

**A Systems Simulation
of Strategies for
Reducing the
Economic Risks
of Producing
and Marketing**

Corn

in North Alabama



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Information contained herein is available to all persons without regard to race, color, sex, or national origin.

A Systems Simulation of Strategies for Reducing the Economic Risks of Producing and Marketing Corn in North Alabama

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GOVERNMENT PROGRAM participation, commodity options, and Multiple Peril Crop Insurance have been presented as methods for reducing price and production risks. Yet farmers do not generally purchase options, and participation in the Multiple Peril Crop Insurance program has been declining for the past 5 years. The study reported here uses a simulation approach to estimate the risk-reducing potential of government farm program participation, commodity options, and crop insurance for north Alabama corn producers. Alternative production strategies available under the 1990 Farm Bill are considered in modelling the decision environment of these producers.

Alternative corn production management strategies were analyzed using Lotus 1-2-3² budget templates and @RISK³, an "add-in" simulation routine from Palisade Corporation. Five-year accumulated returns and single-year results are shown in the analyses.

INTRODUCTION

This study was designed to examine various combinations of planning strategies that would be considered by a typical north Alabama farmer who has a corn base. These combinations involve decisions on whether to participate in the government farm program and in what way (through 15 percent

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flex, 25 percent flex, or 0/92), decisions on what flex crop to plant (corn, soybeans, or cotton), decisions on what to plant on 0/92 acreage (grass or canola), and decisions on whether to protect against crop failure (by purchasing Multiple Peril Crop Insurance) or against unfavorable price movements (by purchasing commodity futures options), or to purchase both insurance and options.

Also examined were the effects of these decisions during a 5-year time frame, including the effect on asset position (accumulated net returns at the end of 5 years), and the distribution of net revenue outcomes likely in any single year. During the 5-year period, high and low revenues tended to cancel each other out. However, a farmer must be able to survive the worst of the lows. For this reason, considerable attention in the Results section is devoted to discussing how each of the many possible combinations of decisions ranks in terms of "minimum net revenue outcome," an outcome that usually appears as a large loss in revenue after paying for both variable and fixed costs. Farmers can take some kind of action to protect themselves from the worst of these losses, and that is why three forms of protection are examined: crop insurance, futures options, and a combination of the two.

ASSUMPTIONS

The alternative management strategies analyzed included various levels of prices and yields for corn, flex crop, and an oilseed crop (canola). Commodity options provided price protection levels of \$2.32 per bushel for corn, \$5.61 per bushel for soybeans, and \$0.612 per pound for cotton. Yield protection for each crop was provided by assuming that crop insurance was purchased at the 65 percent protection level and high price election.

Historical data for north Alabama from 1975 to 1990 were used to represent distributions of yields for the selected corn and flex crops⁴. Prices for all crops were assumed to be triangularly distributed among recent historical low, mean, and high prices. Yield and price ranges for the crops used in the analysis are listed in table 1.

⁴ Alabama Agricultural Statistics, 1984-1988, Bulletin 32, Alabama Agricultural Statistics Service, USDA, NASS, and Alabama Dept. of Agriculture and Industries, Montgomery, Alabama, 1990.

TABLE 1. PRICES AND YIELDS ASSUMED FOR THE ANALYSES

Measure	Corn	Cotton	Soybeans	Canola
	<i>Bu.</i>	<i>Lb.</i>	<i>Bu.</i>	<i>Bu.</i>
Yields				
Low	0.0	154.0	11.4	18.0
Mean	67.0	587.0	22.0	42.0
High	109.1	895.0	32.5	48.0
Prices				
Low	\$2.00	\$0.50	\$5.25	\$4.50
Mean	\$2.57	\$0.63	\$6.00	\$5.25
High	\$2.75	\$0.75	\$6.75	\$6.00

Net returns over variable, fixed, and other costs were estimated using Lotus 1-2-3 corn budget templates, table 2, for 100 acres of corn with and without relevant flex crops. Government program participation alternatives, yields, prices, and deficiency payment assumptions were incorporated in the templates where appropriate. *Note that reported net returns are averages over the 100 acres of corn and flex crop.*

TABLE 2. NORTH ALABAMA COSTS PER ACRE FOR ALTERNATIVE CROPS AND CONSERVING COVER

Costs	Corn	Cotton	Grass	Soybeans	Canola
Variable	\$114.77	\$294.30	\$10.00	\$83.46	\$103.63
Fixed	\$ 65.61	\$181.98	\$37.74	\$69.08	\$ 50.24

Crop insurance costs per acre were estimated using the "Crop Insure" computer program (American Association of Crop Insurers)⁵. Commodity options prices were taken from the futures options contract quotes for December, 1991, corn and cotton and November, 1991, soybeans. Commission costs for participation in the options market were assumed to be \$0.02 per bushel for corn and soybeans and \$0.0015 per pound for cotton lint. Relevant basis costs were also subtracted from the options price.

To keep the number of possible strategies to a reasonable number, several assumptions were made. There is no provision for leaving or entering the farm program between years or for changing levels of participation or protection. Once a

⁵ American Association of Crop Insurers, "Crop Insure, Farm Protection Computer Model Demonstration Risk Management", Ver. 3.31A., Washington, D.C., August, 1991.

strategy is adopted, such as a 15 percent flex using soybeans, the analysis is based on the assumption that this strategy will be followed for the full 5 years.

Multiple Peril Crop Insurance

Multiple Peril Crop Insurance is a government-backed insurance instrument provided to farmers through a system of commercial reinsurance agents. Protection is offered for eligible crops on 50 percent, 65 percent, and 75 percent of a farmer's average production for the crop during the last 10 years. Three levels of guaranteed price may be selected as payment levels for the insured crop. For this analysis, it was assumed that the farmer will use the 65 percent protection level and high price elections for the eligible crops of corn, soybeans, and cotton. Guaranteed prices for the high price election are assumed to be \$2.30 per bushel for corn, \$5.50 per bushel for soybeans, and \$0.58 per pound for cotton lint.

Farm Program Participation

Flex Crops

Farm program participation under the 1990 Farm Bill required corn producers to set aside 7.5 percent of their corn base acreage in 1991. An additional 15 percent of their base was put into "flex" acres. Flex acres are not eligible for deficiency payment, but they can be planted to any crop. For north Alabama the relevant flex crops are assumed to be soybeans, nonprogram cotton, and nonprogram corn. Producers may choose to forego deficiency payments on an additional 10 percent of their base acreage. This 10 percent additional acreage ("25 percent flex") may then be planted to any flex crop.

The 0/92 Program

Provisions also are available allowing participation in the 0/92 program. The 0/92 program allows producers to idle 100 percent of their program crop acreage. Program benefits accruing under this option allow producers to receive program crop deficiency payments on 92 percent of the acreage that would have been planted to the program crop. This would amount to 71.3 percent pay acres for 1991 corn, which is derived from the 77.5 percent eligible acres times 92 per-

cent. Flex crop and set-aside requirements must still be met. A special provision of the program allows producers to plant and harvest minor oilseed crops on 0/92 acreage. If a minor oilseed crop is not planted, resource conserving cover crops, such as grass, must be planted on the 0/92 acres.

RESULTS

Selected risk-return results of the various alternatives are presented in tables 3-12 and Appendix tables 1-28.

**Five-Year Total Returns,
No Government Program Participation**

In most cases, participating in the government program resulted in higher returns than did not participating in the farm program. No insurance and no participation in the farm program resulted in a 5-year total maximum loss of \$50,417 over total costs and \$13,431 over variable costs. Under the no-participation scenario, the maximum net return was attained by not purchasing insurance or options, table 3.

TABLE 3. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF CORN, NO GOVERNMENT PROGRAM PARTICIPATION

Strategy	Returns over total costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
No insurance	-50,416.99	40,006.02	-10,316.06	-151.9	25.4
Insurance only	-44,472.21	28,674.01	-11,681.19	-120.0	19.4
Insurance & options	-43,890.91	38,521.00	-8,476.40	-173.5	28.0
	Returns over variable costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
No insurance	-13,431.02	76,990.99	26,668.91	58.8	96.4
Insurance only	-7,487.25	65,658.98	25,303.78	55.4	96.8
Insurance & options	-6,905.95	75,505.96	28,508.57	51.6	98.0

Purchasing both crop insurance and commodity options resulted in the least severe losses (total 5-year, -\$43,891 over total costs and -\$6,906 over variable costs) of all the no farm program participation alternatives. This would be expected since crop insurance provides downside yield protection and

options provide downside price protection. The options and insurance alternative also showed the highest mean values and fairly high maximum values. The farmer who chooses not to participate in the government program and whose primary strategy is to limit the maximum possible losses should consider the strategy of purchasing both commodity options and crop insurance.

Purchasing crop insurance without options results in a higher minimum value than doing nothing. However, with this strategy, the mean values and maximum values are lower than doing nothing or purchasing both insurance and commodity options. The probability of breaking even on all costs during the 5 years is 19.4 percent for the case of crop insurance alone, as compared to 25.4 percent for the do nothing case and 28 percent for the options and insurance case.

The coefficient of variation ("Coeff. Var.") is a measure of the relative variability of returns (and therefore the riskiness) among alternative strategies. Returns over total costs for insurance-plus-options (Coeff. Var.= -173.5 percent) are about one and one half times more variable than for insurance only (Coeff. Var.= -120.0 percent).

Single-Year Net Returns Over Variable Costs, No Government Program Participation

Appendix table 1 shows the distribution of net returns over variable costs that can occur in any given year of the 5-year planning horizon. Thus, in any 1 year of the 5 simulated, the probability of breaking even on variable costs with no government program participation is about the same for all strategies: 71.4 percent with no crop insurance or commodity options, 67.6 percent with crop insurance, and 70 percent with insurance and commodity options.

Contrasting the various strategies shows that there is a 20 to 25 percent chance that purchasing insurance alone or purchasing insurance and options will result in higher net returns over variable costs than not purchasing insurance or options. However, maximum losses per acre over variable costs could be as much as \$53.02 without insurance, as compared to \$30.90 with insurance and \$22.09 with insurance and options, demonstrating that insurance and options do limit losses at the bottom end of the probability distribution.

Five-Year Total Returns with Normal Flex (15 Percent) Acre Participation

A comparison of downside corn production risk with soybeans, corn, and cotton on normal flex acres shows that purchasing crop insurance and options gives the highest minimum total 5-year net returns over total costs. Again, this is so because purchasing insurance and options limits losses stemming from low yields and low prices. Loss protection in the worst case outcome was \$11,159 higher with cotton as the flex crop, \$6,774 higher with flex corn, and \$6,491 higher with flex soybeans than for the comparable no insurance/no options alternatives, see table 4.

TABLE 4. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF CORN WITH A 15 PERCENT FLEX CROP

	Returns over total costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
15% SOYBEAN FLEX ACRES					
No insurance	-21,104.39	46,382.70	12,233.53	98.6	84.8
Insurance only	-16,358.15	45,984.84	10,692.08	98.7	84.4
Insurance & options	-14,613.01	47,327.45	13,383.94	82.0	88.4
15% CORN FLEX ACRES					
No insurance	-25,058.18	40,361.35	7,432.86	164.8	73.0
Insurance only	-22,431.80	43,570.07	6,091.42	168.4	72.0
Insurance & options	-18,284.53	37,699.09	9,134.92	119.3	80.0
15% COTTON FLEX ACRES					
No insurance	-42,938.11	40,131.59	-2,686.32	-499.6	43.4
Insurance only	-30,245.71	25,020.41	-2,790.49	-395.2	40.0
Insurance & options	-31,779.40	37,662.84	1,341.08	859.6	55.8
	Returns over variable costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
15% SOYBEAN FLEX ACRES					
No insurance	8,074.61	75,561.70	41,412.54	29.2	100.0
Insurance only	12,820.85	75,163.84	39,871.09	26.5	100.0
Insurance & options	14,565.99	76,506.45	42,562.94	25.8	100.0
15% CORN FLEX ACRES					
No insurance	9,152.91	74,572.45	41,643.95	29.4	100.0
Insurance only	11,779.30	77,781.16	40,302.51	25.5	100.0
Insurance & options	15,926.57	71,910.18	43,346.01	25.2	100.0
15% COTTON FLEX ACRES					
No insurance	1,112.81	84,182.51	41,364.60	32.5	100.0
Insurance only	13,805.21	69,071.33	41,260.43	26.7	100.0
Insurance & options	12,271.52	81,713.76	45,392.00	25.4	100.0

Purchasing crop insurance alone provided downside risk protection by limiting yield losses when compared to nonprotected flex crops. Loss protection in the worst case outcome for crop insurance alone was \$12,693 higher with flex cotton, \$2,627 higher with flex corn, and \$4,746 higher with flex soybeans than for the comparable nonprotected alternatives.

Corn alternatives with no protection showed accumulated losses over total costs as high as \$21,104 with a soybean flex, \$25,058 with the corn flex, and \$42,938 with the cotton flex.

Under each flex crop alternative, crop insurance alone showed lower average (mean) returns than did the no-insurance and the insurance-plus-options alternatives. Corn-cotton flex with crop insurance and options showed the highest average (mean) return over variable costs (\$45,392). Corn-soybean flex with insurance and options showed the highest mean return over total costs (\$13,383). The highest maximum value was the noninsured corn-cotton flex (\$84,182), followed closely by the corn-cotton flex with insurance and options (\$81,714).

Single-Year Net Returns Over Variable Costs with Normal Flex (15 Percent) Participation

Appendix tables 2-4 show the distributions of net returns over variable costs that can occur in any given year of the 5 years with 100 acres of corn and a 15 percent flex crop. In any given year during the 5 years of this study, the probability of breaking even on corn variable costs with a flex crop is more than 90 percent with no crop insurance or commodity options, more than 99 percent with crop insurance, and 100 percent with insurance and commodity options. The implication is that insurance and options strategies provide break-even protection over variable costs 99 years out of 100.

As with the no government program participation for corn, purchasing crop insurance is a better strategy than not purchasing insurance 20 to 25 percent of the time with corn and soybean as flex crops and only 25 to 30 percent of the time with flex cotton. Similarly, 25 to 30 percent of the time with corn and soybean as flex crops and 40 to 45 percent of the

time with flex cotton, purchasing both insurance and options gives higher returns than not purchasing insurance and options.

The maximum possible losses over variable costs for corn when the farmer is uninsured are \$11.02 per acre with a soybean flex, \$14.60 per acre with a corn flex, and \$33.38 per acre with a cotton flex. These losses should be contrasted with the certainty of *gains* exceeding \$5.96 per acre with a soybean flex and \$6.44 per acre with a corn flex when the farmer has crop insurance. Crop insurance for corn with a cotton flex shows intermediate results with a maximum possible loss of \$5.20 per acre.

Purchasing both crop insurance and options results in zero probability of returns less than +\$14.97 per acre for a soybean flex, +\$11.17 per acre for a corn flex, and +\$3.00 per acre for a cotton flex, Appendix tables 2, 3, and, 4.

Five-Year Total Net Returns with Optional Flex (25 Percent) Participation

The pattern of 5-year total net returns from corn with 25 percent optional flex acres planted to soybeans or cotton generally follows that of the 15 percent flex crop alternatives. However, the 25 percent flex shows lower minimum, maximum, and mean values than does the 15 percent flex alternative. This indicates that the 15 percent flex is generally to be preferred over 25 percent flex as a program alternative. This is largely due to the influence of deficiency payments.

Referring to table 5, the noninsured corn alternatives showed accumulated 5-year losses over total costs of \$23,689 for the corn-soybean flex and \$52,421 for the corn-cotton flex. Of interest to the very risk-averse producer with soybeans flex acres (25 percent), downside loss protection was highest with crop insurance alone since it gave the highest minimum net worth at the end of the fifth year (-\$19,978). For the corn-25 percent cotton flex, insurance-plus-options would be the preferred "minimum loss" strategy (-\$36,182). Loss protection in the worst case outcome was \$3,711 higher with crop insurance than without insurance in the case of soybeans and \$1,386 higher in the case of cotton flex crops.

TABLE 5. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF CORN WITH A 25 PERCENT FLEX CROP

Program	Returns over total costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
25% SOYBEAN FLEX ACRES					
No insurance	-23,688.62	38,817.40	4,446.90	247.7	65.4
Insurance only	-19,977.70	32,733.74	2,643.11	367.4	60.4
Insurance & options	-24,262.32	29,654.33	5,206.31	190.5	68.2
25% COTTON FLEX ACRES					
No insurance	-52,421.20	31,427.72	-11,862.54	-121.5	20.8
Insurance only	-51,035.00	21,441.54	-11,115.42	-106.3	18.4
Insurance & options	-36,181.60	28,407.62	-6,168.89	-197.2	31.3
Returns over variable costs year 5					
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
25% SOYBEAN FLEX ACRES					
No insurance	11,011.50	73,517.52	39,147.01	28.1	100.0
Insurance only	14,722.41	67,433.84	37,343.22	26.0	100.0
Insurance & options	10,437.79	64,354.44	39,906.42	24.9	100.0
25% COTTON FLEX ACRES					
No insurance	-1,810.39	82,038.52	38,748.27	37.2	99.4
Insurance only	-424.19	72,052.35	39,495.39	29.9	99.8
Insurance & options	14,429.21	79,018.42	44,441.92	27.4	100.0

Purchasing both insurance and options reduces maximum losses over doing nothing in the cotton flex cases, but not in the soybeans case. Purchasing insurance and options in the soybean flex case showed a less favorable minimum net return (-\$24,262) than not purchasing insurance (-\$23,689).

Corn-soybeans protected by crop insurance showed lower average returns (the mean in table 5) than did the comparable noninsured and insured-plus-options alternatives. Corn-cotton flex crops with crop insurance and options showed the highest mean return over *variable* costs (\$44,442) of any of the alternatives.

Differences in the best choice identified by "returns over variable costs" versus "returns over total costs" are due to the influence of fixed costs (particularly equipment costs) on the enterprise.

Single-Year Returns Over Variable Costs with Optional Flex (25 Percent) Participation

Appendix tables 2-4 show the distributions of net returns over variable costs that can occur in any given year of the 5-year plan for 100 acres of corn with 25 percent optional flex crops. In any given year during the 5 years of this study, the probability of covering variable costs with any of the three flex crops is more than 87 percent with no crop insurance or commodity options, more than 91 percent with crop insurance, and more than 96 percent with insurance and commodity options.

No clear pattern emerges over the entire distribution as to whether insurance-plus-options is a strategy that is always better than no insurance or options participation. At the lower end of the distribution of net returns, purchasing crop insurance and options is a better plan of action than doing nothing. At the higher net return and probability levels, doing nothing and purchasing options and insurance alternate with one another in providing higher net returns (regardless of flex crop used).

The lowest returns per acre over variable costs for corn without crop insurance are -\$7.85 with a soybean flex and -\$58.06 per acre with a cotton flex. Purchasing crop insurance assures returns no less than \$4.65 per acre with a soybean flex and -\$18.07 per acre with cotton flex.

Purchasing both crop insurance and options results in a 100 percent probability of gains greater than or equal to +\$11.33 per acre with a soybean flex and -\$6.75 per acre with a cotton flex crop.

0/92 Participation

Table 6 shows the results of 0/92 participation with alternative flex crops in the normal flex program (15 percent). The 0/92 acreage is assumed to be planted to grass, or to canola as the minor oilseed crop. Results using canola should be considered tentative due to the lack of field observations on canola yield response in north Alabama and lack of information on market prices.

Because of the lack of a U.S. options market and crop insurance for canola, comparisons were made solely for the "no crop insurance and no options" 0/92 returns.

TABLE 6. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF 0/92 CORN WITH ALTERNATIVE 15 PERCENT FLEX CROPS, NO CROP INSURANCE OR COMMODITY OPTIONS

Flex crop	Returns over total costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
With canola 0/92	-11,174.79	56,266.46	25,689.14	44.4	98.4
With grass 0/92	-11,558.59	-3,287.33	-7,254.36	-20.9	.0
<i>Corn</i>					
With canola 0/92	-3,463.49	54,407.98	29,484.49	36.7	99.4
With grass 0/92	-13,918.26	744.16	-6,786.53	-36.0	.2
<i>Cotton</i>					
With canola 0/92	-24,858.98	45,772.90	14,992.94	80.0	87.4
With grass 0/92	-31,084.29	-1,351.32	-16,999.38	-33.2	.0
	Returns over variable costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
With canola 0/92	16,614.95	84,056.20	53,478.88	21.4	100.0
With grass 0/92	10,770.22	19,041.48	15,074.45	10.1	100.0
<i>Corn</i>					
With canola 0/92	24,032.84	81,904.31	56,980.82	19.0	100.0
With grass 0/92	8,117.14	22,779.56	15,248.86	16.0	100.0
<i>Cotton</i>					
With canola 0/92	16,845.92	87,477.80	56,697.84	21.1	100.0
With grass 0/92	790.93	30,523.90	14,875.84	37.9	100.0

A comparison of downside production risk showed that 0/92 planted to canola gave higher net returns over variable and fixed costs than did planting grass. Given the assumptions about the distribution of canola yields, canola on 0/92 acreage gave higher returns at every probable outcome than did planting grass.

The minimum net return over *total* costs for canola at the end of year 5 was \$384 higher with the soybean flex, \$10,455 higher with the corn flex, and \$6,225 higher with cotton flex than for comparable 0/92 alternatives with grass.

The minimum net return value over *variable* costs for canola at the end of year 5 was \$5,845 higher for the soybean flex, \$15,915 higher for the corn flex, and \$16,055 higher for the cotton flex than for comparable 0/92 alternatives with grass.

No Crop Insurance or Commodity Options Protection

Table 7 shows that the smallest 5-year losses over total costs for the no insurance/no price protection alternatives were achieved with a 15 percent soybean flex (-\$21,104). This alternative also had the highest mean value (\$12,234) and the highest maximum value (\$46,383) over total costs among the alternatives not protected by insurance or options.

The highest minimum value for 5-year returns over variable costs, among the no insurance or options alternatives, was for corn with a 25 percent soybean flex (\$11,012). Corn with a 15 percent corn flex had the highest mean return (\$41,644) and corn with a 15 percent cotton flex had the maximum return (\$84,183).

Individual year returns per acre over variable costs, with no insurance or options, are shown in table 8. The smallest loss is achieved by corn with a 25 percent soybean flex (\$7.85

TABLE 7. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF CORN WITH ALTERNATIVE FLEX CROPS AND NO CROP INSURANCE OR COMMODITY OPTIONS

Flex crop	Returns over total costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
15% flex	-21,104.39	46,382.70	12,233.53	98.6	84.8
25% flex	-23,688.62	38,817.40	4,446.90	247.7	65.4
<i>Corn</i>					
15% flex	-25,058.18	40,361.35	7,432.86	164.8	73.0
<i>Cotton</i>					
15% flex	-42,938.11	40,131.59	-2,686.32	-499.6	43.4
25% flex	-52,421.20	31,427.72	-11,862.54	-121.5	20.8
	Returns over variable costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
15% flex	8,074.61	75,561.70	41,412.54	29.1	100.0
25% flex	11,011.50	73,517.52	39,147.01	28.1	100.0
<i>Corn</i>					
15% flex	9,152.91	74,572.45	41,643.95	29.4	100.0
<i>Cotton</i>					
15% flex	1,112.81	84,182.51	41,364.60	32.5	100.0
25% flex	-1,810.39	82,038.52	38,748.27	37.2	99.4

TABLE 8. SINGLE-YEAR NET RETURNS PER ACRE OVER VARIABLE COSTS FOR CORN WITH ALTERNATIVE FLEX CROPS AND NO CROP INSURANCE OR COMMODITY OPTIONS

Flex crop	Returns over variable costs				
	Minimum value	Maximum value	Mean value	Coeff. var.	Prob >= \$0
				<i>Pct.</i>	<i>Pct.</i>
<i>Soybeans</i>					
15% flex	-11.02	173.46	73.13	66.0	96.4
25% flex	-7.85	161.70	70.40	61.4	96.0
<i>Corn</i>					
No govt. program	-53.00	170.90	47.90	130.1	71.4
15% flex	-14.60	181.30	73.70	66.2	96.0
<i>Cotton</i>					
15% flex	-33.80	205.90	73.80	72.6	90.2
25% flex	-58.10	204.90	67.60	82.5	87.0

per acre). The highest mean (\$73.80 per acre) and maximum (\$205.90 per acre) values among the unprotected alternatives are achieved by corn with a 15 percent cotton flex. The highest probability of at least breaking even on variable costs is shown by corn with a 15 percent soybean flex (96.4 percent).

Crop Insurance

For the insured alternatives, the smallest 5-year losses over total costs were experienced by corn with a 15 percent soybean flex (\$16,358). This alternative also had the highest mean value (\$10,692) and the highest maximum value (\$45,985) over total costs of the insured alternatives.

The highest minimum 5-year returns over variable costs was achieved by corn with a 15 percent cotton flex (\$13,805), see table 9. Corn with a 15 percent cotton flex also had the highest mean return (\$41,260). Corn with a 15 percent corn flex had the highest maximum return (\$77,781) over variable costs.

Individual year returns per acre over variable costs, with insurance, are shown in table 10. The highest minimum return is achieved by corn with a 15 percent corn flex (\$6.44). The highest mean value (\$68.77) per acre is for corn with a 25 percent cotton flex. The highest maximum value (\$192.80) per acre for the insured alternatives is for corn with a 15 percent cotton flex. The highest probability of breaking even on variable costs is shown by corn with a soybean flex or a 15 percent corn flex (100 percent).

TABLE 9. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF CORN WITH ALTERNATIVE FLEX CROPS AND CROP INSURANCE

Flex crop	Returns over total costs year 5				
	Minimum value (Pr.>=0)	Maximum value (Pr.>=100)	Mean value (Pr.>=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
15% flex	-16,358.15	45,984.84	10,692.08	98.7	84.4
25% flex	-19,977.70	32,733.74	2,643.11	367.4	60.4
<i>Corn</i>					
15% flex	-22,431.80	43,570.07	6,091.42	168.4	72.0
<i>Cotton</i>					
15% flex	-30,245.71	25,020.41	-2,790.49	-395.2	40.0
25% flex	-51,035.00	21,441.54	-11,115.42	-106.3	18.4
Flex crop	Returns over variable costs year 5				
	Minimum value (Pr.<=0)	Maximum value (Pr.<=100)	Mean value (Pr.<=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
15% flex	12,820.85	75,163.84	39,871.09	26.5	100.0
25% flex	14,722.41	67,433.84	37,343.22	26.0	100.0
<i>Corn</i>					
15% flex	11,779.30	77,781.16	40,302.51	25.5	100.0
<i>Cotton</i>					
15% flex	13,805.21	69,071.33	41,260.43	26.7	100.0
25% flex	-424.19	72,052.35	39,495.39	29.9	99.8

TABLE 10. SINGLE-YEAR NET RETURNS PER ACRE OVER VARIABLE COSTS FOR CORN WITH ALTERNATIVE FLEX CROPS AND CROP INSURANCE

Flex crop	Returns over variable costs				
	Minimum value	Maximum value	Mean value	Coeff. var.	Prob >= \$0
				<i>Pct.</i>	<i>Pct.</i>
<i>Soybeans</i>					
15% flex	5.96	169.95	65.86	59.7	100.0
25% flex	4.65	156.04	62.92	61.4	100.0
<i>Corn</i>					
No govt. program	-30.09	166.90	39.20	122.2	67.6
15% flex	6.44	175.48	68.62	60.3	100.0
<i>Cotton</i>					
15% flex	-5.20	192.80	68.40	60.3	99.2
25% flex	-18.07	188.64	68.77	67.6	91.6

Crop Insurance and Commodity Options

From table 11, the smallest 5-year loss over total costs was for the 15 percent soybean flex (\$14,613). This alternative also had the highest mean value (\$13,384) and the highest maximum value (\$47,327).

For the insured and options protected alternatives, the highest minimum 5-year return over variable costs was for corn with a 15 percent corn flex (\$15,927). Corn with a 15 percent cotton flex had the highest mean return (\$45,392) and maximum return (\$81,714) over variable costs of the insurance and options alternatives.

TABLE 11. FIVE-YEAR TOTAL NET RETURNS OVER COSTS FOR 100 ACRES OF CORN WITH ALTERNATIVE FLEX CROPS, CROP INSURANCE AND COMMODITY OPTIONS

Flex crop	Returns over total costs year 5				
	Minimum value (Pr.>=0)	Maximum value (Pr.>=100)	Mean value (Pr.>=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
15% flex	-14,613.01	47,327.45	13,383.94	82.0	88.4
25% flex	-24,262.32	29,654.33	5,206.31	190.5	68.2
<i>Corn</i>					
15% flex	-18,284.53	37,699.09	9,134.92	164.8	80.0
<i>Cotton</i>					
15% flex	-31,779.40	37,662.84	1,341.08	86.0	55.8
25% flex	-36,181.60	28,407.62	-6,168.89	-106.3	31.0
	Returns over variable costs year 5				
	Minimum value (Pr.>=0)	Maximum value (Pr.>=100)	Mean value (Pr.>=50)	Coeff. var. (%)	Prob >= \$0 (%)
<i>Soybeans</i>					
15% flex	14,565.99	76,506.45	42,562.94	25.8	100.0
25% flex	10,437.79	64,354.44	39,906.42	24.9	100.0
<i>Corn</i>					
15% flex	15,926.57	71,910.18	43,346.01	29.4	100.0
<i>Cotton</i>					
15% flex	12,271.52	81,713.76	45,392.00	25.4	100.0
25% flex	14,429.21	79,018.42	44,441.92	29.9	100.0

Individual year returns per acre over variable costs, with insurance and options, are shown in table 12. The highest minimum return is achieved with the 15 percent soybean flex (\$14.97 per acre). The highest mean (\$79.16) and maximum (\$198.02) values per acre are for the 25 percent cotton flex. Probabilities of at least breaking even on variable costs

(i.e. returns greater than \$0) are above 95 percent for all government participation alternatives.

TABLE 12. SINGLE-YEAR NET RETURNS PER ACRE OVER VARIABLE COSTS FOR CORN WITH ALTERNATIVE FLEX CROPS AND CROP INSURANCE

Flex crop	Returns over variable costs				
	Minimum value	Maximum value	Mean value	Coeff. var.	Prob >= \$0
				<i>Pct.</i>	<i>Pct.</i>
<i>Soybeans</i>					
15% flex	14.97	162.56	71.50	57.4	100.0
25% flex	11.33	158.02	69.56	54.0	100.0
<i>Corn</i>					
No govt. program	-22.10	167.70	46.70	110.3	70.0
15% flex	11.17	180.70	72.67	66.2	100.0
<i>Cotton</i>					
15% flex	3.00	191.60	77.10	59.4	100.0
25% flex	-6.75	198.02	79.16	67.6	96.0

CONCLUSIONS

Individual recommendations based on the results reported herein should be sensitive to a producer’s asset position and risk preferences. Crop insurance and commodity futures options do provide a safety net for those who need it and are unable or unwilling to take the risk of “catastrophic” losses. However, in general there is a low probability of experiencing such a level of losses. This may explain why participation in the Multiple Peril Crop Insurance program has been declining during the last few years.

Regardless of flex crop, crop insurance and commodity options do provide higher returns at the bottom of their respective probability distributions. This indicates that, in the event of a disaster, a producer will not lose as much with insurance and options as without them. It is also significant that purchasing both insurance and options provides higher returns at all probability levels than does purchasing insurance alone.

The no insurance or options strategy provides higher returns than the insurance and options strategy over some ranges of the possible outcomes (i.e., the probability distribution of net revenue outcomes) but not over others. Because of the mixed results it cannot be said that purchasing insurance and options “dominates” or always does better than the

strategy of not purchasing insurance and options. However, the results do indicate that insurance and options provide downside risk protection.

Participation in the farm program at the 15 percent flex level, with corn and cotton flex crops, provides higher returns in any given year than does no farm program participation. Corn with soybean flex participation provided higher returns than no participation over most of the probability distribution. Participation in the farm program also contributed significantly to downside risk protection. Probabilities of at least covering total costs exceeded 72 percent with a 15 percent corn or soybean flex and 60 percent with a 25 percent corn or soybean flex. In contrast, with no farm program participation, the probability of covering total costs was less than 28 percent. Probabilities of covering variable costs exceeded 95 percent for all alternatives studied.

In general, participation in the 15 percent flex program did not always provide net returns over variable costs that were higher than the 25 percent flex program at all probability levels. The 15 percent flex strategy therefore cannot categorically be said to be a better strategy than the 25 percent flex program. However, minimum, maximum, and mean values were more often higher with the 15 percent flex strategy than with the 25 percent flex strategy.

Results of the 0/92 program with canola are considered speculative at this point. Although returns may have looked attractive in this study, with high probabilities of breaking even on total and variable costs, it is noted that a minimum price of \$4.50 per bushel was assumed. As this bulletin goes to press, canola prices have fallen below that minimum price.

Returns for 0/92 with grass were never high enough to cover total costs. However, the probabilities of covering *variable* costs with 0/92 grass were, in all cases, 100 percent.

Results obtained are based on regional aggregate yields, prices, and costs for north Alabama. Individual situations may differ considerably from this representative regional situation.

APPENDIX

APPENDIX TABLE 1. PROBABILITY OF NET RETURNS (OVER VARIABLE COSTS)
FOR A SINGLE YEAR, LESS THAN OR EQUAL TO THE VALUE LISTED, FOR
100 ACRES OF CORN, NO GOVERNMENT PROGRAM PARTICIPATION

Probability	No insurance or options	Insurance only	Insurance & options
0	-5.30	-3.09	-2.21
5	-4.23	-2.32	-1.73
10	-3.70	-1.93	-1.52
15	-3.04	-1.72	-1.34
20	-2.08	-1.36	-1.23
25	-.92	-1.10	-.96
30 .....	.27	-.71	-.04
35	1.46	.59	.98
40	2.46	1.76	2.18
45	3.83	2.81	3.36
50	4.79	3.92	4.67
55	5.63	4.79	5.35
60	6.75	5.99	6.88
65	7.98	7.24	7.83
70	8.90	8.21	8.95
75	9.74	9.19	9.98
80	10.72	10.24	11.14
85	12.01	11.31	11.85
90	12.97	12.20	12.94
95	14.43	13.85	14.34
100	17.09	16.69	16.77
Prob. >= 0	71.40	67.60	70.00
Skewness	.092	.300	.261
Kurtosis	1.836	1.747	1.695
Coeff. var.	1.301	1.222	1.103

APPENDIX TABLE 2. PROBABILITIES OF NET RETURNS (OVER VARIABLE COSTS) THAT ARE LESS THAN OR EQUAL TO THE VALUE LISTED, WITHIN ANY GIVEN YEAR, FOR 100 ACRES OF CORN WITH SOYBEAN FLEX ACRES

Probability	15% soybean flex			0/92		25% soybean flex		
	No insurance or options	Insurance only	Insurance & options	0/92 with canola	0/92 with grass	No insurance or options	Insurance only	Insurance & options
	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.
0	-1.10	0.60	1.50	1.38	1.66	-0.79	0.46	1.13
5 .....	.18	1.51	1.93	2.53	1.73	.27	1.41	1.69
10 .....	.93	1.97	2.30	3.05	1.80	1.16	2.04	2.14
15	1.55	2.32	2.69	3.74	1.88	2.14	2.48	2.82
20	2.05	2.59	2.99	4.41	1.99	2.66	2.91	3.20
25	2.95	2.95	3.25	5.50	2.13	3.35	3.34	3.67
30	3.69	3.44	3.69	6.61	2.24	4.07	3.67	4.07
35	4.70	4.30	4.62	7.56	2.36	4.69	4.14	4.47
40	5.67	5.12	5.59	8.55	2.49	5.32	4.63	5.22
45	6.45	5.95	6.31	9.42	2.62	6.10	5.28	6.06
50	7.31	6.59	7.15	10.47	2.72	7.04	6.29	6.96
55	8.17	7.51	7.87	11.35	2.82	7.81	7.09	7.75
60	8.95	8.34	8.78	12.01	2.92	8.25	7.81	8.39
65	9.88	9.12	9.55	12.38	3.01	8.88	8.30	8.88
70	10.61	9.79	10.20	12.86	3.11	9.49	9.02	9.57
75	11.35	10.36	11.27	13.09	3.20	10.36	9.61	10.22
80	12.15	11.38	12.03	13.60	3.27	11.13	10.43	10.82
85	12.98	12.18	12.99	13.92	3.37	11.68	11.07	11.77
90	13.97	13.02	13.86	14.35	3.48	12.70	11.92	12.47
95	15.24	14.05	14.90	14.90	3.62	13.93	13.00	13.42
100	17.35	16.26	16.26	16.57	3.84	16.17	15.60	15.80
Prob. >= 0	96.40	100.00	100.00	100.00	100.00	96.00	100.00	100.00
Skewness	.089	.306	.301	-.326	-.046	.079	.306	.235
Kurtosis	1.853	1.893	1.812	1.760	1.795	1.995	1.939	1.887
Coef. var.	.660	.597	.574	.448	.228	.614	.567	.540

APPENDIX TABLE 3. PROBABILITIES OF NET RETURNS (OVER VARIABLE COSTS) THAT ARE LESS THAN OR EQUAL TO THE VALUE LISTED, WITHIN ANY GIVEN YEARS FOR 100 ACRES OF CORN WITH CORN FLEX ACRES

Probability	15% corn flex			0/92	
	No insurance or options	Insurance only	Insurance & options	0/92 with canola	0/92 with grass
0	-1.46	.64	1.12	1.05	1.21
5 .....	.26	1.34	1.84	2.39	1.38
10 .....	.87	1.91	2.28	3.51	1.44
15	1.44	2.30	2.78	4.20	1.55
20	2.27	2.76	3.05	5.09	1.70
25	2.97	3.32	3.47	6.39	1.87
30	3.70	3.68	4.02	7.30	2.04
35	4.59	4.15	4.70	8.76	2.03
40	5.62	5.18	5.70	10.09	2.36
45	6.63	5.90	6.41	11.02	2.57
50	7.37	6.86	7.27	11.72	2.67
55	8.19	7.34	8.11	12.07	2.88
60	9.01	7.92	9.03	12.47	3.03
65	9.65	8.91	9.77	12.77	3.16
70	10.77	9.89	10.66	13.01	3.28
75	11.52	10.88	11.43	13.34	3.49
80	12.55	11.55	12.24	13.89	3.63
85	13.12	12.39	13.02	14.37	3.75
90	14.06	13.53	13.81	15.03	3.95
95	15.08	14.53	14.86	15.73	4.13
100	18.13	17.55	18.07	17.07	4.67
Prob. >= 0	96.00	100.00	100.00	100.00	100.00
Skewness	.084	.332	.263	-.516	.071
Kurtosis	1.860	1.921	1.799	1.996	1.817
Coef. var.	.662	.603	.568	.427	.338

APPENDIX TABLE 4. PROBABILITIES OF NET RETURNS (OVER VARIABLE COSTS) THAT ARE LESS THAN OR EQUAL TO THE VALUE LISTED, WITHIN ANY GIVEN YEAR, FOR 100 ACRES OF CORN WITH COTTON FLEX ACRES

Probability	15% cotton flex			0/92		25% cotton flex		
	No insurance or options	Insurance only	Insurance & options	0/92 with canola	0/92 with grass	No insurance or options	Insurance only	Insurance & options
	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.	Thou. dol.
0	-3.38	-.52	.30	-1.21	-1.21	-5.81	-1.81	-.68
5	-1.27	.78	1.03	.94	-.96	-2.81	-.41	.20
10 .....	.03	1.41	1.58	2.73	-.84	-.91	.21	1.11
15	1.15	2.36	2.59	4.07	-.40	.64	1.37	2.25
20	2.16	3.20	3.45	5.55	.07	1.68	2.81	3.47
25	3.00	3.76	3.95	6.75	.57	2.63	3.39	4.49
30	4.04	4.29	4.67	7.76	1.03	3.69	4.03	5.12
35	4.80	4.79	5.41	8.63	1.59	4.50	4.66	5.79
40	5.75	5.67	5.99	9.35	2.04	5.31	5.45	6.56
45	6.81	6.20	6.91	10.08	2.60	6.00	5.99	6.99
50	7.38	6.84	7.71	10.62	3.09	6.76	6.88	7.92
55	8.17	7.71	8.52	11.45	3.41	7.69	7.64	8.50
60	8.97	8.52	9.30	11.96	3.66	8.38	8.21	9.17
65	9.71	9.22	10.03	12.63	3.90	9.88	8.76	9.77
70	10.53	9.92	10.91	13.28	4.17	10.62	9.53	10.52
75	11.40	10.53	11.84	14.02	4.55	11.41	10.20	11.19
80	12.26	11.70	12.68	14.70	4.84	12.25	11.22	12.22
85	13.24	12.41	13.95	15.37	5.15	13.01	12.34	13.09
90	14.29	13.18	14.76	15.99	5.41	13.99	13.56	14.17
95	16.16	14.90	16.00	16.59	5.97	15.63	15.25	15.80
100	20.59	19.28	19.16	19.57	7.10	20.49	18.86	19.80
Prob. >= 0	90.20	99.20	100.00	97.0	80.80	87.00	91.60	96.00
Skewness	-.043	.266	.246	-.444	-.166	-.064	.234	.105
Kurtosis	2.182	2.219	2.038	2.358	1.800	2.298	2.324	2.219
Coef. var.	.726	.603	.594	.483	.868	.825	.676	.595

APPENDIX TABLE 5. RETURNS FROM 100 ACRES OF CORN, NO GOVERNMENT PARTICIPATION, CROP INSURANCE, OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-1,835.15	6,148.68	-11,863.81	10,533.73
2	-3,767.02	8,822.66	-22,806.55	20,101.35
3	-5,818.81	11,241.78	-34,935.05	26,395.31
4	-8,006.19	13,217.43	-46,365.91	30,820.47
5	-10,316.06	15,674.32	-50,416.99	40,006.02
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	4,725.85	6,148.68	- 5,302.81	17,094.73
2	9,748.64	8,822.66	- 9,290.89	33,617.01
3	15,068.79	11,241.78	-14,047.45	47,282.91
4	20,695.66	13,217.43	-17,664.06	59,522.33
5	26,668.91	15,674.32	-13,432.02	76,990.99

APPENDIX TABLE 6. RETURNS FROM 100 ACRES OF CORN WITH CROP INSURANCE, NO GOVERNMENT PARTICIPATION OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-2,079.37	5,476.28	- 9,651.47	10,131.10
2	-4,270.71	8,049.87	-18,991.63	16,223.35
3	-6,600.28	10,181.64	-28,420.58	20,066.43
4	-9,092.95	12,235.79	-37,327.85	26,606.02
5	-11,681.19	14,012.13	-44,472.21	28,674.01
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	4,481.63	5,476.28	-3,090.47	16,692.10
2	9,244.95	8,049.87	-5,475.97	29,739.01
3	14,287.32	10,181.64	-7,532.98	40,954.02
4	19,608.90	12,235.79	-8,626.00	55,307.88
5	25,303.78	14,012.13	-7,487.25	65,658.98

Corn insured at the 65 percent level and high price election.

APPENDIX TABLE 7. 100 ACRES OF CORN WITH COMMODITY OPTIONS AND CROP INSURANCE, NO GOVERNMENT PARTICIPATION

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-1,520.03	5,558.72	-8,769.68	10,205.22
2	-3,108.15	8,151.39	-17,645.57	19,117.06
3	-4,793.30	10,627.25	-26,836.46	28,402.51
4	-6,574.27	12,573.05	-34,864.43	31,049.30
5	-8,476.40	14,704.50	-43,890.91	38,521.00
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	5,040.97	5,558.72	-2,208.68	16,766.22
2	10,407.51	8,151.39	-4,129.91	32,632.72
3	16,094.30	10,627.25	-5,948.86	49,290.11
4	22,127.59	12,573.05	-6,162.58	59,751.16
5	28,508.57	14,704.50	-6,905.95	75,505.96

Corn insured at the 65 percent level and high price election.
\$2.50 corn option with \$.13 premium and \$.05 basis.

APPENDIX TABLE 8. 100 ACRES OF CORN WITH A 15% SOYBEAN FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	2,174.91	4,854.01	-6,278.34	12,169.81
2	4,479.07	7,182.75	-12,379.64	24,266.18
3	6,914.44	8,997.99	-15,310.04	33,084.63
4	9,503.96	10,663.89	-17,013.27	39,673.43
5	12,233.53	12,056.74	-21,104.39	46,382.70
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,351.16	4,854.01	-1,102.09	17,346.05
2	15,142.14	7,182.75	-1,716.57	34,929.25
3	23,393.54	8,997.99	1,169.07	49,563.75
4	32,148.07	10,663.89	5,630.83	62,317.54
5	41,412.54	12,056.74	8,074.61	75,561.70

APPENDIX TABLE 9. 100 ACRES OF CORN WITH A 15% SOYBEAN FLEX CROP AND CROP INSURANCE, NO COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	1,889.17	4,219.79	-4,579.88	11,818.82
2	3,896.95	6,295.96	-8,522.77	19,321.70
3	6,018.81	7,634.59	-12,213.45	30,403.15
4	8,285.91	9,020.56	-16,247.32	38,668.72
5	10,692.08	10,551.64	-16,358.15	45,984.84
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,065.42	4,219.79	596.37	16,995.06
2	14,560.02	6,295.96	2,140.31	29,984.77
3	22,497.92	7,634.60	4,265.66	46,882.26
4	30,930.02	9,020.56	6,396.79	61,312.82
5	39,871.09	10,551.64	12,820.85	75,163.84

APPENDIX TABLE 10. 100 ACRES OF CORN WITH A 15% SOYBEAN FLEX CROP, CROP INSURANCE AND COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	2,372.86	4,332.92	-3,679.57	11,079.45
2	4,885.53	6,322.69	-7,418.94	21,186.05
3	7,552.83	7,972.96	-9,258.86	27,157.87
4	10,384.61	9,545.33	-12,117.41	34,669.21
5	13,383.94	10,973.20	-14,613.01	47,327.45
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,549.11	4,332.92	1,496.69	16,255.70
2	15,548.61	6,322.70	3,244.14	31,849.13
3	24,031.93	7,972.96	7,220.25	43,636.97
4	33,028.71	9,545.33	10,526.70	57,313.32
5	42,562.94	10,973.20	14,565.99	76,506.45

Corn and soybeans insured at the 65 percent level and high price election.
 \$2.50 corn option with \$0.13 premium and \$0.05 basis, \$6.25 soybean option with \$0.44 premium and \$0.20 basis.

APPENDIX TABLE 11. 100 ACRES OF 0/92 CORN PLANTED TO CANOLA AND A 15% SOYBEAN FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	4,563.65	4,254.41	-3,547.60	11,642.82
2	9,394.26	6,235.95	-5,548.01	22,876.42
3	14,512.66	8,202.34	-8,149.37	34,137.37
4	19,936.77	9,874.11	-7,728.32	46,991.78
5	25,689.14	11,416.75	-11,174.79	56,266.46
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	9,493.45	4,254.42	1,382.20	16,572.62
2	19,549.64	6,235.95	4,607.37	33,031.81
3	30,207.17	8,202.34	7,545.14	49,831.88
4	41,502.75	9,874.11	13,837.66	68,557.76
5	53,478.88	11,416.74	16,614.95	84,056.20

APPENDIX TABLE 12. 100 ACRES OF 0/92 CORN PLANTED TO GRASS AND A 15% SOYBEAN FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-1,285.93	609.45	-2,297.70	-120.98
2	-2,649.72	886.20	-4,630.40	-537.41
3	-4,096.45	1,124.03	-6,973.52	-1,125.98
4	-5,629.45	1,326.81	-9,435.55	-2,408.00
5	-7,254.36	1,517.22	-11,558.59	-3,287.33
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	2,675.12	609.45	1,663.36	3,840.07
2	5,510.05	886.20	3,529.37	7,622.35
3	8,513.95	1,124.03	5,636.88	11,484.42
4	11,698.63	1,326.81	7,892.52	14,920.07
5	15,074.45	1,517.22	10,770.22	19,041.48

APPENDIX TABLE 13. 100 ACRES OF CORN WITH A 25% SOYBEAN FLEX CROP,
NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	776.43	4,252.62	-6,940.75	10,015.65
2	1,612.08	6,203.43	-13,176.11	19,804.65
3	2,501.10	7,969.75	-17,633.68	29,966.37
4	3,441.11	9,552.94	-23,007.81	32,799.88
5	4,446.90	11,015.78	-23,688.62	38,817.40

Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	6,932.10	4,252.62	-785.07	16,171.32
2	14,292.77	6,203.43	-495.42	32,485.46
3	22,098.30	7,969.75	1,963.52	49,563.57
4	30,369.82	9,552.94	3,920.91	59,728.59
5	39,147.01	11,015.78	11,011.50	73,517.52

APPENDIX TABLE 14. 100 ACRES OF CORN WITH A 25% SOYBEAN FLEX CROP
AND CROP INSURANCE, NO COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	463.28	3,755.88	-5,690.75	9,448.86
2	945.99	5,682.41	-9,688.07	16,325.72
3	1,475.36	7,135.58	-14,411.87	22,842.94
4	2,040.69	8,383.56	-16,384.96	25,968.85
5	2,643.11	9,710.56	-19,977.70	32,733.74

Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	6,618.96	3,755.88	464.93	15,604.54
2	13,626.68	5,682.41	2,992.62	29,006.41
3	21,072.56	7,135.58	5,185.34	42,440.15
4	28,969.40	8,383.56	10,543.76	52,897.56
5	37,343.22	9,710.56	14,722.41	67,433.84

Corn and soybeans insured at the 65 percent level and high price election.

APPENDIX TABLE 15. 100 ACRES OF CORN WITH A 25% SOYBEAN FLEX CROP, CROP INSURANCE AND COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	924.64	3,826.51	-5,022.44	9,645.92
2	1,906.82	5,815.16	-9,737.27	17,848.03
3	2,953.17	7,480.84	-14,810.24	26,469.43
4	4,045.23	8,646.11	-18,959.83	24,966.15
5	5,206.31	9,918.71	-24,262.32	29,654.33
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,080.31	3,826.51	1,133.24	15,801.59
2	14,587.51	5,815.16	2,943.42	30,528.72
3	22,550.38	7,480.84	4,786.97	46,066.64
4	30,973.94	8,646.10	7,968.89	51,894.87
5	39,906.42	9,918.71	10,437.79	64,354.44

Corn and soybeans insured at the 65 percent level and high price election.
 \$2.50 corn option with \$0.13 premium and \$0.05 basis, \$6.25 soybean option with \$0.44 premium and \$0.20 basis.

APPENDIX TABLE 16. 100 ACRES OF CORN WITH A 15% CORN FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	1,323.44	4,894.24	-7,531.75	12,063.26
2	2,714.42	7,213.09	-12,680.81	20,441.79
3	4,187.73	8,736.15	-17,822.28	27,080.84
4	5,762.48	10,912.13	-23,933.83	34,678.89
5	7,432.86	12,250.09	-25,058.18	40,361.35
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,392.36	4,894.24	-1,462.82	18,132.19
2	15,216.40	7,213.09	-178.82	32,943.78
3	23,508.76	8,736.16	1,498.75	46,401.88
4	32,311.69	10,912.13	2,615.38	61,228.11
5	41,643.95	12,250.09	9,152.91	74,572.45

APPENDIX TABLE 17. 100 ACRES OF CORN WITH A 15% CORN FLEX CROP AND CROP INSURANCE

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	1,080.63	4,313.65	-5,424.87	11,479.08
2	2,229.70	6,267.25	-10,353.18	19,858.77
3	3,432.77	7,522.33	-15,462.75	22,302.53
4	4,742.96	9,077.36	-17,911.38	30,056.80
5	6,091.42	10,259.77	-22,431.80	43,570.07
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,149.55	4,313.65	644.05	17,548.01
2	14,731.69	6,267.25	2,148.81	32,360.76
3	22,753.79	7,522.33	3,858.28	41,623.56
4	31,292.18	9,077.36	8,637.83	56,606.02
5	40,302.51	10,259.77	11,779.30	77,781.16

Corn insured at the 65 percent level and high price election.

APPENDIX TABLE 18. 100 ACRES OF CORN WITH A 15% CORN FLEX CROP, CROP INSURANCE AND COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	1,615.77	4,368.25	-4,952.09	12,002.45
2	3,337.29	6,451.54	-9,418.73	20,749.05
3	5,155.62	7,906.87	-12,366.64	27,860.63
4	7,083.25	9,430.44	-15,506.55	32,978.20
5	9,134.92	10,900.75	-18,284.53	37,699.09
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,684.69	4,368.25	1,116.83	18,071.37
2	15,839.27	6,451.54	3,083.26	33,251.04
3	24,476.65	7,906.87	6,954.38	47,181.66
4	33,632.46	9,430.44	11,042.66	59,527.42
5	43,346.01	10,900.75	15,926.57	71,910.18

Corn insured at the 65 percent level and high price election.
 \$2.50 corn option with \$0.13 premium and \$0.05 basis.

APPENDIX TABLE 19. 100 ACRES OF 0/92 CORN PLANTED TO CANOLA AND A 15% CORN FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	5,244.27	4,319.22	-3,831.07	12,189.02
2	10,785.07	6,438.71	-6,685.61	22,554.40
3	16,640.46	8,051.68	-7,301.42	33,546.47
4	22,869.08	9,326.98	-5,947.20	44,189.52
5	29,484.49	10,825.21	-3,463.49	54,407.98
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	10,122.01	4,319.22	1,046.68	17,066.77
2	20,833.24	6,438.71	3,362.56	32,602.56
3	32,169.26	8,051.68	8,227.39	49,075.28
4	44,207.37	9,326.98	15,391.09	65,527.80
5	56,980.82	10,825.21	24,032.84	81,904.31

APPENDIX TABLE 20. 100 ACRES OF 0/92 CORN PLANTED TO GRASS AND A 15% CORN FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-1,207.10	914.12	-2,703.27	760.47
2	-2,481.32	1,371.30	-5,409.06	932.14
3	-3,835.25	1,753.30	-8,082.65	1,032.15
4	-5,268.86	2,085.95	-10,738.88	479.00
5	-6,786.53	2,443.80	-13,918.26	744.16
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	2,701.91	914.12	1,205.73	4,669.48
2	5,571.22	1,371.30	2,643.48	8,984.68
3	8,609.44	1,753.30	4,362.04	13,476.84
4	11,831.51	2,085.95	6,361.49	17,579.37
5	15,248.86	2,443.80	8,117.14	22,779.56

APPENDIX TABLE 21. 100 ACRES OF CORN WITH A 15% COTTON FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-467.20	5,334.48	-11,196.05	12,777.91
2	-964.61	8,126.44	-20,932.73	21,607.60
3	-1,501.67	9,747.70	-27,398.51	26,825.69
4	-2,063.01	11,262.17	-35,244.58	29,495.47
5	-2,686.32	13,421.66	-42,938.11	40,131.59
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,347.27	5,334.48	-3,381.57	20,592.39
2	15,133.20	8,126.44	-4,834.91	37,705.42
3	23,376.49	9,747.70	-2,520.35	51,703.85
4	32,122.32	11,262.17	-1,059.25	63,680.79
5	41,364.60	13,421.66	1,112.81	84,182.51

APPENDIX TABLE 22. 100 ACRES OF CORN WITH A 15% COTTON FLEX CROP AND CROP INSURANCE

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-501.42	4,412.21	-8,331.77	11,469.97
2	-1,002.40	6,471.49	-15,576.21	18,508.54
3	-1,573.31	8,092.94	-21,980.54	23,418.75
4	-2,151.90	9,588.34	-25,665.46	29,693.56
5	-2,790.49	11,029.19	-30,245.71	25,020.41
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,313.05	4,412.21	-517.30	19,284.45
2	15,095.42	6,471.49	521.60	34,606.36
3	23,304.85	8,092.94	2,897.62	48,296.91
4	32,033.43	9,588.34	8,519.86	63,878.89
5	41,260.43	11,029.19	13,805.21	69,071.33

Corn and cotton insured at the 65 percent level and high price election.

APPENDIX TABLE 23. 100 ACRES OF CORN WITH A 15% COTTON FLEX CROP,
CROP INSURANCE AND COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	233.43	4,779.33	-7,515.96	11,343.42
2	487.99	6,830.52	-14,118.99	17,750.26
3	756.05	8,835.38	-21,355.68	22,264.37
4	1,035.38	10,035.04	-28,491.66	29,491.61
5	1,341.08	11,528.08	-31,779.40	37,662.84
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	8,047.90	4,779.33	298.52	19,157.90
2	16,585.81	6,830.52	1,978.83	33,848.07
3	25,634.21	8,835.38	3,522.48	47,142.54
4	35,220.70	10,035.04	5,693.66	63,676.94
5	45,392.00	11,528.08	12,271.52	81,713.76

Corn and cotton insured at the 65 percent level and high price election.
\$2.50 corn option with a \$0.13 premium and \$0.05 basis, \$0.68 cotton option with
a \$0.033 premium and \$0.035 basis.

APPENDIX TABLE 24. 100 ACRES OF 0/92 CORN PLANTED TO CANOLA AND A 15%
COTTON FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	2,681.24	4,868.14	-8,608.32	12,172.80
2	5,499.67	6,568.96	-15,090.69	21,703.77
3	8,474.62	8,497.37	-17,526.27	30,251.91
4	11,640.83	10,129.72	-18,790.96	39,923.99
5	14,992.94	11,988.45	-24,858.98	45,772.90
Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	10,079.54	4,868.14	-1,210.02	19,571.11
2	20,740.17	6,568.96	149.80	36,944.27
3	32,027.85	8,497.37	6,026.96	53,805.14
4	44,005.55	10,129.72	13,573.76	72,288.71
5	56,697.84	11,988.45	16,845.92	87,477.80

APPENDIX TABLE 25. 100 ACRES OF 0/92 CORN PLANTED TO GRASS AND A 15% COTTON FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-3,016.81	2,290.24	-6,864.81	1,440.66
2	-6,223.42	3,298.56	-13,760.49	1,953.68
3	-9,619.46	4,163.70	-20,602.69	1,231.29
4	-13,195.63	4,954.02	-26,378.78	288.69
5	-16,999.38	5,637.26	-31,084.29	-1,351.32

Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	2,637.75	2,290.24	-1,210.26	7,095.21
2	5,424.95	3,298.56	-2,112.11	13,602.05
3	8,382.37	4,163.70	-2,600.86	19,233.12
4	11,540.86	4,954.02	-1,642.29	25,025.17
5	14,875.84	5,637.26	790.93	30,523.90

APPENDIX TABLE 26. 100 ACRES OF CORN WITH A 25% COTTON FLEX CROP, NO CROP INSURANCE OR COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-2,093.08	5,677.48	-14,784.15	11,514.91
2	-4,303.95	8,445.40	-26,916.70	15,105.86
3	-6,663.46	10,442.71	-35,606.70	20,583.16
4	-9,203.23	12,646.54	-44,295.34	27,169.14
5	-11,862.54	14,408.85	-52,421.20	31,427.72

Year	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	6,885.09	5,677.48	-5,805.97	20,493.09
2	14,191.09	8,445.40	-8,421.66	33,600.90
3	21,919.46	10,443.71	-7,023.79	49,166.07
4	30,072.84	12,646.54	-5,019.27	66,445.20
5	38,748.27	14,408.85	-1,810.39	82,038.52

APPENDIX TABLE 27. 100 ACRES OF CORN WITH A 25% COTTON FLEX CROP AND CROP INSURANCE, NO COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-1,974.61	4,737.16	-10,784.77	9,885.85
2	-4,089.61	6,690.24	-20,239.01	16,745.60
3	-6,279.08	8,581.13	-28,914.77	19,807.59
4	-8,624.81	10,336.15	-39,649.64	20,680.76
5	-11,115.42	11,815.90	-51,035.00	21,441.54
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,003.57	4,737.16	-1,806.60	18,864.02
2	14,405.43	6,690.24	-1,743.97	35,240.64
3	22,303.84	8,581.13	-331.85	48,390.51
4	30,651.25	10,336.15	-373.58	59,956.82
5	39,495.39	11,815.90	-424.19	72,052.35

Corn and cotton insured at the 65 percent level and high price election.

APPENDIX TABLE 28. 100 ACRES OF CORN WITH A 25% COTTON FLEX CROP, CROP INSURANCE AND COMMODITY OPTIONS

Year	Accumulated returns over total costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	-1,097.10	4,692.36	-9,652.89	10,823.95
2	-2,270.73	7,035.09	-18,734.94	20,009.54
3	-3,485.83	8,731.20	-27,697.74	23,182.70
4	-4,788.48	10,415.71	-34,294.02	27,503.98
5	-6,168.89	12,163.74	-36,181.60	28,407.62
	Accumulated returns over variable costs			
	Mean	Std. dev.	Minimum	Maximum
0	0	0	0	0
1	7,881.08	4,692.36	-674.71	19,802.13
2	16,224.31	7,035.09	-239.90	38,504.58
3	25,097.08	8,731.20	885.17	51,765.62
4	34,487.58	10,415.71	4,982.05	66,780.05
5	44,441.92	12,163.74	14,429.21	79,018.42

Corn and cotton insured at the 65 percent level and high price election.

\$2.50 corn option with a \$0.13 premium and \$0.05 basis, \$0.68 cotton option with a \$0.033 premium and \$0.035 basis.