

| Crop | Total costs per acre (note a) | Average FCIC coverage value per acre | Percent of FCIC coverage value to total investment |
|---|---|---|---|
| Cotton | $238 | $89 | 37 |
| Wheat | 96 | 30 | 31 |
| Corn | 198 | 59 | 30 |
| Grain sorghum | 108 | 37 | 34 |
| Barley | 89 | 22 | 25 |

a/Costs include direct costs, such as labor, seed, fertilizer, and machinery; overhead costs, such as taxes and electricity; the estimated value of management input; and land costs. For this table, land costs are the estimated current values multiplied by the applicable Federal Land Bank interest rate.

FCIC insurance is, in effect, a production guarantee. For most crops the insured is guaranteed a specified number of units per acre. For production shortfalls below the guarantee, the producer is indemnified at a specified price per unit. FCIC production guarantees range from 30 to 75 percent of average yield, depending on the specific crop and county. Thus, some FCIC insured producers can incur losses of up to 70 percent of average yield with no indemnity.

The prices per unit at which production shortfalls are valued vary in relation to market prices from year to year and crop to crop. The following table illustrates the relationship of FCIC protection, production costs, and expected revenues on wheat for 1974. Data is shown for wheat production guarantees of 12 and 18 bushels to the acre, representing 40 to 60 percent of an expected yield of 30 bushels an acre. For purposes of the table:

--Market price is assumed to be $4 a bushel, the approximate market price for 1974; expected revenues are therefore $120 an acre.

--FCIC indemnities are valued at $2 a bushel, the maximum price at which FCIC indemnified wheat growers for 1974.

--Production costs are assumed to be $90 an acre. 1/

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1/The Economic Research Service estimated 1974 wheat production costs, depending on treatment of land values, at from $72 to $96 an acre.

| Actual yield per acre | | Dollar per acre | | |
|---|---|---|---|---|
| | | Production costs not recovered from sales | Amount of FCIC indemnity | |
| Percent of expected | Bushels | | 12-bushel guarantee | 18-bushel guarantee |
| 80 | 24 | $ 0 | $ 0 | $ 0 |
| 70 | 21 | 6 | 0 | 0 |
| 60 | 18 | 18 | 0 | 0 |
| 50 | 15 | 30 | 0 | 6 |
| 40 | 12 | 42 | 0 | 12 |
| 33 | 10 | 50 | 4 | 16 |
| 25 | 7.5 | 60 | 9 | 21 |
| 20 | 6 | 66 | 12 | 24 |
| 10 | 3 | 78 | 18 | 30 |
| 0 | 0 | 90 | 24 | 36 |

## CONTINUED LOW PARTICIPATION IS INDICATIVE OF NEGLIGIBLE ECONOMIC IMPACT

For several years FCIC has reported that it was insuring some 10 to 15 percent of eligible planted acres. This reported percentage is based on only the planted acres in counties where crop insurance is offered. If total acres planted are considered, the percentage of insured acres is substantially less. For example, the table on the following page, which compares the percent of participation as reported by FCIC with that based on total acres planted for crop year 1974, shows that FCIC insured only about 6.6 percent of the acreage planted nationwide with 18 of the 22 crops on which insurance was offered. The acreage planted with these crops comprised over 97 percent of insured acres.

The 1974 Census of Agriculture showed that some 296.1 million acres of cropland were harvested in the 39 States where FCIC offered crop insurance. During crop year 1974, FCIC insured a total of 18.7 million acres, or 6.3 percent.

The percent of total planted acres FCIC insures varies significantly among crops, ranging from 33 percent for tobacco to less than 3 percent for oats, rice, tomatoes, and grain sorghum. Significant variations exist also for the same crop among States and counties. For example, FCIC offered crop year 1975 wheat insurance in 746 counties in 29 States and insured 25 percent of total eligible acreage. For individual States, however, insured acreage ranged from 1 to 58 percent, with 13 States under 10 percent. In 366 of the 746 counties, insured acreage was less than 10 percent.

CROP YEAR 1974

| Crop | FCIC data: Potential insurable acres | FCIC data: Actual insured acres | FCIC data: FCEC participation rate | National data: Planted acres | National data: Percent by FCIC insured |
|---|---|---|---|---|---|
| | (000 omitted) | | (percent) | (000 omitted) | |
| Wheat* | 41,444 | 9,513 | 22.95 | 71,169 | 13.37 |
| Oats* | 9,502 | 314 | 3.31 | 18,100 | 1.74 |
| Rice | 812 | 28 | 3.45 | a/2,569 | 1.09 |
| Cotton* | 6,209 | 607 | 9.78 | 13,729 | 4.42 |
| Citrus | 830 | 67 | 8.07 | 1,194 | 5.61 |
| Sugarbeet | 875 | 123 | 14.06 | 1,254 | 9.81 |
| Corn* | 42,051 | 3,677 | 8.74 | 77,746 | 4.73 |
| Beans | 684 | 101 | 14.77 | 1,647 | 6.13 |
| Grain sorghum* | 6,985 | 515 | 7.37 | 17,733 | 2.90 |
| Green peas | 230 | 54 | 23.48 | a/426 | 12.68 |
| Tobacco | 828 | 322 | 38.89 | a/963 | 33.44 |
| Peanuts | 957 | 190 | 19.85 | a/1,520 | 12.50 |
| Soybeans* | 34,922 | 1,894 | 5.42 | 53,580 | 3.54 |
| Tomatoes | 16 | 2 | 12.50 | 126 | 1.59 |
| Barley* | 6,088 | 525 | 8.62 | 9,117 | 5.76 |
| Sugar cane | 268 | 34 | 12.69 | a/748 | 4.55 |
| Dry peas | 307 | 16 | 5.21 | 220 | 7.27 |
| Flax | 2,239 | 170 | 7.59 | 1,739 | 9.78 |
| Total | 155,247 | 18,152 | 11.69 | 273,580 | 6.64 |
| Total for seven crops marked * | 147,201 | 17,045 | 11.58 | 261,174 | 6.53 |

a/Harvested acres--planted acres not readily available.

## PARTICIPATION AND GROWTH TRENDS

The number of county programs 1/ increased from 2,689 in 1964, when FCIC insured 22 crops, to 3,616 in 1976, when FCIC insured 23 crops. The number of counties in which insurance was offered on at least one crop increased from 1,187 in 1964 to 1,464 in 1976, an average of 23 a year; however, since 1969 an average of less than 6 counties a year has been added.

The total number of acres insured increased from 14.8 million in 1964 to 18.7 million in 1974, a 26.4 percent increase.

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1/All insurable acres of a crop in a county represent one county program.

Total acres harvested for nine major crops increased at almost the same rate, as shown in the following table. Therefore, the percent of harvested acres insured increased only slightly--from 7.1 percent in 1964 to 7.5 percent in 1974.

| Crop (note a) | Harvested Acres 1964 | 1974 | Percent change | Percent insured in 1964 | Percent insured in 1974 |
|---|---|---|---|---|---|
| | (000 omitted) | | | | |
| Corn | 59,878 | 65,194 | + 8.9 | 4.87 | 5.64 |
| Grain sorghum | 11,962 | 13,917 | +16.3 | 2.68 | 3.70 |
| Wheat | 46,208 | 65,459 | +41.7 | 13.94 | 14.53 |
| Cotton | 13,045 | 12,547 | - 3.8 | 5.31 | 4.84 |
| Barley | 9,568 | 8,281 | -13.5 | 7.24 | 6.34 |
| Oats | 17,880 | 13,325 | -25.5 | 3.08 | 2.36 |
| Soybeans | 28,786 | 52,460 | +82.2 | 5.33 | 3.61 |
| Tobacco | 897 | 963 | + 7.4 | 20.62 | 33.44 |
| Peanuts | 1,267 | 1,520 | +20.0 | 6.55 | 12.50 |
| Total | 189,491 | 233,666 | +23.3 | 7.08 | 7.51 |

a/These nine crops constituted about 94 percent of FCIC's total insured acres and about 92 percent of FCIC's coverage for crop year 1974.

Turnover rates

Each year about 18 percent of FCIC contracts are canceled either at the request of the policyholder or by FCIC. Some are reinstated in later years. Almost 25 percent of FCIC's annual premiums in the last 5 years resulted from new or reinstated customers. This situation is detrimental to efficient FCIC operations because

--a portion of already limited marketing resources may be devoted to contacting former policyholders instead of potential new customers and

--actuarial operations may be handicapped by the lack of a consistent universe of insureds from which to predict loss experience.

## WHY IS PRODUCER PARTICIPATION LOW?

Studies by third parties indicate that the predominant reason for not purchasing Federal crop insurance is that the guarantees are too low. The studies show also that many producers had not been contacted and/or did not understand the crop insurance program. Following are examples.

--The predominant reason given by farmers for non-participation was that guarantees are too low. Most farmers apparently did not feel present coverage value is adequate for crop expenses. They indicated coverage value should also include living costs, but not a profit. 1/

--Program education is needed for both participants and prospective participants. Some farmers attributed the lack of program knowledge to the fact that a local agent was no longer available. Several suggested that local service be provided through a local general insurance agent, commercial banks, or the ASCS office. 2/

--A substantially lower share of the larger farms were insured. For example, 6.9 percent of Kansas wheat farms with 500 or more acres were insured; whereas, 28 percent of those with less than 100 acres were insured. Over one-third of non-users of the Federal crop insurance indicated that they did not understand the program. Many large farmers had not been contacted by FCIC salespeople. 3/

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1/Laurel D. Loftsgard, "Attitudinal Reactions to the FCIC Program," printed in Crop Insurance In The Great Plains, Publication Number 28 of the Great Plains Agricultural Council, Montana Agricultural Experiment Station, Montana State University, Bulletin 617, July 1967, pp. 40-41.

2/Ralph Cole, "Factors Affecting Success of the Federal Crop Insurance Program," printed in Crop Insurance In The Great Plains, Publication Number 28 of the Great Plains Agricultural Council, Montana Agricultural Experiment Station, Montana State University, Bulletin 617, July 1967, pp. 84-85.

3/"Preliminary Report on Federal Crop Insurance Market Research in Iowa, Illinois, Kansas, "the Biddle Company, Kansas City, Missouri, Sept. 16, 1969, pp. 8-11, 18.

Relatively recent FCIC internal program evaluations tentatively concluded that policy cancellations can be reduced by expanding personalized rates and guarantees to individual growers. They also indicated that selective rate and guarantee adjustments based on individual farmer experience appear to be needed to reduce cancellations and improve loss history.

## CONCLUSIONS

Federal crop insurance has alleviated losses incurred by some producers of agricultural commodities, but nationally the program has had only nominal effect on the agriculture industry's economic stability. Past indemnities have covered a relatively insignificant part of producers' losses. In the event of widespread crop failure, total economic protection provided by the insurance program would be nominal. The Federal crop insurance program has not attained a high degree of acceptance and participation from the Nation's agricultural producers. Studies indicate that producers are dissatisfied with the insurance package, particularly the guarantees offered. The lack of consistent and widespread participation has prevented FCIC from having any significant stabilizing effect on the Nation's agricultural economy. Furthermore, even with 100-percent participation, the level of protection would be marginal.

A change is needed if Federal crop insurance is to attain the goal set for it by the Congress. We believe the insurance plan should be changed from one offering insurance on a county or area basis to one offering personalized insurance on the basis of individual producer experience. Such a plan would not only be actuarially sound but also would be more equitable and attractive to producers and therefore should increase program participation. A program of personalized insurance is discussed in the next chapter.

## CHAPTER 3

## FCIC SHOULD OFFER A PERSONALIZED INSURANCE PROGRAM BASED ON INDIVIDUAL PRODUCER EXPERIENCE

The most equitable insurance contract for both the insured and the insurer is one that offers a reasonable amount of coverage for a fair premium. We believe a crop insurance policy should offer

--a production guarantee that is a reasonable portion of the producer's normal yield;

--indemnification for guaranteed production which does not exceed the market value of the unit; and

--a fair premium--one that properly reflects the risk involved in insuring the specific production guarantee.

The Federal Crop Insurance Corporation's present insurance plan, which sets production guarantees and premium rates on a county or areawide basis, is unrealistic and inequitable for many producers. For most crops, FCIC sets production guarantees on the basis of the estimated productive capability of designated land areas within counties. Generally all farms within these designated areas are eligible for the same guarantee. Because the productive capability of land and farm management practices vary, even within relatively small geographic areas, FCIC's production guarantees for many producers are either too high or too low.

When an insured farm's yield is below the FCIC production guarantee, an indemnity is paid. Frequent and large annual yield deviations increase a farm's insurance risk and should result in a higher premium. Yet FCIC generally charges all producers within an area the same basic premium even though their yields vary. As a result, many producers' premiums are either too high or too low.

An insurance plan offering personalized rates and guarantees would be more equitable because both the production guarantee and the premium could be derived from the insured's actual yield history. Because the plan would be more equitable, producer participation should increase, thus more effectively stabilizing the agricultural economy in the event of a widespread crop failure. Individual or personalized insurance is also actuarially sound; therefore, it should have a favorable effect on FCIC's financial operations.

To develop personalized insurance programs FCIC needs to obtain individual farm yield data. Although initially some difficulty may be experienced in obtaining such data, this problem could be overcome by using appropriate estimating techniques and by requiring producers to report annual yield data as a condition of the insurance contract.

A personalized insurance program would be relatively more attractive to low-risk producers because of higher guarantees and/or lower rates. Participation among the low-risk producers should therefore increase to a greater extent than among high-risk producers. In our test of a system to provide personalized insurance without any subsidy, some high-risk producers were excluded from the program. (See p. 33.)

## CURRENT PRACTICES IN SETTING RATES AND GUARANTEES

FCIC operating procedures call for a study of farming practices, soil types, topography, and hazards in a county before establishing an actuarial base for a prospective county insurance program. The procedures state that a sound county actuarial base requires (1) eliminating all poor-risk producers, (2) accurately classifying soil productivity in each area in the county, (3) establishing guarantees in proportion to area productivity, (4) setting premiums adequate to cover the risk of loss and establish a reasonable reserve, and (5) distributing risk over all areas. FCIC generally determines that some land in each county is ineligible for insurance because it is unsuitable or too risky for growing the insured crop, or the producer has a poor insurance record.

### Countywide guarantees

FCIC's Actuarial Division develops countywide average yield figures over a period of time--frequently 10 years--from estimates made by the Department of Agriculture's Statistical Reporting Service. The percent of the crop's average yield that will be insured ranges from 30 to 75 percent of the county average yield. The division strives to set the percentage high enough, commensurate with a reasonable rate, to be attractive to prospective insureds while maintaining a sound insurance program. The percentage decided on is applied to the estimated average countywide yield to determine the number of production units guaranteed for the county; for example, 18 bushels or 100 pounds an acre. Separate production guarantees are often computed for different farming practices, such as irrigation and summer fallow.

## Countywide premium rates

The Actuarial Division computes the countywide premium rate from the loss history for the years the program has been offered in the county. Estimated loss history is used for new county programs. Factors are added to provide for reserves and anticipated discounts. This is illustrated in the following table.

Countywide Premium Rate Computation

| Description | Percent |
|---|---|
| Average annual ratios of indemnities paid to coverage value for past years | 4.35 |
| Factor for unmeasurable risk and catastrophe | 1.00 |
| Total | 5.35 |
| Factor to provide for 10-percent reserve (5.35 x .10) | 0.54 |
| Factor to allow for anticipated discounts | 0.84 |
| Countywide premium rate (expressed as a percentage of the coverage value) | 6.73 |

## Rates and guarantees for areas in a county

The Actuarial Division provides the countywide average rates and guarantees to field underwriters who establish areas within counties to reflect differences in land productivity and risk. An area may be one contiguous or several separated tracts. The number of areas per county varies with an average of three.

Although areas and production guarantees in many county tobacco, cotton, and peanut programs are established by grouping producers on the basis of past yield data, for most other crops they are determined from productivity estimates for the various land types within the county. After the guarantees are set, premium rates for the areas are set. The rates are intended to be sufficient to pay anticipated losses in the areas over a period of years.

## RATES DO NOT ADEQUATELY REFLECT THE INDIVIDUAL RISK OF INSUREDS

Even if all producers in an area had the same average yield over a period of years, their insurance premium rates should not be the same if their annual yields vary significantly. Annual yields do deviate from the average

significantly; for example, there are high-risk producers and low-risk producers. Yet FCIC basic premium rates are usually the same for all insureds in an area.

Producers' annual yields deviate because of variances of nature, types of soil involved, and producers' management practices--in effect, all of the risks. By measuring both the frequency and amount of deviation in a producer's annual yields, the amount of risk and the probability of losses can be quantified and premium rates set accordingly.

For example, consider the actual yields and FCIC's insuring experience for the two cotton farms shown in the following table. Both farms were in the same county and both had about the same average yield per acre during the period 1970-74. FCIC's 1975 guarantee and premium rates were the same for both farms.

Because of the extreme deviation in annual yields, Farm A is the higher insurance risk and should pay higher premiums. Both farms claimed indemnities in 2 of the 5 years; however, Farm A's indemnities were about 23 percent of coverage, while Farm B's were only about 4.5 percent.

| Year | Pounds yield per acre | | Indemnity as a percent of coverage | |
|---|---|---|---|---|
| | Farm A | Farm B | Farm A | Farm B |
| 1970 | 181 | 144 | 0 | 0 |
| 1971 | 50 | 128 | 71.4 | 0 |
| 1972 | 217 | 115 | 0 | 11.2 |
| 1973 | 55 | 193 | 56.3 | 0 |
| 1974 | 196 | 111 | 0 | 8.5 |
| Average (1970-74) | 140 | 138 | 23.1 | 4.5 |

Our test of a personalized rate-setting system based on the deviation in annual yields computed 1975 premium rates of about 22 percent for Farm A and about 9 percent for Farm B; FCIC's 1975 basic premium rate for each farm was 10.7 percent.

## Some loss histories used in countywide rate computations are not comparable

As stated previously, FCIC uses annual countywide loss history to set countywide premium rates. However, some of the loss histories available to FCIC are a mixture of the losses incurred over the years under noncomparable insurance programs--programs that offered different production guarantees.

FCIC does not have a reliable or proven method of adjusting the annual loss histories to achieve comparability. As a result, some countywide rates are probably too low while others are too high.

The loss history from a county program offering a production guarantee of 35 percent of average yield is not comparable to the loss history from a program offering 70 percent of average yield. FCIC frequently adjusts prior loss history for changes in the guarantees by using a "rule-of-thumb" method which assumes that indemnities will increase at twice the percentage income in the guarantee. For example, increasing the guarantee from 40 to 50 percent of estimated average yield would presumably result in a 50-percent increase in indemnities; from 40 to 60, a 100-percent increase; and from 40 to 70, a 150-percent increase.

During 1971 and 1972, FCIC made a computerized study of the relationship between annual loss history and percent of average yield guaranteed. Because the study covered only 4 years, 1967-70, FCIC management tabled it for possible future consideration. The FCIC official responsible for the study said it demonstrated that:

--The rule-of-thumb adjustment method frequently used by FCIC probably understates the prior loss history. The study indicated that the adjustments vary by insured crop, management practices, and area.

--Premium rates are probably too low for the guarantee levels being offered, indicating a need for many across-the-board increases.

An insurance plan offering personalized rates and guarantees on the basis of a producer's prior yield history would not need to manipulate or adjust loss history.

Distribution of countywide rate to areas within the county

After the Acturial Division computes countywide premium rates, the field underwriters distribute the rate to areas in the county. Some area premium rates do not appear to be based on prior losses in the area. As a result, the rates for some areas are probably too high while others are too low.

As shown in the following table, the area premium rates for one county's tobacco program varied significantly from actual losses incurred during the preceding 8 years. The premium rates set for areas 1 and 2 were considerably higher

than the prior loss history and may have been overstated. On the other hand, the rates from areas 3, 4, and 5 were probably understated. For example, the rate for area 5 was set at 2.30 percent even though the prior 8 years' loss history was 4.26 percent of coverage.

| Area number | Premium rate as percent of coverage set by underwriter | Prior 8 years' indemnities as percent of coverage |
|---|---|---|
| 1 | 3.70 | 0 |
| 2 | 3.20 | 1.35 |
| 3 | 2.80 | 3.70 |
| 4 | 2.50 | 3.44 |
| 5 | 2.30 | 4.26 |

A 1970 FCIC task force study (see p. 27) made similar observations about the distribution of the countywide rate to areas.

A system of personalized insurance based on the producer's own yield history would eliminate the necessity for distributing a countywide rate to areas or groups within a county. On the other hand, producers anywhere in the Nation with the same annual yields would be given the same rate and guarantee.

## PRESENT PROGRAM ENCOURAGES ADVERSE SELECTIVITY

Insurance principles require a homogeneous insured population for an ideal insurance program. The principal technique used to obtain maximum homogeneity is to stratify individuals into groups with similar risks. Regardless of the grouping method used, no group of individuals is perfectly homogeneous; both above- and below-average risks will exist within any insurance group. The problem is to avoid insuring a greater-than-proportionate share of the below-average risks, that is, an adverse selection of risks.

Under the present crop insurance program, producers are grouped initially within established political boundaries--county lines. Generally the land or producers within a county are then divided into several areas or groups on the basis of estimated productivity and risks. For most crops, all producers within an area receive the same production guarantee. Because producers in an area have different yields, many producers' guarantees are either too high or too low.

Our review disclosed extreme yield fluctuations. For example, 5-year average yields for 152 insureds in a 1975 county cotton program ranged from 79 to 622 pounds (25 to 200 percent of the county average yield for the same period). On the basis of payment yields established by the Agricultural Stabilization and Conservation Service for its programs, such yield variations within a county are expected. For example, the estimated countywide average yield for corn in 1976 in an east central Kansas county was 73 bushels an acre, with ASCS payment yields ranging from 56 to 232 percent of the countywide average.

The 1970 task force study stated that there was ample evidence of extreme productivity variations within very small areas and probably as much variation within risk areas as among areas. The study also stated that:

--Classically, insurance is not intended as a device by which the insured may profit. However, establishing a blanket area guarantee will naturally attract participants whose normal production performance approaches that level; in other words, greatest interest will be among those most likely to realize a return from premiums paid. This is a natural tendency toward adverse selectivity.

A publication of the Great Plains Agricultural Council 1/also commented on adverse selectivity.

--There is concern that the low-risk producer is adverse to entering the crop insurance program because the beginning rates are too high. The high-risk producer may not view the premium as too high relative to his risk. This tends to increase adverse selectivity because of low participation among low-risk producers and higher participation among high-risk producers.

Also, during fiscal year 1976 congressional hearings, 2/ the then manager of FCIC stated:

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1/Dana H. Myrick, "All-Risk Crop Insurance: Principles, Problems, Potentials," Montana Agricultural Experiment Station, Montana State University, Bulletin 640, Sept. 1970, p. 35.

2/Hearings before the House Subcommittee on Agriculture and Related Agencies, Committee on Appropriations, 94th Cong., 1st sess., part 3, p. 409.

"A lot of the time we do not get the better growers because they feel that the crop policy that we are offering doesn't provide sufficient coverage for them."

Because of this general recognition of adverse selectivity in the present crop insurance program, we did not consider it necessary to measure its extent. However, average rates and guarantees inherently must attract a disproportionate share of erratic and/or below-average producers, particularly when production guarantees may be as low as 30 percent of average yield.

An insurance plan based on personalized rates and guarantees would largely eliminate the problem of adverse selectivity. Both guarantees and rates could be tailored to the producer on the basis of his yield history, and reasonable production guarantees could be developed.

## OTHER PROBLEMS WITH THE PRESENT ACTUARIAL SYSTEM

In addition to effectively resolving two of the major problems with the present crop insurance program--adverse selectivity and rates and guarantees which in some cases are either too high or too low--a personalized plan based on individual yield data would also help eliminate other problems, such as

--inconsistent and inequitable premium discounts,

--out-of-date coverages and rates,

--weaknesses in the present actuarial process, and

--questionable loading of premium rates for unmeasurable risk and catastrophe.

### Inconsistent premium discounts

FCIC adds a factor to the countywide premium rate to recoup the discounts allowed to individual farmers. However, the amounts are not determined consistently. Thus, some of the resulting countywide premium rates are too high, while others are too low.

In various countywide rate computations, FCIC has used national, State, or area average discounts instead of the actual discounts allowed in the county. For example, in one countywide rate computation, FCIC added a factor for a 7-percent discount (the State average) even though actual

discounts in the county averaged almost 19 percent. Therefore, the resulting countywide premium rate was probably too low. A factor of 0.38 would be added to a 5-percent premium rate to provide for recovery of a 7-percent discount. (5.38 X 0.93 = 5.00.) A factor of 1.17 would be needed for recovery of a 19-percent discount. (6.17 X 0.81 = 5.00.)

Premium discounts are inherent in a system of personalized rates based on the producer's annual yield data.

Inequitable premium discounts

Farming is subject to many variables which can result in widely varying yields among members of any group. Management differences, such as timeliness of operations, weed control, and soil erosion control, all affect yields. Merit rating is a method of recognizing these differences among group members and is designed to provide equitable rates for insureds with below-average risks. FCIC's system of premium discounts does not adequately recognize these differences, resulting in inequitable premium rates for low-risk insureds.

Three types of premium discounts are available to FCIC insureds:

1. Cotton and wheat producers who insure large acreages receive discounts.

2. For wheat, when insured's premium reserve (amount paid in excess of indemnities) on consecutively insured crop equals or exceeds his annual coverage, he is eligible for a 50-percent discount.

3. All producers are eligible for good experience discounts. The amount varies with the number of consecutively insured years without a loss up to a maximum of 25 percent.

The Great Plains Agricultural Council publication referred to on page 21 commented on FCIC's merit-rating system:

--The present system may hinder participation. The premium for new insureds is higher than the average actuarial risk (because of loadings for discounts) and will look especially high when compared to an insured earning high discounts. Reducing the base rate for a new insured should be considered if he can prove a favorable loss history. Present insureds may leave when their premiums are increased as much as 100 percent

because one indemnity resulted in loss of the discount.

--The size and experience discounts are a matter of "administrative decision," or a matter of judgment.

--The procedure does what merit rating should not do, it allows rate changes for "good or bad luck."

Prior yield data reflects all of the risks as well as producers' management differences. Thus, premium rates based on deviations in prior yields incorporate the principles of merit rating. New insureds would receive the same rate and guarantee as prior insureds if their annual yields and deviations were comparable.

Coverages and rates are not kept current

Much of the information used in setting guarantees and rates is maintained on computerized records, but the actual process is a manual operation. FCIC's 1970 task force study noted that rate review had not been computerized and was not accomplished on a regular and frequent basis.

Because of staffing limitations and lack of automation, an average of only 20 percent of the county insurance programs are updated annually. Some counties have carried the same premium rates for several years without revision. For example, the 1976 rates for some county wheat programs were based on loss history through the 1968 crop year.

Yields for some crops have increased over the years. These yield increases, FCIC's use of a 10-year average yield to compute production guarantees, and FCIC's inability to make frequent reviews have combined to make FCIC's production guarantees progressively less attractive to producers.

With a computerized actuarial system, which would be needed to provide personalized insurance, rates and guarantees could be kept on a more current basis than under the present system.

Actuarial process is degraded by administrative adjustments and limitations

FCIC's actuarial process is subject to many administrative adjustments and limitations. Some countywide rates and coverages are determined in part by the financial position of the county or State program, as measured by the ratio of indemnities paid to premiums collected.

For example, the Actuarial Division limited some computed countywide rates as follows:

--If the cumulative loss ratio was below 0.75, rates were reduced a minimum of 5 percent. If the cumulative loss ratio was 1.00 or less, rates were not increased.

--Any rate increase was not to exceed the percentage by which the cumulative loss ratio exceeded 1.00. For example, any county with a cumulative loss ratio of 1.05 would be limited to a rate increase of 5 percent regardless of computed rate.

In some instances, the Actuarial Division adjusted countywide rates and guarantees without a formal rate and/or guarantee computation. These adjustments were also influenced by the program's financial status. For example, the Actuarial Division adjusted county premium rates for the 1971 oats program according to the State's cumulative loss ratio. The following schedule was used to apply the adjustments.

| State loss ratio | Adjustment to county rate |
|---|---|
| 0.25 and under | Reduce 20 percent |
| .26 to .50 | " 15 " |
| .51 to .75 | " 10 " |
| 1.25 to 2.00 | increase 20 " |
| 2.01 and over | " 30 " |

Under a personalized insurance plan based on scientific or mathematical principles, many of the administrative adjustments and limitations inherent in the present actuarial process would be eliminated.

Questionable loading or unmeasurable risk and catastrophe

FCIC's stated goal is to accumulate 10 percent of premiums collected in each county program for the "reasonable reserve" required by the act. FCIC has not formally defined a reasonable reserve for unforeseen losses, but an FCIC official told us that a reserve of 2-1/2 times annual premiums might be reasonable. For crop years 1948-75, the FCIC program accumulated reserves of $71.3 million, about 78 percent of crop year 1976 premiums. However, estimated crop year 1976 losses reduced this reserve to about $20 million.

Much of the accumulated reserve is attributable to FCIC's practice of including a factor of up to 1.15 in county premium rates. This loading, which is in addition to the

10-percent factor for reserve, is to provide for unmeasurable risk and catastrophe.

It seems reasonable to discontinue loading for unmeasurable risk and catastrophe when accumulated reserves for county programs reach reasonable levels. We identified counties with quite substantial reserves, yet premium rates continued to be increased. For example, 1976 premiums for a county tobacco program included a reserve factor of 1.15, even though the county's existing reserve of $1.2 million was 11.4 percent of total coverage and 6.4 times greater than 1975 premiums. Similarly, 1976 premiums for a county wheat program were increased, although the county's existing reserve of $3.1 million was 62.9 percent of total coverage value and 9.9 times greater than 1975 premiums.

Further, it is inequitable to load one county program to accumulate reserves at a higher rate than another one, particularly when the one being loaded at the higher rate is a lower risk county on the basis of loss history. The following table shows the inequitable effect that loading at a higher rate actually had on lower risk producers in county 1 compared with high-risk producers in county 2.

Effect of Loading on Premium Rates

| | County 1 | County 2 |
|---|---|---|
| Prior loss history (percent of coverage value paid for indemnities) | 0.41 | 2.30 |
| Add loading factor | 1.15 | .30 |
| Total | 1.56 | 2.60 |
| Multiply by factor to provide reserve | x 1.10 | x 1.10 |
| Premium rate (percent of coverage value) | 1.72 | 2.86 |
| Percent increase over prior loss history | 420 | 124 |

## PERSONALIZED RATES AND GUARANTEES HAVE BEEN SUGGESTED BEFORE

The concept of personalized rates and guarantees is not new. In support of a 1922 bill, a USDA agricultural economist said that the identification of individual farm yields is a necessary feature for a successful crop insurance

program. In 1937, the President's Committee on Crop Insurance recommended that the amount of insurance be determined by the average yield per acre for the individual farm insured.

In 1970 the Secretary of Agriculture appointed a task force to conduct an overall study of FCIC's organization, management policy, and actuarial practices. The task force was composed of members from outside Government who had expert knowledge in the management and organization of corporations involved in insurance operations. The task force's report 1/ stated that

> --One would have hoped that FCIC, after 30 years in the all-risk insurance business, might have gravitated toward the idea and developed data and techniques for what seems easily the most urgent of all requirements--gearing the guarantee to the individual farm risk.
>
> --There is always a danger in reliance upon average rate, as opposed to individual risk analysis.

The primary source for annual farm yield data is the producer. The 1970 task force recommended that pursuant to the goal of individual risk underwriting, FCIC consider collecting annual farm yield data from insureds as a condition of the insurance contract. ASCS has collected cotton, tobacco, and peanut farm yield data for its program purposes. FCIC has used some of this yield data to group farms, all of which were then eligible for the same production guarantee; however, FCIC did not consider annual deviations in producers' yield data in computing rates.

FCIC has experimented also with other actuarial practices that consider personal experience. For example, adjustment tables that recognize producers' actual loss experience are used in some counties for some crops. This method increases the producer's guarantee for each year without a loss and reduces the guarantee for consecutive losses.

One FCIC study concluded that raising premiums and reducing guarantees regardless of individual producers' past performance is not an effective way of improving the poor

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1/"A Study of the Federal Crop Insurance Corporation," Report of the FCIC Task Force, Nov. 4, 1970, pp. 35 and 38.

loss ratio of the cotton program. The study noted that a 10-percent premium increase plus an 11-percent guarantee reduction in one county program resulted in 70 percent premium cancellations. Those producers who canceled had a loss ratio of 1.06, while those who remained had a loss ratio of 1.90. The study concluded that (1) it would be difficult or impossible to improve the loss ratio of the cotton program through uniform guarantee and rate adjustments because the good producer would be penalized so severely that he would drop the insurance and (2) selective adjustments based on individual producer experienced appeared to be needed.

Tentative findings from another FCIC study suggest that policy cancellations could be reduced and loss ratios improved by expanding personalized insurance rates and guarantees to individual producers, but that further testing and evaluation, including expansion to more crops, was desirable.

## OUR TEST OF A SYSTEM TO PROVIDE PERSONALIZED RATES AND GUARANTEES

To test a system providing personalized rates and guarantees, we selected a county cotton program. From farm yield data FCIC had obtained from ASCS, we computed the average yields and standard deviations from the averages for 152 insured farms. These comprised all the farms insured in the county in crop year 1975 for which 4 or 5 years of yield data was available. Using this data we computed a crop year 1975 production guarantee and premium for each farm.

Our application was based on statistical principles that measure the probability that an insured's yield will fall below the production guarantee. Annual yields below the production guarantee result in indemnities. The greater the frequency of deviation in a farmer's annual yields, the greater the insurance risk. By measuring the standard deviation in annual farm yields in relation to the guarantee per acre, the amount of annual expected loss can be predicted mathematically.

A personalized insurance package permits actuarial flexibility in setting rates and guarantees. The design and parameters used in our application are presented in appendix VI. Others could be used. The actual design, use, and parameters of such a system would be a matter for administrative decision.

Our model application recognizes the variation in individual farm yield histories and establishes guarantees and premiums accordingly. Therefore, the guarantees and

premiums for many individual farms differed significantly from those set by FCIC. Although the total losses under both were about the same, there are several differences between the two approaches.

--Thirteen of the 152 farms were excluded as impracticable to insure under the model because guarantees offered by the model were less than 50 pounds per acre. FCIC offered higher guarantees and incurred losses on seven of these farms in 1975.

--The model would offer higher guarantees than FCIC for 101 of the 152 farms. For example, our model offered 69 farms a guarantee in excess of 220 pounds, the maximum FCIC guarantee.

--The model would have offered lower premium rates on 112 farms. The model's average rate was 4.4 percent, while FCIC's average rate was 6.1 percent.

--The model would have offered higher guarantees and lower rates on 90 farms.

--Premium rates charged by the model for a given guarantee vary significantly, depending on the deviation in yields for an individual farm.

--Most of FCIC's insured farms were grouped in three guarantee ranges--from 141 to 200 pounds. The model achieved a more equitable distribution.

Comparison with FCIC experience

Overall results of our test compared with FCIC's actual crop year 1975 insuring experience on the same farms are presented in the following table. Premiums and losses are expressed in pounds instead of dollars. To achieve comparability, the factors for catastrophic losses and reserve that FCIC used for this county were added to our premiums.

## Comparison of Our Application with FCIC's Crop Year 1975 Insuring Experience

| Guarantee range in pounds per acre | Number of farms | | Insured acres | | Pounds guaranteed | | Pounds premium | | Pounds loss | | Premium rates (percent) Range of rates | Premium rates (percent) Average rate | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | FCIC | Model | FCIC | Model | FCIC | Model | FCIC | Model | FCIC | Model | Model | FCIC |
| 0 | 13 | 0 | 372 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50-75 | 7 | 2 | 281 | 28 | 18,677 | 2,123 | 3,187 | 361 | 1,578 | 206 | 7.8-24.8 | 17.1 | 17.0 |
| 76-100 | 7 | 1 | 274 | 23 | 24,169 | 1,921 | 1,922 | 297 | 0 | 0 | 5.6-14.5 | 8.0 | 15.5 |
| 101-120 | 8 | 3 | 285 | 72 | 31,492 | 8,078 | 2,496 | 847 | 0 | 2,570 | 5.1-11.5 | 7.9 | 10.5 |
| 121-140 | 6 | 12 | 242 | 324 | 30,972 | 42,913 | 1,947 | 4,157 | 2,453 | 13,013 | 5.0-9.1 | 6.3 | 9.7 |
| 141-160 | 8 | 16 | 341 | 904 | 50,783 | 135,510 | 3,452 | 9,624 | 5,561 | 697 | 3.7-13.2 | 6.8 | 7.1 |
| 161-180 | 9 | 70 | 261 | 2,542 | 44,872 | 432,191 | 2,009 | 25,845 | 3,067 | 26,593 | 3.3-6.3 | 4.5 | 6.0 |
| 181-200 | 15 | 39 | 679 | 1,965 | 130,938 | 373,350 | 8,029 | 20,330 | 2,276 | 8,615 | 3.0-10.9 | 6.1 | 5.5 |
| 201-220 | 10 | 9 | 458 | 316 | 96,787 | 69,520 | 4,380 | 3,033 | 4,872 | 0 | 2.9-8.3 | 4.5 | 4.4 |
| 221-240 | 8 | 0 | 222 | 0 | 51,737 | 0 | 1,927 | 0 | 6,718 | 0 | 2.6-4.9 | 3.7 | - |
| 241-260 | 14 | 0 | 483 | 0 | 122,323 | 0 | 4,783 | 0 | 7,111 | 0 | 2.5-5.6 | 3.9 | - |
| 261-280 | 19 | 0 | 835 | 0 | 227,547 | 0 | 8,019 | 0 | 13,262 | 0 | 2.4-6.3 | 3.5 | - |
| 281-300 | 16 | 0 | 811 | 0 | 238,395 | 0 | 8,605 | 0 | 2,262 | 0 | 2.2-6.1 | 3.6 | - |
| 301-325 | 12 | 0 | 630 | 0 | 202,753 | 0 | 5,661 | 0 | 1,426 | 0 | 2.1-4.8 | 2.8 | - |
| Total | 152 | 152 | 6,174 | 6,174 | 1,271,445 | 1,065,606 | 56,417 | 64,494 | 50,586 | 51,694 | 2.1-24.8 | 4.4 | 6.1 |

FCIC loss ratio .80
Model loss ratio .90

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Providing personalized rates and guarantees probably would have increased participation in this county. For example, for 90--or almost 60 percent of the insureds--lower rates and higher guarantees could have been offered. Although application of our model excluded 13 insureds, on 7 of which FCIC incurred losses, the model could have been designed to permit insuring them. There were about 1,000 non-FCIC-insured cotton farms in this county during crop year 1975.

## FCIC COMMENTS ABOUT OUR TEST AND OUR EVALUATION

Personnel in FCIC's Actuarial Division agreed with the basic concepts and had no serious questions about the methodology of our application. They said that, given individual yield data for a sufficient number of years, the method discussed would no doubt be quite workable.

The FCIC actuarial personnel did have reservations about using deviations in yield to set guarantees, the mechanics of obtaining the needed yield data, and the side effects on the total insurance program, as reflected by the following comments.

--"For this system to be successful, a high degree of reliability in the data input is required. It is much more difficult to obtain reliable individual farm data than countywide data. We question the ability and willingness of producers to furnish satisfactory long term yield data. Past attempts in this area have obtained little success."

--"With the diminishing emphasis on ASCS programs requiring individual farm statistics, our main source of data no longer exists in broad enough form to be useful."

--"FCIC is not in a position to solicit individual yield data from the producer because of personnel and budgetary limitations. A great deal of policing and independent verification of such data would be required."

--"The variation in guarantee levels leads one to question the equitability of this method to some extent. We believe that variations should occur mainly in the rates. Guarantees represent the ability of the land to produce, which is relatively constant. Producers are very sensitive

about their neighbors' guarantees and rebel if they feel they are out of alignment. They may decline insurance or drop out of the program due to this effect."

Obtaining yield data

In response to the 1970 task force recommendation that FCIC consider requiring insureds to provide annual farm yield data, FCIC requested yield data from insured corn producers in 10 counties in Illinois, Indiana, and Ohio. The insureds were asked to report their 1972 actual yield voluntarily when they filed their 1973 acreage reports. Yields were reported on 317--or 28.6 percent--of the 1,110 farms insured. Of the 317 farms reporting, 291, or about 92 percent, reported yields above the county average yield.

The Actuarial Division director said that the data led to several questions, namely:

--Were 92 percent of the insureds above-average producers?

--Did only the more successful, high-yield producers report?

--Was the reported data reliable or did the producers overstate their yields?

--Was the county average yield data accurate?

FCIC concluded that:

--It is not feasible to request producers to furnish yield data voluntarily.

--Accumulation and verification of this data would be very costly.

--Even if FCIC had legislative authority to collect such data, producers have limited incentive to furnish accurate data because of the absence of price-support programs.

Our one-county application was based on 4 or 5 years of farm yield data. FCIC officials contended that 10 to 20 years of yield data would be desirable for establishing guarantees and premium rates using our model. While we believe that our test showed that 4 or 5 years of data is adequate to initiate a personalized actuarial system, we recognize that yield data for a longer period could be desirable.

Since actual yield data older than 5 years would likely be very difficult to obtain, we also tested our model over a 20-year period by determining the ratio of each producer's 4 or 5 years of actual yields to the county average yields for those years, and then applied such ratios to the county averages for the preceding 15 or 16 years to obtain our data bases. This test indicated that such a procedure would be feasible.

The primary source for annual farm yield data is the producer. As recommended by the 1970 task force study, which said that actual yield history can be obtained and inspections can be made, FCIC could collect annual yield data from its policyholders as a condition of the contract. The contract could also require that supporting records be available for verification, which could be done as a part of loss adjustment. Further, the contract could specify that unverifiable or inaccurate yield data would necessitate reduced indemnities or other penalty. Prospective insureds would have to furnish yield data when they request insurance. For those unable to furnish prior yield data, insurance could be based on conservative estimates of yields and standard deviations until an actual yield base could be created.

Using yield deviations to set rates only

FCIC officials felt that individual variations should occur mainly in the premium rates and that the use of yield deviations is appropriate for rate determinations, but not for guarantees. They said that guarantees should reflect the ability of land to produce, which is relatively constant. However, the Great Plains Agricultural Council publication referred to on page 21 contained the following comment on management's impact on yields.

> --"In favorable crop years, the effect of management may not be obvious, but the effect may be very pronounced in years of poor crops. Management differences are evidenced in such things as timeliness of operations, weed control, control of wind and water, soil erosion, experimentation and use of new technology, care of seed, and attention to insects and disease."

The inherent flexibility of personalized insurance allows rates to be computed that will reflect the risk of insuring any particular guarantee. To demonstrate the impact of using deviations in yield to set rates only, we computed rates for the FCIC guarantees on the 152 farms in our test. The total premiums collected under this method would have been comparable to the amount FCIC charged, but

the impact on individual farms was significant. For example, premiums of nearly 61 percent of the coverage value would have been required for one farm because of the extreme variation in its annual yields. FCIC charged 16 percent. Another farm would have required a premium rate of less than 1 percent to insure the FCIC guarantee of 170 pounds. The farm's average yield was 418 pounds an acre, with little deviation in the annual yields. FCIC charged a rate of 5.7 percent.

## CONCLUSIONS

FCIC's present insurance plan is inequitable for many producers. The production guarantees and premiums generally are not based on the individual insured's production experience; instead, FCIC sets most guarantees and premiums on the basis of county or areawide production data and loss history. This practice results in production guarantees and premiums that are excessive for some producers and too low for others. This also encourages an adverse selection of risks, that is, those producers most likely to purchase crop insurance are the below-average producers who are most likely to incur losses.

Crop insurance should be based on personalized rates and guarantees determined from the producer's actual yield history. Personalized insurance would be less attractive to high-risk producers and more attractive to low-risk producers than FCIC's present program. Since personalized insurance is actuarially sound, it should have a favorable effect on FCIC's financial operations.

Conversion to personalized insurance would require collection of annual yield data from producers, a matter of concern for FCIC officials. We agree that some difficulty may be experienced; however, we believe it can be overcome. Our test indicates that 4 or 5 years of annual yield data is adequate to initiate such a system. Reporting of annual yield data could be made a condition of the FCIC contract. Prospective insureds, if unable to provide prior yield data, could be insured on the basis of conservative estimates of annual yields and standard deviations until a yield base was established.

## RECOMMENDATION

To provide a more attractive and salable insurance program--with increased actuarial soundness and equity--and to stimulate producer participation, we recommend that the Secretary of Agriculture and the FCIC Board of Directors develop a personalized crop insurance program with production

guarantees and premiums based on producers' prior yield history.

FCIC COMMENTS

The FCIC Corporation Manager concurred with the principles of individualizing insurance rates and coverages. He indicated that this objective can be accomplished more rapidly by using local county ASCS committees that are cognizant of individual farm operations in their counties. (See app. VII.)

The Corporation plans a pilot program in 20 counties in crop year 1978 to test the ASCS capability to rate farms and sell crop insurance. We believe such a program provides the Corporation an excellent opportunity to begin developing individualized rates and coverages. The Corporation can then ascertain resource commitments necessary to implement such a program nationwide.

## NUMBER OF 1976 INSURANCE PROGRAMS AND COUNTIES

| STATE | APPLES | BARLEY | BEANS | CITRUS | COMB. CR. | CORN | COTTON | FLAX | GRAIN SORGHUM | GRAPES | OATS | ORANGES | PEACHES | PEANUTS | DRIED PEAS | GREEN PEAS | RAISINS | RICE | SOYBEANS | SUGAR BEETS | SUGAR CANE | SUN FLOWERS | TOBACCO | TOMATOES | WHEAT | | TOTAL PROG. | TOTAL COS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 Alabama | | | | | | 3 | 18 | | | | | | 1 | 10 | | | | | 14 | | | | | | | | 46 | 31 |
| 04 Arizona | | 2 | | 2 | | | 3 | | 3 | | | | | | | | | | | | | | | | 3 | | 13 | 3 |
| 05 Arkansas | | | | | | | 20 | | | | | | 4 | | | | | 17 | 22 | | | | | | 10 | | 73 | 24 |
| 06 California | | 9 | | 2 | | | 8 | | | | 1 | 3 | | | | | 7 | | | 8 | | | | | 10 | | 48 | 11 |
| 08 Colorado | | 4 | 9 | | | 12 | | | 1 | | | | | | | | | | | 10 | | | | | 14 | | 50 | 15 |
| 10 Delaware | | | | | | 3 | | | | | | | | | | | | | 3 | | | | | | | | 6 | 1 |
| 12 Florida | | | | 18 | | 1 | | | | | | | | 1 | | | | | | | | | 5 | | | | 25 | 24 |
| 13 Georgia | | | | | | 1 | 13 | | | | | | 3 | 28 | | | | | 2 | | | | 27 | | 1 | | 75 | 44 |
| 16 Idaho | | 27 | 9 | | | | | | | | | | | | 5 | 2 | | | | 11 | | | | | 26 | | 80 | 27 |
| 17 Illinois | | | | | | 80 | | | | | 6 | | | | | | | | 80 | | | | | | 52 | | 218 | 80 |
| 18 Indiana | | | | | | 62 | | | | | | | | | | | | | 62 | | | | | | 62 | | 186 | 62 |
| 19 Iowa | | | | | | 98 | | | | | 96 | | | | | | | | 98 | | | | | | | | 292 | 98 |
| 20 Kansas | | | | | | 39 | | | 80 | | | | | | | | | | 23 | 6 | | | | | 102 | | 250 | 103 |
| 21 Kentucky | | | | | | 7 | 1 | | | | | | | | | | | | 9 | | | | 63 | | 1 | | 81 | 65 |
| 22 Louisiana | | | | | | 1 | 13 | | | | | | | | | | | 6 | 18 | | 13 | | | | | | 51 | 31 |
| 24 Maryland | | 3 | | | | 4 | | | | | | | | | | | | | 4 | | | | | | 3 | | 14 | 4 |
| 26 Michigan | | | 7 | | | 20 | | | | | | | | | | | | | 11 | 4 | | | | | 23 | | 65 | 23 |
| 27 Minnesota | | 22 | | | | 52 | | 29 | | | 64 | | | | | 24 | | | 56 | 14 | | 3 | | | 35 | | 299 | 64 |
| 28 Mississippi | | | | | | 1 | 26 | | | | | | | | | | | 2 | 22 | | | | | | 7 | | 58 | 28 |
| 29 Missouri | | | | | | 62 | 7 | | 6 | | | | | | | | | | 60 | | | | 2 | | 59 | | 196 | 63 |
| 30 Montana | | 29 | | | | | | | | | | | | | | | | | | 9 | | | | | 33 | | 71 | 33 |
| 31 Nebraska | | | 4 | | | 49 | | | 31 | | | | | | | | | | 17 | 3 | | | | | 51 | | 155 | 72 |
| 35 New Mexico | | | | | | | 4 | | 2 | | | | | | | | | | | | | | | | 1 | | 7 | 5 |
| 36 New York | | | | | | 1 | | | | 7 | | | | | | | | | | | | | | | | | 8 | 3 |
| 37 North Carolina | 3 | | | | | 9 | 7 | | | | | | | 12 | | | | | 10 | | | | 65 | | | | 106 | 69 |
| 38 North Dakota | | 46 | | | 7 | 4 | | 36 | | | 27 | | | | | | | | 3 | 7 | | 3 | | | 52 | | 185 | 52 |
| 39 Ohio | | | | | | 48 | | | | | | | | | | | | | 48 | 7 | | | 3 | 6 | 48 | | 160 | 50 |
| 40 Oklahoma | | | | | | 1 | 8 | | 8 | | | | | 3 | | | | | 1 | | | | | | 37 | | 58 | 39 |
| 41 Oregon | 1 | 12 | | | | | | | | | 1 | | | | 2 | 2 | | | | 1 | | | | | 12 | | 31 | 12 |
| 42 Pennsylvania | | 7 | | | | 10 | | | | 1 | 4 | | | | | | | | | | | | 1 | | 9 | | 32 | 10 |
| 45 South Carolina | | | | | | | 22 | | | | | | 5 | 2 | | | | | 20 | | | | 15 | | | | 64 | 27 |
| 46 South Dakota | | 17 | | | | 28 | | 19 | 9 | | 31 | | | | | | | | 18 | | | | | | 37 | | 159 | 51 |
| 47 Tennessee | | | | | | 1 | 20 | | | | | | | | | | | | 15 | | | | 40 | | 5 | | 81 | 56 |
| 48 Texas | | | | 3 | | 1 | 59 | | 49 | | | | | 11 | | | | 4 | | | | | | | 28 | | 155 | 87 |
| 49 Utah | | 5 | | | | | | | | | | | | | | 4 | | | | 5 | | | | | 6 | | 20 | 6 |
| 51 Virginia | | | | | | 2 | 1 | | | | | | | 8 | | | | | 1 | | | | 26 | | | | 38 | 28 |
| 53 Washington | 4 | 11 | 2 | | | | | | | | | | | | 5 | 1 | | | | 4 | | | | | 15 | | 42 | 16 |
| 55 Wisconsin | | | | | | 35 | | | | | 35 | | | | | 12 | | | 14 | | | | 6 | | | | 102 | 35 |
| 56 Wyoming | | 4 | 4 | | | 1 | | | | | | | | | | | | | | 4 | | | | | 3 | | 16 | 6 |
| TOTAL | 8 | 198 | 35 | 25 | 7 | 636 | 230 | 84 | 189 | 8 | 265 | 3 | 13 | 75 | 12 | 45 | 7 | 29 | 631 | 93 | 13 | 6 | 253 | 6 | 745 | | 3,616 | 1,464 |

APPENDIX I

## 1976 SUMMARY OF CROPS INSURED

| STATE | APPLES | BARLEY | BEANS | CITRUS | COMB. CROPS | CORN | COTTON | FLAX. | GRAIN SORGHUM | GRAPES | OATS | ORANGES | PEACHES | PEANUTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 Alabama | | | | | | 89 | 746 | | | | | | 1 | 771 |
| 04 Arizona | | 14 | | 50 | | | 52 | | 34 | | | | | |
| 05 Arkansas | | | | | | | 82 | | | | | | 20 | |
| 06 California | | 98 | | 9 | | | 102 | | | | 10 | 471 | | |
| 08 Colorado | | 54 | 384 | | | 255 | | | 6 | | | | | |
| 10 Delaware | | | | | | 219 | | | | | | | | |
| 12 Florida | | | | 1,102 | | 6 | | | | | | | | 39 |
| 13 Georgia | | | | | | 11 | 44 | | | | | | 18 | 948 |
| 16 Idaho | | 616 | 478 | | | | | | | | | | | |
| 17 Illinois | | | | | | 6,445 | | | | | 235 | | | |
| 18 Indiana | | | | | | 4,235 | | | | | | | | |
| 19 Iowa | | | | | | 25,936 | | | | | 3,978 | | | |
| 20 Kansas | | | | | | 1,741 | | | 4,856 | | | | | |
| 21 Kentucky | | | | | | 202 | 5 | | | | | | | |
| 22 Louisiana | | | | | | 1 | 73 | | | | | | | |
| 24 Maryland | | 13 | | | | 180 | | | | | | | | |
| 26 Michigan | | | 670 | | | 602 | | | | | | | | |
| 27 Minnesota | | 2,373 | | | | 15,027 | | 1,435 | | | 6,712 | | | |
| 28 Mississippi | | | | | | 1 | 632 | | | | | | | |
| 29 Missouri | | | | | | 3,102 | 123 | | 163 | | | | | |
| 30 Montana | | 2,225 | | | | | | | | | | | | |
| 31 Nebraska | | | 577 | | | 7,078 | | | 2,191 | | | | | |
| 35 New Mexico | | | | | | | 328 | | 56 | | | | | |
| 36 New York | | | | | | 22 | | | | 222 | | | | |
| 37 North Carolina | 33 | | | | | 142 | 30 | | | | | | | 1,571 |
| 38 North Dakota | | 5,129 | | | 1,799 | 96 | | 2,846 | | | 1,409 | | | |
| 39 Ohio | | | | | | 3,028 | | | | | | | | |
| 40 Oklahoma | | | | | | 60 | 138 | | 90 | | | | | 217 |
| 41 Oregon | 69 | 617 | | | | | | | | | 40 | | | |
| 42 Pennsylvania | | 87 | | | | 650 | | | | 64 | 71 | | | |
| 45 South Carolina | | | | | | | 285 | | | | | | 159 | 14 |
| 46 South Dakota | | 1,144 | | | | 2,719 | | 1,603 | 177 | | 1,967 | | | |
| 47 Tennessee | | | | | | 17 | 418 | | | | | | | |
| 48 Texas | | | | 428 | | 10 | 3,652 | | 1,505 | | | | | 277 |
| 49 Utah | | 29 | | | | | | | | | | | | |
| 51 Virginia | | | | | | 34 | 5 | | | | | | | 607 |
| 53 Washington | 249 | 364 | 32 | | | | | | | | | | | |
| 55 Wisconsin | | | | | | 4,176 | | | | | 2,712 | | | |
| 56 Wyoming | | 118 | 193 | | | 24 | | | | | | | | |
| TOTAL | 351 | 12,881 | 2,334 | 1,589 | 1,799 | 76,099 | 6,715 | 5,884 | 9,078 | 286 | 17,134 | 471 | 198 | 4,444 |

APPENDIX II

1976 SUMMARY OF CROPS INSURED - Page 2

| STATE | DRY PEAS | GR. PEAS | RAISINS | RICE | SOYBEANS | SUGAR BEETS | SUGAR CANE | SUN FLOWERS | TOBACCO | TOMATOS | WHEAT | | TOTAL CROPS | TOTAL CONTRACTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 Alabama | | | | | 189 | | | | | | | | 1,796 | 1,682 |
| 04 Arizona | | | | | | | | | | | 36 | | 186 | 134 |
| 05 Arkansas | | | | 203 | 93 | | | | | | 37 | | 435 | 375 |
| 06 California | | | 616 | | | 86 | | | | | 125 | | 1,517 | 1,419 |
| 08 Colorado | | | | | | 98 | | | | | 1,762 | | 2,559 | 2,259 |
| 10 Delaware | | | | | 107 | | | | | | | | 317 | 231 |
| 12 Florida | | | | | | | | | 268 | | | | 1,415 | 1,412 |
| 13 Georgia | | | | | 17 | | | | 1,291 | | 14 | | 2,343 | 2,038 |
| 16 Idaho | 120 | 25 | | | | 157 | | | | | 807 | | 2,203 | 1,448 |
| 17 Illinois | | | | | 5,587 | | | | | | 2,148 | | 14,415 | 7,778 |
| 18 Indiana | | | | | 3,751 | | | | | | 2,546 | | 10,532 | 5,404 |
| 19 Iowa | | | | | 20,456 | | | | | | | | 50,170 | 26,489 |
| 20 Kansas | | | | | 744 | 31 | | | | | 11,785 | | 19,157 | 11,965 |
| 21 Kentucky | | | | | 117 | | | | 13,366 | | 29 | | 13,719 | 13,497 |
| 22 Louisiana | | | | 89 | 73 | | 224 | | | | | | 460 | 444 |
| 24 Maryland | | | | | 89 | | | | | | 42 | | 324 | 213 |
| 26 Michigan | | | | | 335 | 42 | | | | | 1,055 | | 2,704 | 1,771 |
| 27 Minnesota | | 777 | | | 12,974 | 459 | | 104 | | | 5,884 | | 45,745 | 20,967 |
| 28 Mississippi | | | | 17 | 226 | | | | | | 47 | | 923 | 760 |
| 29 Missouri | | | | | 2,697 | | | | 150 | | 1,406 | | 7,641 | 4,401 |
| 30 Montana | | | | | | 104 | | | | | 4,498 | | 6,827 | 4,659 |
| 31 Nebraska | | | | | 3,267 | 77 | | | | | 4,537 | | 17,727 | 11,887 |
| 35 New Mexico | | | | | | | | | | | 75 | | 459 | 413 |
| 36 New York | | | | | | | | | | | | | 244 | 244 |
| 37 North Carolina | | | | | 261 | | | | 25,244 | | | | 27,281 | 25,932 |
| 38 North Dakota | | | | | 537 | 143 | | 275 | | | 17,777 | | 30,011 | 19,906 |
| 39 Ohio | | | | | 2,807 | 253 | | | 1,012 | 62 | 2,568 | | 9,730 | 5,566 |
| 40 Oklahoma | | | | | 1 | | | | | | 2,402 | | 2,908 | 2,732 |
| 41 Oregon | 9 | 123 | | | | 26 | | | | | 1,216 | | 2,100 | 1,372 |
| 42 Pennsylvania | | | | | | | | | 148 | | 233 | | 1,253 | 905 |
| 45 South Carolina | | | | | 324 | | | | 2,757 | | | | 3,539 | 3,202 |
| 46 South Dakota | | | | | 810 | | | | | | 4,673 | | 13,093 | 7,128 |
| 47 Tennessee | | | | | 251 | | | | 8,316 | | 290 | | 9,292 | 9,046 |
| 48 Texas | | | | 111 | | | | | | | 728 | | 6,711 | 5,563 |
| 49 Utah | | 52 | | | | 20 | | | | | 123 | | 224 | 193 |
| 51 Virginia | | | | | 1 | | | | 6,620 | | | | 7,267 | 7,197 |
| 53 Washington | 59 | 26 | | | | 111 | | | | | 1,690 | | 2,531 | 2,100 |
| 55 Wisconsin | | 1,280 | | | 387 | | | | 1,305 | | | | 9,860 | 6,612 |
| 56 Wyoming | | | | | | 78 | | | | | 172 | | 585 | 443 |
| TOTAL | 188 | 2,283 | 616 | 420 | 56,101 | 1,685 | 224 | 379 | 60,477 | 62 | 68,705 | | 330,403 | 221,787 |



APPENDIX II

## FCIC OPERATIONS 1948-76 (note a)

### SUMMARY BY CROP (note b)

| Crop | Premium | Indemnity | Loss ratio |
|---|---|---|---|
| | (000 omitted) | | |
| Wheat | $352,070 | $291,773 | 0.83 |
| Apple | 4,415 | 6,000 | 1.36 |
| Barley | 17,597 | 13,507 | .77 |
| Bean | 7,502 | 7,336 | .98 |
| Cherry (note c) | 150 | 392 | 2.61 |
| Citrus | 33,856 | 51,228 | 1.51 |
| Combined crop | 35,284 | 39,076 | 1.11 |
| Corn | 169,158 | 204,730 | 1.21 |
| Cotton | 80,355 | 132,877 | 1.65 |
| Flax | 16,311 | 13,986 | .86 |
| Grain sorghum | 16,051 | 12,234 | .76 |
| Grape | 1,569 | 1,637 | 1.04 |
| Oat | 8,535 | 6,491 | .76 |
| Pea, dry | 658 | 433 | .66 |
| Pea, green | 4,984 | 6,837 | 1.37 |
| Peach | 6,107 | 8,151 | 1.33 |
| Peanut | 18,751 | 10,007 | .53 |
| Potato (note c) | 1,270 | 2,669 | 2.10 |
| Raisin | 4,523 | 4,296 | .95 |
| Rice | 1,631 | 695 | .43 |
| Safflower (note c) | 2 | 9 | 3.93 |
| Soybean | 65,799 | 51,883 | .79 |
| Sunflower | 96 | 34 | .35 |
| Sugar beet | 7,195 | 7,228 | 1.01 |
| Sugarcane | 1,768 | 1,220 | .69 |
| Tobacco | 106,461 | 68,170 | .64 |
| Tomato | 444 | 407 | .92 |
| Tung nut (note c) | 90 | 67 | .75 |
| Total | d/$962,633 | d/$943,374 | .98 |

a/Includes estimates for crop year 1976.
b/Does not include Puerto Rico reinsurance.
c/These programs have been discontinued.
d/Columns do not add due to rounding.

## FCIC OPERATIONS 1948-76 SUMMARY BY CROP YEAR

| Year | Counties | County programs | Crops insured | Value of coverage | Premium | Indemnities | Loss ratio |
|---|---|---|---|---|---|---|---|
| | | | | (000 omitted) | | | |
| 1948 | 324 | 375 | 169,129 | $ 153,997 | $ 12,684 | $ 6,780 | 0.53 |
| 1949 | 357 | 394 | 165,076 | 163,495 | 11,862 | 15,531 | 1.31 |
| 1950 | 549 | 624 | 306,685 | 240,448 | 14,104 | 12,799 | .91 |
| 1951 | 730 | 810 | 343,210 | 317,463 | 19,111 | 21,338 | 1.12 |
| 1952 | 795 | 874 | 340,686 | 350,216 | 21,200 | 20,609 | .97 |
| 1953 | 847 | 922 | 406,630 | 437,514 | 27,098 | 31,057 | 1.15 |
| 1954 | 803 | 884 | 346,887 | 354,279 | 22,655 | 28,030 | 1.24 |
| 1955 | 794 | 888 | 319,958 | 309,924 | 22,330 | 25,505 | 1.14 |
| 1956 | 806 | 948 | 324,949 | 306,743 | 22,139 | 27,890 | 1.26 |
| 1957 | 816 | 989 | 307,604 | 242,200 | 17,407 | 12,004 | .69 |
| 1958 | 830 | 1,213 | 324,435 | 242,712 | 17,617 | 4,505 | .26 |
| 1959 | 847 | 1,488 | 339,463 | 270,828 | 18,461 | 14,138 | .77 |
| 1960 | 869 | 1,550 | 330,448 | 265,885 | 17,797 | 10,316 | .58 |
| 1961 | 890 | 1,597 | 320,056 | 271,709 | 18,149 | 16,092 | .89 |
| 1962 | 995 | 1,967 | 364,175 | 356,354 | 21,854 | 24,022 | 1.10 |
| 1963 | 1,094 | 2,379 | 418,076 | 496,669 | 30,374 | 23,524 | .77 |
| 1964 | 1,187 | 2,689 | 447,567 | 542,117 | 33,852 | 30,362 | .90 |
| 1965 | 1,214 | 2,781 | 450,652 | 590,393 | 36,015 | 40,753 | 1.13 |
| 1966 | 1,304 | 3,023 | 457,396 | 635,523 | 36,828 | 25,198 | .68 |
| 1967 | 1,363 | 3,245 | 449,143 | 773,010 | 43,485 | 55,112 | 1.27 |
| 1968 | 1,395 | 3,398 | 455,750 | 875,054 | 48,966 | 51,280 | 1.05 |
| 1969 | 1,425 | 3,558 | 436,103 | 918,520 | 48,816 | 52,780 | 1.08 |
| 1970 | 1,423 | 3,537 | 396,816 | 852,086 | 44,387 | 41,850 | .94 |
| 1971 | 1,423 | 3,536 | 381,147 | 946,005 | 47,878 | 28,553 | .60 |
| 1972 | 1,422 | 3,535 | 342,326 | 854,971 | 42,063 | 25,266 | .60 |
| 1973 | 1,432 | 3,570 | 318,683 | 1,007,519 | 47,537 | 28,355 | .60 |
| 1974 | 1,444 | 3,561 | 303,746 | 1,149,844 | 53,984 | 63,393 | 1.17 |
| 1975 | 1,470 | 3,623 | 315,966 | 1,570,610 | 73,416 | 63,451 | .86 |
| 1976 (note a) | 1,464 | 3,616 | 330,403 | 1,985,292 | 90,907 | 142,954 | 1.57 |
| Total | | | 10,213,165 | $17,481,380 | $962,976 | $943,447 | .98 |

a/Estimated figures.



APPENDIX IV

## FCIC OPERATIONS 1948-75 SUMMARY BY STATE

| State | Premiums | Indemnities | Premium reserve or (deficit) | Loss ratio |
|---|---|---|---|---|
| | (000 omitted) | | | |
| Alabama | $ 12,237 | $ 15,594 | $(3,357) | 1.27 |
| Arizona | 4,577 | 8,475 | (3,898) | 1.85 |
| Arkansas | 6,613 | 8,949 | (2,336) | 1.35 |
| California | 22,788 | 29,327 | (6,539) | 1.29 |
| Colorado | 28,875 | 41,716 | (12,841) | 1.44 |
| Connecticut (note a) | 1,094 | 1,323 | ( 229) | 1.21 |
| Delaware | 1,546 | 1,996 | ( 450) | 1.29 |
| Florida | 19,663 | 23,659 | (3,996) | 1.20 |
| Georgia | 11,491 | 8,051 | 3,440 | .70 |
| Idaho | 8,583 | 9,855 | (1,272) | 1.15 |
| Illinois | 17,428 | 11,233 | 6,195 | .64 |
| Indiana | 11,437 | 7,441 | 3,996 | .65 |
| Iowa | 60,024 | 47,751 | 12,273 | .80 |
| Kansas | 66,681 | 47,008 | 19,673 | .70 |
| Kentucky | 10,501 | 6,347 | 4,154 | .60 |
| Louisiana | 5,994 | 7,497 | (1,503) | 1.25 |
| Maryland | 1,717 | 951 | 766 | .55 |
| Massachusetts (note a) | 279 | 157 | 122 | .56 |
| Michigan | 4,579 | 4,844 | ( 265) | 1.06 |
| Minnesota | 78,498 | 79,439 | ( 941) | 1.01 |
| Mississippi | 9,553 | 13,611 | (4,058) | 1.42 |
| Missouri | 12,477 | 13,800 | (1,323) | 1.11 |
| Montana | 54,354 | 32,968 | 21,386 | .61 |
| Nebraska | 44,167 | 36,942 | 7,225 | .84 |
| New Jersey (note a) | 43 | 32 | 11 | .76 |
| New Mexico | 7,443 | 14,323 | (6,880) | 1.92 |
| New York | 1,329 | 1,386 | ( 57) | 1.04 |
| North Carolina | 55,042 | 32,442 | 22,600 | .59 |
| North Dakota | 101,646 | 70,101 | 31,545 | .69 |
| Ohio | 11,416 | 8,884 | 2,532 | .78 |
| Oklahoma | 18,998 | 18,320 | 678 | .96 |
| Oregon | 11,385 | 12,855 | (1,470) | 1.13 |
| Pennsylvania | 2,705 | 2,594 | 111 | .96 |
| South Carolina | 16,559 | 22,158 | (5,599) | 1.34 |
| South Dakota | 41,283 | 35,216 | 6,067 | .85 |
| Tennessee | 10,876 | 12,002 | (1,126) | 1.10 |
| Texas | 46,818 | 63,484 | (16,666) | 1.36 |
| Utah | 1,477 | 2,026 | ( 549) | 1.37 |
| Virginia | 15,997 | 11,060 | 4,937 | .69 |
| Washington | 17,305 | 18,258 | ( 953) | 1.06 |
| West Virginia (note a) | 19 | 23 | ( 4) | 1.25 |
| Wisconsin | 13,230 | 13,399 | ( 169) | 1.01 |
| Wyoming | 2,999 | 2,922 | 77 | .97 |
| Total | $871,726 | $800,419 | $71,307 | .92 |

a/FCIC does not currently offer insurance in these States.

## GAO TEST OF A SYSTEM TO PROVIDE PERSONALIZED RATES AND GUARANTEES

For our test we selected the Williamson County, Texas, cotton program. We chose the cotton program because annual farm yield data was available for the 1970-75 period. Williamson County was selected because of relatively high participation in the FCIC cotton insurance program.

Our application was based on the principles of normal curve theory. Annual yields below the production guarantee result in indemnities. The greater the amount and frequency of deviation in a farm's annual yields, the greater the insurance risk. The deviation in individual farm yields varies among farms because of differences in climate, soil, farming practice, management, etc.--essentially all the risk factors. By measuring the standard deviation in annual farm yields in relation to the amount of coverage per acre, the amount of annual expected loss can be predicted mathematically.

Our application was limited to those farms which met all of these conditions:

1. Insured by FCIC for crop year 1975.
2. Crop year 1975 yield data available.
3. Yield data available for four or five of the years during the period 1970-74.
4. Planted acres available for the corresponding 4 or 5 years.

We computed each farm's weighted average annual yield and standard deviation for the 1970-74 period. For computing the per-acre expected loss, we used the formula $L = \sigma (d - \frac{1}{2}A)$ where:

L = Expected loss per acre

$\sigma$ = Standard deviation

d = Height of ordinate at coverage level (C)

$\frac{1}{2}$ = Weighted mean less coverage divided by the standard deviation

A - Portion of a normal curve to the left of an ordinate at C (coverage)

The appropriate values for A and d were read from standard mathematical tables for the normal curve of error.

The actual design and parameters for such an application are matters for management discretion. Individual farm coverage could be established in any number of ways; however, we chose to set coverages from the weighted mean yield and the standard deviation, using these parameters:

1. Used 70 pounds per acre as the minimum standard deviation. Five years of yield data is not a truly representative time period from which to measure standard deviation. During this period some of the farms had nominal yield deviation. It seems reasonable to expect some yield deviation over more extended time periods. The minimum of 70 pounds represents about 25 percent of the county average yield. Once an adequate data base was created, the farm's actual deviation could be used instead of an estimate.

2. All farm coverages were set at 1.2 standard deviations from the weighted mean yield. This could be set at any desired level. Our tests showed that this level resulted in about the same number of indemnities as FCIC paid for 1975.

3. Established 50 pounds per acre as the minimum coverage offered. Computed coverages below 50 were reduced to 0. We did not believe insurance below this level would be attractive to producers since county average yield was over 300 pounds.

4. Established maximum coverage at 325 pounds or 75 percent of average yield, whichever was less. The 325-pound limitation was an attempt to keep maximum coverage below estimated production costs.

Application of the loss formula under these restraints resulted in some nominal expected losses, requiring nominal premium rates. To avoid offering almost free insurance, we set 3.93 pounds an acre as the minimum expected loss, requiring a premium of about $1.25 an acre.

To obtain a premium rate for comparison with FCIC's crop year 1975 insuring experience, we determined the percent