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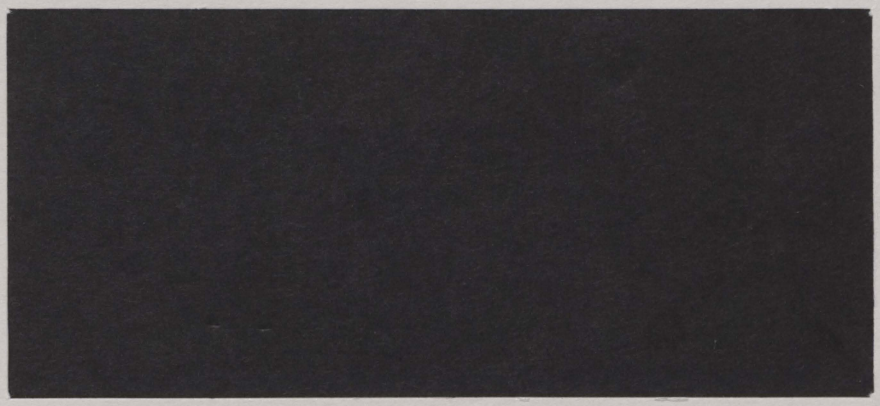

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AREA-MEASURED CROP INSURANCE AND DISASTER AID FOR WHEAT AND GRAIN SORGHUM

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ABSTRACT

Area crop insurance and disaster aid program designs are compared to an individual farm-yield insurance design like the current FCIC multiple peril program. Stochastic dominance analysis of net return distributions for 45 wheat and grain sorghum farms in southcentral Kansas is used to determine which strategy is preferred. The area disaster aid program is preferred by generally risk-averse managers over the individual farm-yield design for wheat and sorghum. When individual farm crop insurance is compared directly with area crop insurance, given an equivalent level of government liability for each, individual insurance is usually preferred by risk-averse managers. When the premium for the area insurance is subsidized by 10 percent or more, slightly risk-averse managers usually prefer area insurance to full-cost individual insurance. For area crop insurance to be preferred by managers that are more strongly risk averse, a higher subsidy level is required.

Area-Measured Crop Insurance and Disaster Aid for Wheat and Grain Sorghum

During the last two decades, there has been considerable discussion in Congress as to whether the federal government should have a crop insurance program, a direct disaster aid program, or a combination of the two. More recently, the expense of the current Federal Crop Insurance Corporation (FCIC) program and federal budget considerations have intensified this discussion. Adverse selection and moral hazard are significant problems that contribute to the high cost of the current crop insurance program. Adverse selection occurs when farmers with higher relative yield-risk can buy insurance at the same cost as farmers who have lower relative yield-risk, and yield guarantees are based on the expected individual farm yield (Skees and Reed). If farmers recognize this, the insurance program will tend to attract those farmers with relatively high risks, thereby causing insurance rates to increase and compounding the problem. If rates are not increased, under the pretense of increasing participation, this creates a situation in which indemnity payments increase relative to premiums. In fact, indemnities paid to farmers from 1981-88 exceeded premiums collected by 56 percent (GAO). Moral hazard occurs when the farmer has an incentive to alter production or harvest practices to increase the chance of collecting crop insurance. This can happen when indemnity payments are based on farm-specific measured losses, and the market price is less than the price election used to calculate the indemnity payment.

Alternative designs for area crop insurance and disaster aid, which reduce moral hazard and adverse selection, as described in this paper, have not received much attention in the literature. The use of crop insurance as a risk management tool has been widely studied (King and Oamek; Kramer and Pope; Leatham et al.; Lemieux et al.; Patrick and Rao; Pflueger and Barry; Williams et al.). All of

these studies generally have examined crop insurance and government program designs that are either currently in place or existed in the late 1970's and early 1980's. As early as 1949, Halcrow proposed an alternative, all-risk (multiple peril), crop insurance based on area yields rather than the expected farm yield and deviations from that yield. He believed that voluntary, individual, all-risk, crop insurance would fail to work satisfactorily, particularly in the higher risk areas of the United States, because of adverse selection. Under the area-yield (Halcrow) or area-hedge (Barnaby) approach, using individual counties as the area of production reduces the adverse selection and moral hazard problems inherent in the current crop insurance program. Under the current FCIC program, insurance premiums are based on the insured pool of farmers. By contrast, the area average loss measurement under an area-yield insurance design includes both insured and uninsured farmers, thus reducing adverse selection. The area plan pays an indemnity to each producer based on the average area-yield loss, with no individual loss adjustment. The probability of collecting indemnity payments is the same for all insured farmers in the area, although the effective cost and coverage vary. Moral hazard is prevented because individual farmers cannot influence the indemnity payment they receive by altering production and/or harvest practices.

To date, three analyses have been performed to determine the effectiveness of an area-yield insurance design. Miranda analyzed Halcrow's alternative using farm-level data from 102 western Kentucky soybean farms. By comparing the reduction in variance of insured and uninsured yield distributions without crop prices or deficiency payments, he concluded that an area-yield design is capable of providing effective yield-loss coverage. In a second study, the effectiveness of two crop insurance designs was compared by Carriker et al. (1990): individual farm-yield insurance similar to the current federal multiple-peril program and

an area-yield insurance design similar to Halcrow's. Using coefficient of variation statistics, these designs were examined for reductions in yield and income (gross income less actuarially fair insurance premiums with and without deficiency payments) variability using farm-level dryland wheat yield data from 98 southcentral Kansas farms. This study concluded that, although individual farm-level insurance is complex and suffers from moral hazard and adverse selection problems, it provides more farm income risk-reduction than an area design. In a related study, Carriker et al. (1991) examined the effectiveness of several crop insurance and disaster aid designs for reducing income and yield risk using farm-level yield data from 98 southcentral Kansas dryland wheat farms and 38 northeast Kansas dryland corn farms. Results from their second-degree stochastic dominance analysis indicated that risk-averse wheat producers, as well as corn producers, would prefer an actuarially fair, individual farm-yield insurance plan with a 100-percent coverage level to area insurance with 100-percent coverage or the free disaster aid designs with 65-percent coverage levels. None of these studies determined the preferred designs for alternative risk-preference levels or examined the effectiveness of these designs under equivalent government expenditures or alternative subsidy levels for each.

The purpose of this study is to compare the use of crop insurance, in its present form, with participation in the government commodity program to area crop insurance and disaster aid designs. This study uses historical National Agricultural Statistics Service (NASS) county yield data and continuous historical wheat and sorghum yield data from 45 farms in southcentral Kansas. Stochastic dominance analysis of estimated net return distributions is used to determine which combination of these designs is preferred under alternative risk preferences.

PROGRAM ALTERNATIVES AND NET RETURN ESTIMATION METHODS

This section contains a description of the four alternative programs examined.

Government Commodity Program (GCP)

The current government commodity program does not specifically provide for income replacement because of yield loss but provides some income protection when price is below the target price. Many farm managers consider the deficiency payment to be an important part of risk management.

Annual per-acre net returns for wheat and sorghum enterprises participating in the government program on each farm are estimated using

$$(1) \quad NR = [((\max\{P,EL\} * Y_F) - PRODC - HARVC) * (1 - SETA)] + [(\max\{0,(TP - \max\{EP,EL\})\} * Y_p) * (1 - SETA - FLEXA)] - (SMC * SETA),$$

where: NR = net returns ($/acre);
P = market price ($/bu.);
EL = effective national average loan rate ($/bu.);
Y_F = actual farm yield produced on planted acres (bu./acre);
TP = target price ($/bu.);
EP = expected national average price ($/bu.);
Y_p = program yield (bu./acre);
PRODC = production costs ($/acre);
HARVC = harvest cost ($/acre);
SETA = set-aside acreage requirement (%);
FLEXA = flex acreage requirement (%); and
SMC = maintenance cost on set-aside acres.

Individual Multiple Peril Crop Insurance (CI)

Under current FCIC procedures, each farm has an insurance yield based on historical farm-level production. The farm is reimbursed for any yield loss below the guaranteed yield (the insurance yield multiplied by the level of coverage) selected by the producer. The per acre-net returns under this plan are calculated as

$$(2) \quad NR = [((\max\{P,EL\} * Y_F) + INDEM - CIP - PRODC - HARVC) * (1 - SETA)] +$$
$$[(\max\{0,(TP - \max\{EP,EL\})\} * Y_p) * (1- SETA - FLEXA)] - (SMC * SETA),$$

where: $INDEM = \max\{0,IP * [(CL * IY_F) - Y_F]\}$, indemnity payment ($/acre);
IP = indemnity price, the value at which bushels are insured ($/bu.);
IY_F = the insurance yield, historical average farm yield (bu./acre);
CL = 1-% deductible, the coverage level (%); and
CIP = crop insurance premium ($/bu.);

with all other variables previously defined.

Area Multiple Peril Crop Insurance (ACI)

Halcrow's alternative to individual, all-risk, crop insurance bases the premiums and indemnities on yields received in an area of uniform crop production. Indemnities would be paid in bushels to any insured producer in those years in which the area average yield falls below the guaranteed area yield level (the historical mean of the area average yield or a percentage thereof). All participating farmers would receive the same per-acre indemnity and pay the same premium rate based on the historical area yield data.

The area percentage method, suggested by Barnaby and used in this study, is less restrictive than Halcrow's plan because it allows the liability and, consequently, the premium to vary by farm. The indemnity payment calculation for this method is

$$(3) \quad INDEM = \max\{0, LIAB * [((CL * IY_A) - Y_A)/IY_A]\},$$

where: LIAB = total potential liability ($/acre);
IY_A = historical average area yield (bu./acre); and
Y_A = actual area yield produced on planted acres (bu./acre).

The resulting value from equation (3) replaces the value of the indemnity in Equation (2); the remainder of Equation (2) is unaffected. In this study, the liability level is equivalent to the farm's program yield valued at the target

price (LIAB = Y_p * TP). Participating farmers receive different per-acre indemnity payments according to the liability level, which varies by the ASCS program yield.

Area Disaster Aid (ADIS)

Disaster aid using an area yield measure functions similarly to an area crop insurance yield measure, except that there is no premium charge. In an area disaster aid program, disaster payments are based on the difference between the actual area yield and the expected area yield. Disaster aid is received by all producers in the area in any year in which the actual area yield falls below a prespecified disaster designation level (for instance, 65 percent or 75 percent of an area's historical mean yield). Per-acre net returns, which include government deficiency payments and area disaster aid payments, are estimated using

$$(4) \quad NR = [((\max\{P,EL\} * Y_F) + PAYA - PRODC - HARVC) * (1 - SETA)] + [(\max\{0,(TP - \max\{EP,EL\})\} * Y_p) * (1- SETA - FLEXA)] - (SMC * SETA),$$

where: $PAYA = \max\{0,LIAB * [((CL * IY_A) - Y_A)/IY_A]\}$; and
$LIAB = TP * Y_p$.

In this study, as indicated in equation (4), the total disaster liability (LIAB) is based on the producer's program yield (Y_p) rather than the historical mean area yield.

During debate on the 1990 Farm Bill, several alternative crop disaster assistance proposals were put forth. In general, they differ only in how a disaster would be defined and how disaster payments would be calculated -- either at the individual-farm level or the county (area) level. Carriker et al. (1990, 1991) provide a discussion of these proposals. A farm-level disaster assistance program was proposed by House democrats, and an area-level disaster assistance

program was proposed by the Bush Administration. Our area disaster proposal is similar to the Administration's with an important exception; the Administration's crop disaster assistance proposal would require that the NASS county average be less than 65 percent of normal yield and then that the farm have a yield that is less than 60 percent of the county average yield. The method used in this study does not require a similar second condition.

PROCEDURES AND DATA

Net return distributions for the following strategies are analyzed to determine which are efficient for wheat and sorghum producers with differing risk preferences:

(a) Participation in the government commodity program only (GCP);

(b) Participation in the government commodity program and purchase of 65 percent coverage individual crop insurance (GCP+CI);

(c) Participation in the government commodity program and purchase of area crop insurance (GCP+ACI); and

(d) Participation in the government commodity program and receipt of disaster aid under an area disaster aid program (GCP+ADIS).

Strategies (a) through (d) are examined for wheat and sorghum separately and also as a joint enterprise. Cumulative probability distributions of per-acre net returns for each strategy are calculated using historical wheat and sorghum yields and adjusted market price data (1990 dollars) for a 10-year (1978-87) period to reflect the potential outcomes under the provisions of the 1991 government commodity program authorized by the Food, Agricultural, Conservation and Trade Act of 1990 (FACT). Initially, the means, standard deviations, coefficients of variation (CV), and minimums of the per-acre net return distributions are compared. Stochastic dominance analysis is then used to evaluate the effectiveness of the four strategies. Finally, the effectiveness

of the individual crop insurance (GCP+CI) and area crop insurance (GCP+ACI) strategies under three government subsidy levels is evaluated.

Historical yields from 45 farms in southcentral Kansas that had planted acreage for the 1978-87 period are from the Kansas Farm Management Association Data Base. The commodity program yields are based on the actual yields for 1980-84. Historical area yields used in the area insurance and area disaster aid programs are the weighted average NASS county yields on planted acres for 1978-87. Production costs for wheat/grain sorghum enterprises are from budgets developed for central Kansas (Warmann and Schlender, 1990a, 1990b). The typical ratio of wheat to grain sorghum acreage on southcentral Kansas farms is 3:1 (Langemeier and DeLano); therefore, the combined net returns from the joint wheat/grain sorghum enterprise is based on 75 percent of the wheat net return and 25 percent of the grain sorghum net return.

Target prices are used as the indemnity prices in the individual crop insurance program. Net returns for the area insurance and area disaster aid designs are estimated with the liability level equivalent to the program yield valued at the target price ($LIAB = Y_p * TP$). The coverage level (CL) in the individual crop insurance program is set at 65 percent (a typical level selected by producers). The CLs in the area crop insurance program and area disaster aid program are set at levels where the total of the government liability (deficiency payments plus insurance indemnities or disaster payments) to all farms under each program is equal to that for all farms under the individual crop insurance strategy. This results in CLs for the area insurance and disaster aid programs of 73.45 and 73.85 percent for southcentral Kansas wheat and grain sorghum, respectively. When the joint wheat/grain sorghum enterprise is considered, the CL is 73.66 percent for both the area insurance and area disaster aid programs. The coverage and liability level for the area insurance and disaster designs are

different from those in previous studies by Carriker et al. (1990, 1991); the coverage level is not set at 100 percent, and the liability level in the area measurement is equivalent to the value of the farm program yield instead of the value of the historical area yield. For all crop insurance programs, actuarially fair premiums are used.

As mentioned previously, stochastic dominance analysis is used to select the preferred strategies based on risk preferences. The risk preference categories used in this analysis are whole-farm risk aversion coefficients developed for southcentral Kansas and adjusted to evaluate per-acre net returns using a method suggested by Raskin and Cochran. The SDRF analysis is conducted using a computer program developed by Cochran and Raskin.

RESULTS AND DISCUSSION

Descriptive statistics for the net return distributions resulting from the four strategies, calculated using equations (1) through (4), are presented in table 1. Results of the stochastic dominance analysis of the net return distributions are presented in tables 2, 3, and 4.

Net Returns, Variability and Liabilities

Under three of the strategies (GCP, GCP+CI, and GCP+ACI), the mean average net returns are the same because of the use of actuarially fair insurance premiums (table 1). For two of the three enterprises considered, the GCP+ADIS strategy provides the greatest average reduction in relative variability, as measured by the coefficients of variation, over the baseline strategy (GCP). The greatest reduction in relative variability in net returns for wheat is provided by the GCP+CI strategy. The individual crop insurance program (GCP+CI) reduces the relative variability in net returns more than area insurance (GCP+ACI).

Average per-acre liabilities resulting from the alternative strategies are indicated in table 1. The difference between the liability under the GCP strategy and that under the individual crop insurance alternative (GCP+CI) may be used as a measure of the cost to producers of the additional risk reduction provided by this strategy. Because the liability levels were restricted to be equal for the GCP+CI strategy and the other crop insurance alternatives, direct evaluation of the risk reduction available for the same cost to the producers may be made. Under the disaster aid program (GCP+ADIS), the total, annual, per-acre liabilities are paid by the government.

The frequency and direction of changes in the descriptive statistics of the net return distributions under the GCP strategy, and the alternative strategies are also presented in table 1. Individual crop insurance using a 65 percent coverage level with the government deficiency payment program (GCP+CI) reduces the net returns standard deviation for wheat on 13 of the 45 farms and for grain sorghum on all farms (table 1). Area crop insurance in combination with the government deficiency payment program (GCP+ACI) reduces net return variability compared to the government program alone for wheat on 31 of the 45 farms but increases it on 4 farms. The GCP+ACI strategy also reduces the standard deviation for grain sorghum on 40 farms and increases it on 5. The area disaster aid program (GCP+ADIS) increases net returns on the majority of farms for both wheat and grain sorghum and reduces the standard deviation on the same number of farms as the area insurance plan (GCP+ACI) does.

Stochastic Dominance Analysis

Results of the stochastic dominance analysis are reported in table 2. The numbers in the table indicate how many times a strategy is dominated by another strategy in each risk preference interval. For example, in the moderately risk-averse interval, the GCP+ADIS strategy for wheat is dominated on 4 of the 45

farms by other strategies, when all strategies (set # 1) are included. The least dominated strategy is then removed from the set of strategies analyzed, and the stochastic dominance analysis is repeated (set, #2 - #3).

In the slightly and moderately risk-averse intervals, the area disaster aid program (GCP+ADIS) for wheat as well as grain sorghum is dominated the least number of times. In the strongly risk-averse interval, GCP+ADIS is the least dominated strategy for wheat and the wheat/sorghum enterprise; the GCP+CI strategy is the least dominated for sorghum. In most intervals of risk aversion, the GCP+CI strategy is the second least dominated strategy for wheat and grain sorghum.

Individual strategies are also compared directly to each other rather than within a group of all strategies, using the moderately risk-averse interval (table 3). The individual crop insurance program and the area crop insurance program comparison is important. For wheat, the area crop insurance program (GCP+ACI) is preferred to individual insurance (GCP+CI) on 16 of the 45 farms, whereas individual crop insurance is preferred to the area crop insurance on 15 of the 45 farms, with 14 of the farms revealing no preference. For grain sorghum, the area crop insurance program is preferred to the individual crop insurance program on only 7 of the 45 farms, individual crop insurance is preferred to area crop insurance on 35 farms, and no preference is revealed on 3 farms. For farms that produce both wheat and grain sorghum, the area crop insurance program is preferred to individual crop insurance on only 8 farms and individual crop insurance is preferred on 23 farms, with 14 farms revealing no preference.

Subsidized Area Insurance

The disaster aid program is not financed through premiums charged to producers; the government expenditures (liabilities) for this program are

financed through general government revenues. The preceding results examined the effectiveness of the program alternatives with equal average per-acre government liability levels and did not take into account the net government expenditures. Additional analysis is performed to compare the effectiveness of individual crop insurance to area crop insurance under alternative government subsidy levels.

For this part of the analysis, stochastic dominance analysis is used to directly compare the full-cost individual crop insurance strategy (GCP+CI) to subsidized area crop insurance (GCP+ACI) at three subsidy levels (table 4). Recall, from table 1, that the difference between the liabilities under any of the crop insurance alternatives and that under the GCP strategy is a measure of the cost to the producer of that insurance program. For example, the average cost of the area crop insurance for the grain sorghum enterprise is $4.30/acre/year ($20.37 - $16.07). The subsidies used in this part of the analysis are calculated as a percentage of the cost of the area crop insurance. Using the previous example, a 10 percent producer subsidy for area crop insurance for a grain sorghum enterprise increases the mean average net returns by $0.43, from $4.79 to $5.22 (table 4).

Full-cost area crop insurance (GCP+ACI) is dominated more times than individual crop insurance (GCP+CI) in the generally and slightly risk-averse intervals (0.0 to + .105 and 0.0 to +0.0105, respectively). However, as the subsidy increases, GCP+ACI becomes less dominated. With a 10 percent subsidy or greater, GCP+ACI is preferred in the slightly risk-averse and the generally risk-averse intervals for all crops. In the moderately risk-averse interval (+0.0105 to +0.052), GCP+CI is dominated fewer times than GCP+ACI without subsidization, with a narrow exception for wheat. With a 20 percent subsidy or greater, GCP+ACI is dominated fewer times than GCP+CI, with the exception of grain sorghum for which, even with a 30 percent subsidy, GCP+ACI is dominated more times than

GCP+CI. In the most risk-averse interval, the only situation in which GCP+ACI is preferred to GCP+CI is for wheat with a 20 percent subsidy or greater, and the margin of preference is small.

Alternative Disaster Aid Coverage Levels

In the previous analysis, the coverage level (CL) for the area disaster aid program was selected so that the total government liability (deficiency payments plus disaster payments) to all farms would be equal to that for all farms under the individual crop insurance strategy. The CLs ranged from 73.45 to 73.85 percent. However, these coverage levels are significantly higher than those suggested by the Bush Administration, as discussed above. Therefore, the stochastic dominance analysis is performed for alternative coverage levels for the area disaster aid program (GCP+ADIS). The results of the analysis are reported in table 5.

When the coverage level in the GCP+ADIS program for wheat is 70 percent, the results indicate that the GCP+ADIS program is dominated on the same number of farms as the GCP program. Therefore, the area disaster aid program has no additional impact on risk under these conditions. This level of coverage is higher than would normally be expected in a disaster aid program. However, the coverage level must be 38 percent or lower for the area disaster aid program to have no risk reduction effect for grain sorghum (table 5). When the coverage level in the GCP+ADIS program for grain sorghum is 65 percent, the GCP+CI program (also with a coverage level of 65 percent) is dominated the fewest number of times for risk-averse managers. When the joint wheat/grain sorghum enterprise is examined, the GCP+ADIS program must have a CL of 50 percent or less for the GCP+CI program to be preferred to the GCP+ADIS program by moderately and strongly risk-averse managers.

SUMMARY

It is unlikely that public policy makers will support more than one crop insurance or disaster assistance program. A major argument by the Administration for replacing federal crop insurance with a standing disaster program has been the provision of ad hoc disaster programs when multiple peril crop insurance was available (Yeutter). However, the Administration's current crop disaster assistance proposal would require heavy administrative expense to adjust individual yields and would also suffer from moral hazard caused by farmers that might under-report yields because there is no expected premium increase and yield guarantee reduction.

The area disaster design examined in this paper is similar to the Administration's, with an important exception: the elimination of a second condition that requires farmers to have an individual farm yield that is less than 60 percent of county average yield, if the county average is first less than 65 percent of the historical county average. The area disaster program examined in this study would have to provide greater than 65 percent coverage to be an effective risk management tool for central Kansas wheat farmers. A county yield of less than 65 percent of the historical 10-year county yield would never have been reached for the period 1978-87, thus rendering both the Administration proposals and a 65-percent coverage area disaster aid program ineffective.

The results suggest that wheat and grain sorghum producers would prefer a risk management program in addition to the government commodity programs. Of the strategies examined, the area disaster aid program provides the best protection for wheat and grain sorghum farmers that are generally risk averse. Those grain sorghum farmers who are strongly risk averse would prefer the individual farm crop insurance program. A subsidized area insurance program appears somewhat feasible when compared to the individual farm yield insurance program. Both of

the area-based policies (insurance or disaster aid) have the potential to be less costly to administer than the present crop insurance program or the Administration's proposed disaster program, because they would not require individual loss adjustment and would prevent moral hazard. The area insurance program also would reduce adverse selection problems. If budget constraints continue to force hard choices about insurance and disaster aid policies, then a subsidized area insurance plan may be a reasonable alternative.

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Table 1. Means and Frequency of Changes in Descriptive Statistics for Alternative Strategies Compared to the Government Commodity Program Strategy[a]

Statistic	Strategies			
	GCP	GCP +CI	GCP +ACI	GCP+ ADIS
		Wheat		
Average Net Returns	$23.15/Acre	$23.15/Acre	$23.15/Acre	$23.45/Acre
# higher	---	0	0	35
# lower	---	0	0	0
Standard Deviation	$18.60/Acre	$17.93/Acre	$18.24/Acre	$18.24/Acre
# higher	---	0	4	4
# lower	---	13	31	31
Coeff. of Variation[c]	.80	.77	.79	.78
# higher	---	0	4	2
# lower	---	13	31	33
Minimum Net Returns	-6.56	-3.87	-5.23	-4.93
# higher	---	12	20	20
# lower	---	1	15	0
Liabilities[d]	17.51	17.81	17.81	17.81
		Grain Sorghum		
Average Net Returns	$ 4.79/Acre	$ 4.79/Acre	$ 4.79/Acre	$ 9.10/Acre
# higher	---	0	0	45
# lower	---	0	0	0
Standard Deviation	$37.84/Acre	$31.88/Acre	$34.80/Acre	$34.80/Acre
# higher	---	0	5	5
# lower	---	45	40	40
Coeff. of Variation[c]	7.90	6.59	7.26	3.82
# higher	---	0	5	0
# lower	---	45	40	45
Minimum Net Returns	-55.66	-34.54	-48.77	-44.47
# higher	---	45	32	37
# lower	---	0	13	0
Liabilities[d]	16.07	20.37	20.37	20.37
		Wheat/Grain Sorghum		
Average Net Returns	$18.56/Acre	$18.56/Acre	$18.56/Acre	$19.86/Acre
# higher	---	0	0	45
# lower	---	0	0	0
Standard Deviation	$16.99/Acre	$15.66/Acre	$16.41/Acre	$16.41/Acre
# higher	---	2	7	7
# lower	---	43	38	38
Coeff. of Variation[c]	.92	.84	.88	.83
# higher	---	2	7	0
# lower	---	43	38	45
Minimum Net Returns	-8.56	-5.15	-7.44	-6.14
# higher	---	32	30	35
# lower	---	13	15	0
Liabilities[d]	17.15	18.45	18.45	18.45

[a] 45 total farms.
[b] Refer to Table 2 for a definition of the strategies.
[c] Calculated from the mean average and mean standard deviation.
[d] Equals the sum of deficiency payments and insurance indeminities or disaster aid payments in dollars/acre/year.

Table 2. Stochastic Dominance Analysis with Respect to a Function Results for Wheat and Sorghum as Separate Enterprises and a Combination Wheat/Grain Sorghum Enterprise

Approx. Risk Attitude	Pratt-Arrow Risk Aversion Coef.	Strategy[b]	# of Times a Strategy is Dominated by Another in Successive Set[a]								
			Wheat (Set #)			Grain Sorghum (Set #)			Wheat/G. Sorghum (Set #)		
			1	2	3	1	2	3	1	2	3
Slightly Risk Preferring	-0.0105 to 0.0	GCP	35	0	--	45	1	--	45	4	--
		GCP+CI	36	9	4	45	29	15	45	20	6
		GCP+ACI	35	18	10	45	11	1	45	19	4
		GCP+ADIS	0	--	--	0	--	--	0	--	--
Risk Neutral	-0.0105 to +0.0105	GCP	35	0	0	45	0	0	45	0	0
		GCP+CI	32	0	--	43	0	--	44	0	--
		GCP+ACI	35	0	0	45	0	0	45	0	0
		GCP+ADIS	0	--	--	0	--	--	0	--	--
Generally Risk Neutral & Risk Averse	0.0 to +0.105	GCP	35	3	1	45	28	13	45	11	3
		GCP+CI	24	0	--	15	5	--	29	0	--
		GCP+ACI	38	6	0	45	7	0	45	8	0
		GCP+ADIS	0	--	--	0	--	--	0	--	--
Slightly Risk Averse	0.0 to +0.0105	GCP	35	1	0	45	23	9	45	7	2
		GCP+CI	32	0	--	43	1	--	44	0	--
		GCP+ACI	35	3	0	45	4	0	45	5	0
		GCP+ADIS	0	--	--	0	--	--	0	--	--
Moderately Risk Averse	+0.0105 to +0.052	GCP	36	28	13	45	45	38	45	39	31
		GCP+CI	26	16	0	19	7	--	38	8	--
		GCP+ACI	36	15	--	45	35	2	45	23	4
		GCP+ADIS	4	--	--	2	--	--	1	--	--
Strongly Risk Averse	+0.052 to +0.105	GCP	36	28	25	45	45	39	45	39	32
		GCP+CI	24	16	--	15	--	--	29	14	--
		GCP+ACI	36	17	6	45	45	3	45	29	10
		GCP+ADIS	10	--	--	26	0	--	7	--	--

[a] 45 total farms.

[b] GCP - Participation in the commodity program only.
GCP+CI - Participation in the commodity program and individual crop insurance.
GCP+ACI - Participation in the commodity program and area crop insurance.
GCP+ADIS - Participation in the commodity program and an area disaster aid program.

Table 3. Stochastic Dominance Comparison of Individual Strategies for Moderately Risk-Averse Managers[a]

Strategy	Strategy[b]			
	GCP	GCP +CI	GCP +ACI	GCP+ ADIS
	- - - - - # of Times a Strategy is Dominated - - - -			
Wheat				
GCP	--	13	25	35
GCP+CI	0	--	16	26
GCP+ACI	3	15	--	35
GCP+ADIS	0	4	0	--
Grain Sorghum				
GCP	--	45	38	45
GCP+CI	0	--	7	19
GCP+ACI	2	35	--	45
GCP+ADIS	0	2	0	--
Wheat & Grain Sorghum				
GCP	--	38	31	45
GCP+CI	0	--	8	26
GCP+ACI	4	23	--	41
GCP+ADIS	0	3	0	--

[a] Moderately risk-averse managers in this study are defined as those having Pratt-Arrow risk aversion coefficients (adjusted to evaluate returns/acre) within the range of +0.0105 to +0.052. The numbers indicate the number of farms, out of a possible 45, for which the strategy indicated by the column label dominates the strategy indicated by the row label.

[b] GCP - Participation in the commodity program only.
GCP+CI - Participation in the commodity program and individual crop insurance.
GCP+ACI - Participation in the commodity program and area crop insurance.
GCP+ADIS - Participation in the commodity program and an area disaster aid program.

Table 5. Stochastic Dominance Analysis with Respect to a Function Results for Alternative Disaster Aid Coverage Levels

Approx. Risk Attitude	Pratt-Arrow Risk Aversion Coeffic.	Strategy[b]	# of Times a Strategy is Dominated by Another[a]										
			Wheat (Disaster CL)			Grain Sorghum (Disaster CL)				Wheat/G. Sorghum (Disaster CL)			
			73.45%	71.72%	70%	73.85%	65%	50%	38%	73.66%	65%	50%	38%
Slightly Risk Preferring	-0.0105 to 0.0	GCP	35	35	0	45	45	10	1	45	45	10	4
		GCP+CI	36	36	9	45	45	35	29	45	45	27	20
		GCP+ACI	35	35	18	45	45	18	11	45	45	29	19
		GCP+ADIS	0	0	0	0	0	0	1	0	0	0	4
Risk Neutral	-0.0105 to +0.0105	GCP	35	35	0	45	45	10	0	45	45	10	0
		GCP+CI	32	26	0	43	22	4	0	44	38	9	0
		GCP+ACI	35	33	0	45	41	5	0	45	44	45	0
		GCP+ADIS	0	0	0	0	0	0	0	0	0	0	0
Generally Risk Neutral & Risk Averse	0.0 to +0.105	GCP	35	35	3	45	45	29	28	45	45	20	11
		GCP+CI	24	24	0	15	8	5	5	29	11	3	0
		GCP+ACI	38	15	6	45	11	7	7	45	21	15	8
		GCP+ADIS	0	0	3	0	0	19	28	0	0	10	11
Slightly Risk Averse	0.0 to +0.0105	GCP	35	35	1	45	45	25	23	45	45	17	7
		GCP+CI	32	26	0	43	22	5	1	44	38	9	0
		GCP+ACI	35	34	3	45	41	10	4	45	45	14	5
		GCP+ADIS	0	0	1	0	0	15	23	0	0	7	7
Moderately Risk Averse	+0.0105 to +0.052	GCP	36	36	28	45	45	45	45	45	45	44	39
		GCP+CI	26	24	16	19	9	7	7	38	18	12	8
		GCP+ACI	36	26	15	45	36	35	35	45	33	25	23
		GCP+ADIS	4	10	28	2	23	42	45	1	7	35	39
Strongly Risk Averse	+0.052 to +0.105	GCP	36	36	28	45	45	45	45	45	45	44	39
		GCP+CI	24	24	16	15	9	7	7	29	17	15	14
		GCP+ACI	36	23	17	45	37	37	37	45	33	30	29
		GCP+ADIS	10	22	28	26	42	45	45	7	31	39	39

[a] 45 total farms.

[b] GCP - Participation in the commodity program only.
GCP+CI - Participation in the commodity program and individual crop insurance.
GCP+ACI - Participation in the commodity program and area crop insurance.
GCP+ADIS - Participation in the commodity program and an area disaster aid program.

Table 4. Stochastic Dominance Analysis of Individual Crop Insurance and Area Crop Insurance under Alternative Subsidization Rates

		Wheat				Grain Sorghum				Wheat/Grain Sorghum			
	Strategy[a]	0%	10%	20%	30%	0%	10%	20%	30%	0%	10%	20%	30%
Mean Average Net Returns[b]	GCP+CI	$ 23.15	23.15	23.15	23.15	4.79	4.79	4.79	4.79	18.56	18.56	18.56	18.56
	GCP+ACI	$ 23.15	23.18	23.21	23.24	4.79	5.22	5.65	6.08	18.56	18.69	18.82	18.95
		($0.00)	(0.03)	(0.06)	(0.09)	(0.00)	(0.43)	(0.86)	(1.29)	(0.00)	(0.13)	(0.26)	(0.39)
Approx. Risk Attitude[c]		# of Times a Strategy is Dominated by the Other[d]											
Generally Risk Neutral and Averse	GCP+CI	0	14	16	16	5	7	7	8	0	9	12	17
	GCP+ACI	6	0	0	0	7	0	0	0	8	0	0	0
Slightly Risk Averse	GCP+CI	0	22	26	26	1	15	20	26	0	30	38	42
	GCP+ACI	3	0	0	0	4	0	0	0	5	0	0	0
Moderately Risk Averse	GCP+CI	16	17	19	21	7	9	9	10	8	13	20	23
	GCP+ACI	15	12	10	10	35	29	25	19	23	15	6	3
Strongly Risk Averse	GCP+CI	16	16	16	17	7	8	8	9	11	13	16	17
	GCP+ACI	17	16	15	15	37	36	35	34	29	27	22	20

[a] GCP+CI - Participation in the commodity program and individual crop insurance.
GCP+ACI - Participation in the commodity program and area crop insurance.

[b] In dollars/acre/year. Dollar level of subsidy in parentheses.

[c] Refer to table 2 for specification of the Pratt-Arrow risk aversion coefficients.

[d] 45 total farms in analysis.