Lifting the Fruit and Vegetable Cropping Restriction: Potential Impacts on Cropping Preference in the Lower Rio Grande Valley, Texas

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ABSTRACT

We estimate the effect of lifting the fruit and vegetable cropping restriction on cropping preference in the Lower Rio Grande Valley, using a stochastic simulation model and Stochastic Efficiency analysis. Results suggest that, based on risk-adjusted net returns, lifting the cropping restriction may likely have the most profound effect on watermelon and cabbage acreage.

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INTRODUCTION

The 2002 Farm Bill authorized the Direct Payment and Counter-cyclical Payment Programs (DP & CCP) for U.S. agricultural producers of specific crops[1]. Both DP and CCP programs provide direct payments to eligible producers. Since both DP and CCP payments are "decoupled" from current production decisions, it has been claimed by U.S. policymakers that the programs do not distort current production decisions (Farm Service Agency (FSA)).

There is still considerable debate over how this system of government payments might actually affect production. Some contend that decoupled payments significantly affect agricultural production and trade (Key, Lubowski, and Roberts). Five arguments typically underpin the assertion that these programs have distorting effects. First, the payments influence production, because restrictions in the policy preclude the planting of fruits and vegetables

[1] Base acres and payment yields are established for the following commodities: Barley, corn, grain sorghum (including dual purpose varieties that can be harvested as grain), oats, canola, crambe, flax, mustard, rapeseed, safflower, sesame, sunflower (including oil and non-oil varieties), peanuts, rice (excluding wild rice), soybeans, upland cotton, and wheat.

(FAVs) or the conversion of land to nonagricultural uses. Second, the perfect market assumptions that underpin the theory that these payments do not affect production are not maintained in practice (Key, Lubowski, and Roberts). Third, payments help producers overcome credit constraints by serving as capital directly or by increasing financing options through increased wealth and increased land values. Fourth, payments change the producers' level of risk-averseness through increasing wealth. Lastly, the potential to update base acres/yields in the future offers incentive to continue to increase production of specific crops (Goodwin and Mishra).

The first argument given above, the restriction on the planting of FAVs, is the focus of this paper, since many policy observers expect the restriction to be dropped in future legislation. Producers who participate in DP and CCP programs are subject to certain restrictions on the planting of wild rice, fruits, and vegetables (WR/FAV). In general, if WR/FAVs are planted on DP/CCP base acres and certain exceptions do not apply, the DP/CCP contract has been violated and may be terminated. If FSA determines the violation does not warrant contract termination, the farm's payment acres will be reduced by an acre for each acre of WR/FAV planted on base acres. FSA will also assess an additional payment reduction based on the market value of the WR/FAV (FSA).

Since 1996, there has been ongoing research done on the impacts that these "decoupled" payments may have on production decisions. Examples include work done by Key, Lubowski, and Roberts; Goodwin and Mishra; Chau and deGorter; Ahearn, Yee, and Korb; and McDonald and Sumner. However, there has been little work done to isolate the effects of the WR/FAV planting restriction on production decisions. However, the seemingly minor restriction has now become a focus of ongoing policy debates (Hudson et al).

As part of the recent U.S./Brazil cotton dispute, the WTO ruled that due to cropping restrictions, the U.S. DP and CCP do not qualify for WTO exemptions from reduction commitments as fully decoupled income support. This finding, along with several others, meant that the U.S. had exceeded agreed-upon 1992 subsidy limits, which opened the door for Brazil to argue its complaints against U.S. cotton policies (Hudson et al). Hence, as long as the WR/FAV planting restrictions remain in place, the DP and CCP programs are not considered "green box" and are subject to ongoing subsidy reduction commitments.

As early as May 2005, legislation was introduced that would lift the planting restriction on fruits and vegetables used for processing. Under this legislation, U.S. commodity program participants may produce FAVs for processing use on acreage enrolled in the DP and CCP programs. This acreage would be subtracted from the acreage producers use as a basis for calculating government payments in the year the FAVs are planted, but the acreage could be re-enrolled in subsequent years in which FAVs are not grown (Patterson). However, it is doubtful that legislation crafted in such a way that it continues to tie DP and CCP to specific crops will fulfill WTO expectations. Hence, it may be more likely that future legislation will allow producers to continue receiving DP and CCP payments for base acres while concurrently growing FAVs on those same base acres. The fruit and vegetable industry is concerned that the lifting of the FAV restriction, to comply with the WTO ruling, will cause declining output prices due to increased production (Morris).

ECONOMIC PROBLEM

How might a change in the current cropping restriction contained in the DP and CCP provisions of the U.S. Farm Bill affect harvested acreage of U.S. fruits and vegetables? The analysis presented here does not comprehensively answer that question, but begins the

investigation by addressing a more specific question: How does the lifting of the FAV planting restriction change the ranking (based on expected risk-adjusted net returns) of the primary crops grown in the Lower Rio Grande Valley (LRGV) of Texas?

OBJECTIVE OF THE STUDY

The objective of this study was to estimate the change in stochastic ranking (based on net income) of the primary crops grown in the LRGV due to a lifting of the FAV planting restriction. Primary crops chosen excluded permanent crops such as citrus, since we were interested in analyzing crops that could be rotated more easily on a year to year basis. Crops included in the analysis are: green cabbage (CB), cantaloupe (CP), corn for grain (CN), upland cotton (CT), honeydew (HD), spring onions (ON), sorghum for grain (GS), and watermelon (WM).

MATERIALS AND METHODS

A stochastic simulation model was used to empirically estimate the per acre net income (NI) distributions for alternative crops in 2006, under two scenarios. The first scenario assumes that the current FAV planting restriction remains in place. The second scenario assumes that the FAV planting restriction is lifted, and producers continue to receive DP and CCP payments while planting FAVs on base acres. The simulation model is represented by:

$$\tilde{NI}_{ij} = \left[\left(\sum_{w=1}^{N} \tilde{Y}_{wij} * \tilde{P}_{wij}\right) + \left(\tilde{LDP}_{ij} + DP_{ij} + \tilde{CCP}_{ij}\right)\right] - \left(\tilde{TVC}_{ij} + DFC_{ij} + CR_{ij}\right)$$

where

- $\tilde{NI}_{ij}$ is the stochastic annual net income per acre for scenario *i* crop *j*
- $\tilde{Y}_{wij}$ is the stochastic harvested yield per acre in intra-annual period *w* for scenario *i* crop *j*
- $\tilde{P}_{wij}$ is the stochastic price per unit in intra-annual period *w* for scenario *i* crop *j*
- $\tilde{LDP}_{ij}$ is the stochastic annual loan deficiency payment per acre for scenario *i* crop *j*

- DP_{ij} is the annual direct payment per acre for scenario *i* crop *j*
- $\tilde{CCP}_{ij}$ is the stochastic annual counter cyclical payment per acre for scenario *i* crop *j*
- $\tilde{TVC}_{ij}$ is the stochastic annual variable cost per acre for scenario *i* crop *j*
- DFC_{ij} is the annual direct fixed cost per acre for scenario *i* crop *j*
- CR_{ij} is the annual cash rent per acre for scenario *i* crop *j*

An important distinction in the above equation is how $\tilde{Y}_{wij}$ is computed for FAV crops versus how it is computed for program crops. For FAV crops:

$\tilde{Y}_{wij} = \tilde{YA}_{ij} / N_j$ when $\tilde{P}_{wij} \geq \tilde{CH}_{wij}$, and zero otherwise

where

- $\tilde{YA}_{ij}$ is stochastic annual yield per acre for scenario *i* crop *j*
- N_j is the number of weeks in the season for crop *j*
- $\tilde{CH}_{wij}$ is the stochastic harvest cost per acre in week *w* for scenario *i* crop *j*

For program commodities:

$\tilde{Y}_{wij} = \tilde{YA}_{ij} / 12$

where

- $\tilde{YA}_{ij}$ is the stochastic annual yield per acre for scenario *i* crop *j*

Annual prices and yields are the basic stochastic variables in the model. These variables make intra-annual prices, intra-annual yields, loan deficiency payments, and counter cyclical payments stochastic. Since stochastic prices also affect the decision to harvest (particularly for FAVs), harvest costs are also stochastic, which makes total variable costs stochastic. A multivariate empirical (MVE) distribution of annual prices and yields for the LRGV was estimated and used to simulate these variables. A MVE distribution of annual U.S. prices for

corn, cotton, and sorghum was also estimated and used to simulate these variables for use in estimating government payments. A MVE distribution has been shown to appropriately correlate random variables based on their historical correlation (Richardson et al). Parameters for the MVE distribution were estimated using historical yields and prices.

DATA

Revenue Side

Annual harvested acreage, average yield per acre, and average price received per unit for each crop was collected for each of the four counties in the LRGV for years 1992-2004. The data was extracted from the Annual Crop Increment Reports from Texas Cooperative Extension. The data was then used to calculate annual prices and yields for the LRGV for years 1992-2004. Cottonseed price and yield data was also used to contribute to cotton revenue.

Weekly (during season) price data for LRGV FAV crops, years 1998-2004, was collected from the Agricultural Marketing Service (AMS). Monthly price data for Texas program crops, years 1988-2004, was collected from the National Agricultural Statistics Service (NASS). The intra-annual prices were used to create the intra-annual price indices, in order to account for intra-annual variation in price.

Annual U.S. program crop data was collected from NASS, and included prices for years 1970-2004, loan rates, target prices, and direct payment rates. The 2003 data for cotton, corn, and sorghum in the LRGV counties was collected from the FSA, and included DP yields, DP quantities, DP acres, CCP payment yields, CCP payment quantities, and CCP acres. This data was used to estimate government payments per acre in the LRGV for 2006.

Cost Side

The 2004 Itemized Crop Budgets for the LRGV were collected from Texas Cooperative Extension. The budgets were adjusted to estimate costs in 2006, using Food and Agricultural Policy Research Institute (FAPRI) production cost indices (% change).

NET INCOME AND RISK ANALYSIS

Simulated probability distributions of net income for each crop under each of the policy scenarios in 2006 were used as an indicator of their risk and profitability. While only two general scenarios exist, planting restriction versus no planting restriction, the empirical model had to account for sub-scenarios under the no planting restriction regime. The amount of DP and CCP payments received per acre while planting FAVs depended on the crop base used. For the planting of program crops the base used was assumed to be for that particular crop. Ranking risky alternatives such as different cropping regimes is more difficult than simply comparing the average net income. In the literature, risky alternatives have been ranked using mean variance analysis and stochastic dominance (Richardson). These procedures often result in inconclusive rankings for some types of decision makers (McCarl).

A procedure proposed by Hardaker, Richardson, Lien, and Schumann, using certainty equivalents (CE)[2], ranks risky decisions for different types of decision makers based on a range of risk aversion levels. Their procedure, Stochastic Efficiency with Respect to a Function (SERF), calls for calculating the CE that a decision maker would place on a risky alternative relative to a no risk investment at different absolute risk aversion coefficients (ARACs)[3]. An

[2] The CE is the amount of money a decision maker would be willing to pay to gain a fair bet (risky alternative or investment) vs. a risk-free alternative with the same average return. The investment with the greater CE is the preferred strategy.

[3] Pratt and Arrow defined RAC or r(x) as a function of wealth (x) as the negative ratio of the second and first derivatives of a utility function u(x), or $r(x) = -u''(x)/u'(x)$. Therefore, this coefficient is positive for risk aversion and diminishes for increasing x if there is diminishing risk aversion (Hardaker et al). The RACs represent the decision maker's degree of risk aversion (RAC>0), neutrality (RAC=0), or risk preference (RAC<0), and are used to

advantage of using CE over other methods is that a risk ranking can be done without calculating individual ARACs, since a range of ARACs is used to represent a wide range of risk preference/aversion levels. Hence, preferences can be estimated for different classes of decision makers based on their risk preference (ARAC). Additionally, the absolute differences in the CE values between risky alternatives represent the risk premium that decision makers place on the preferred alternative over another alternative (Ribera, Hons, and Richardson). In this case, the risk premium represents the amount of money that a decision maker would have to be paid to be indifferent between growing one crop versus another. In this study, the CE ranking procedure was applied to ARAC levels ranging from -.04 (risk-preferring) to .04 (risk-averse).

RESULTS AND DISCUSSION

Recall that each scenario represents the following:

Scenario 1: Continued planting restriction on FAVs

Scenario 2a: Planting FAVs on corn base acreage while receiving DP and CCP payments for that acreage

Scenario 2b: Planting FAVs on cotton base acreage while receiving DP and CCP payments for that acreage

Scenario 2c: Planting FAVs on sorghum base acreage while receiving DP and CCP payments for that acreage

Non-stochastic Results

Scenario 1 (Continued planting restriction on FAVs)

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classify decision makers. Risk-averse decision makers are willing to take a fair bet if the increased risk has an increased payoff, risk-neutral agents prefer strategies with the highest mean payoff without regard to risk (variance of the payoff), and risk-preferring agents prefer strategies with greater downside risk if the potential exists for a large payoff. The CE procedure ranks risky strategies over a feasible range of RACs and thus avoids having to estimate RACs for individual decision makers (Hardaker et al and Ribera et al).

Based on mean (risk free) net income ranking of the alternative crops, the crop with the highest expected net income per acre is preferred. The 2006 ranking is as follows: ON ($284.83), CT ($193.73), WM ($140.04), CP ($56.37), CN ($28.99), GS (-$43.80), CB (-$65.14), and HD (-$396.47) (Table 1).

Scenario 2a (No FAV planting restriction and corn base)

Based on mean (risk free) net income ranking of the alternative crops, the crop with the highest expected net income per acre is preferred. The 2006 ranking is as follows: ON ($318.67), CT ($193.73), WM ($173.89), CP ($90.21), CN ($28.99), CB (-$31.29), GS (-$43.80), and HD (-$362.63) (Table 1).

The only change in ranking under this scenario is that cabbage would now be preferred over grain sorghum.

Scenario 2b (No FAV planting restriction and cotton base)

Based on mean (risk free) net income ranking of the alternative crops, the crop with the highest expected net income per acre is preferred. The 2006 ranking is as follows: ON ($405.92), WM ($261.13), CT ($193.73), CP ($177.45), CB ($55.96), CN (28.99), GS (-$43.80), and HD (-$275.38) (Table 1).

Using cotton base, watermelon is now ranked over cotton, and cabbage returns turn positive, and cabbage is now ranked over corn.

Scenario 2c (No FAV planting restriction and grain sorghum base)

Based on mean (risk free) net income ranking of the alternative crops, the crop with the highest expected net income per acre is preferred. The 2006 ranking is as follows: ON ($314.78), CT ($193.73), WM ($170.00), CP ($86.32), CN (28.99), CB (-$35.18), GS (-$43.80), and HD (-$366.52) (Table 1).

Like the corn base scenario, the only change in ranking over scenario 1 is that cabbage is now more profitable than grain sorghum.

Using the non-stochastic results, the most significant change in crop preference occurs using the cotton base. This result is to be expected, as per acre government payments to cotton base tend to be four times higher than either corn or sorghum payments in the LRGV. Hence, DP and CCP payments to cotton base tend to more greatly affect expected NI.

At this point it should be noted that the proposed model does not account directly for changes in expected prices due to shifts in supply, which can occur as producers change their cropping preferences. We recognize that this research should be expanded in the future to estimate new equilibrium prices. The work done by McDonald and Sumner offers a useable framework. The model does account for correlation between prices, since a MVE distribution was used in simulation.

Stochastic Results

A series of cumulative distribution function (CDF) graphs were generated from the simulated NI results for each scenario. Visual appraisal of the CDFs indicated only minor changes in the CDFs from one scenario to another. However, these minor changes can have a significant impact on the preference ranking of the crops, particularly for certain classes of producers. In addition, the CDFs did cross one another and therefore the more rigorous SERF method was used to determine the ranking of crops under the assumption of risk. The CEs were evaluated to rank cropping preferences at different levels of risk preference/aversion. Tables 2 through 5 summarize the SERF analysis by presenting the CEs for each of the scenarios. Recall that a higher (less negative) CE represents a more preferred crop at each level of ARAC, and the

higher (less negative) the ARAC the more risk-averse the producer. The preferred crop at each ARAC is denoted in green, and the least preferred is denoted in red.

Table 2 indicates that under current policy conditions onion production should be strongly preferred by more risk-preferring producers (negative ARACs), as well as preferred by risk-neutral producers (ARAC = 0). Cotton production ranks first for risk-averse producers (positive ARACs). Grain sorghum production should be the least preferred option for risk-preferring producers, while honeydew production ranks last for risk-neutral and risk-averse producers. Table 3 indicates that cabbage outranks corn when we move from scenario 1 (current policy) to scenario 2a (corn base).

Table 4 summarizes CEs using cotton base under the regime of no FAV planting restriction. Risk-preferring producers should still favor planting onions over other crops, however watermelon now ranks higher than cotton, and cabbage ranks higher than corn for the risk-preferring producers. For risk-neutral producers, onion production remains ranked first, but watermelon now outranks cotton, and cabbage outranks grain sorghum. For risk-averse producers under the cotton base scenario, watermelon production is now ranked first, versus being ranked third under current policy conditions. Table 5 indicates that there is no change in preference ranking when moving from current policy to the grain sorghum base scenario.

Table 6 summarizes the ranking of crop preference under each scenario, based on CE. The table shows only the ranking for the most risk-preferring producers (ARAC = -.04), risk-neutral producers (ARAC = 0), and the most risk-averse producers (ARAC = .04).

SUMMARY AND CONCLUSIONS

Due to the recent WTO cotton ruling in the U.S./Brazil case, the FAV planting restriction is likely to be lifted in future U.S. farm policy. The FAV industry fears that the lifting of this

restriction will cause declining FAV prices due to increased FAV plantings by DP and CCP program participants. The objective of this study was to estimate potential changes in crop planting preference in the LRGV due to a lifting of the FAV planting restriction.

Based on a mean NI ranking, cabbage becomes preferred over grain sorghum when the planting restriction is lifted and corn base or grain sorghum base acreage is used. Using cotton base acreage, watermelon becomes preferred over cotton, and cabbage becomes preferred over corn.

When risk (variability) is accounted for, the following changes occur in ranking for risk-preferring producers; watermelon becomes preferred over cotton when moving to scenario 2b (cotton base), and cabbage becomes preferred over corn when moving to either scenario 2a (corn base) or scenario 2b (cotton base). Watermelon becomes preferred over cotton, and cabbage becomes preferred over grain sorghum for risk-neutral producers when cotton base is used. Watermelon becomes preferred over all crops when cotton base is used for risk-averse producers.

The results suggest that the most profound change in cropping preference in the LRGV from lifting the FAV planting restriction might occur for crops planted on cotton base acreage. Since government payments to cotton base tend to be considerably higher than corn or grain sorghum, using cotton base has a larger impact on the relative risk of planting FAVs. If there is an increase in FAV planting due to a lifting of the planting restriction, the most likely increases could be for watermelon and cabbage in the LRGV. The risk in planting onions, cantaloupe, or honeydew does not appear to be overcome by DP and CCP payments, relative to other crop choices available. Any change in cropping practices based on risk-adjusted NI alone, assumes that no other constraints exist that keep producers from growing a particular crop. The authors are *not* claiming that other constraints do not exist.

Table 1
Summary of 2006 Simulated Net Income Results ($/Acre)

	Minimum	Mean	Maximum		Minimum	Mean	Maximum
Scenario 1				Scenario 2a			
CB	-290.44	-65.14	164.52	CB	-269.28	-31.29	215.94
CP	-1213.53	56.37	1669.32	CP	-1167.67	90.21	1701.01
CN	-50.18	28.99	220.03	CN	-50.18	28.99	220.03
CT	-47.48	193.73	611.16	CT	-47.48	193.73	611.16
HD	-1339.60	-396.47	671.86	HD	-1318.44	-362.63	693.02
ON	-788.92	284.83	4923.07	ON	-748.41	318.67	4944.23
GS	-98.62	-43.80	108.91	GS	-98.62	-43.80	108.91
WM	-123.55	140.04	556.16	WM	-96.98	173.89	586.12
	Minimum	Mean	Maximum		Minimum	Mean	Maximum
Scenario 2b				Scenario 2c			
CB	-167.06	55.96	287.90	CB	-267.25	-35.18	200.99
CP	-1090.15	177.46	1792.69	CP	-1177.06	86.32	1705.79
CN	-50.18	28.99	220.03	CN	-50.18	28.99	220.03
CT	-47.48	193.73	611.16	CT	-47.48	193.73	611.16
HD	-1216.22	-275.38	789.15	HD	-1319.03	-366.52	692.44
ON	-665.54	405.92	5033.29	ON	-752.44	314.78	4943.64
GS	-98.62	-43.80	108.91	GS	-98.62	-43.80	108.91
WM	-17.96	261.13	679.54	WM	-89.90	170.00	589.53

Scenario 1 (Continued planting restriction on FAVs)
Scenario 2a (No FAV planting restriction and corn base)
Scenario 2b (No FAV planting restriction and cotton base)
Scenario 2c (No FAV planting restriction and grain sorghum base)

Table 2
Certainty Equivalents at Various ARAC Levels (Scenario 1 – Current Policy)

ARAC	Onion	Cabbage	Cantaloupe	Watermelon	Honeydew	Cotton	Corn	G. Sorghum
-0.0400	4807.97	86.70	1556.12	452.82	556.73	496.27	121.75	8.67
-0.0367	4797.53	81.83	1546.31	445.15	546.27	485.99	114.61	3.41
-0.0333	4785.03	76.31	1534.67	436.43	533.71	473.80	106.68	-1.96
-0.0300	4769.80	69.99	1520.61	426.46	518.36	459.16	97.96	-7.35
-0.0267	4750.88	62.69	1503.29	414.99	499.20	441.40	88.62	-12.64
-0.0233	4726.79	54.16	1481.44	401.63	474.59	419.71	78.93	-17.73
-0.0200	4695.24	44.08	1453.01	385.79	441.88	393.28	69.29	-22.53
-0.0167	4652.35	32.04	1414.47	366.39	396.50	361.72	60.18	-26.99
-0.0133	4591.02	17.60	1359.21	341.56	330.06	325.91	51.94	-31.07
-0.0100	4495.92	0.37	1272.81	308.11	227.10	288.53	44.76	-34.77
-0.0067	4322.92	-19.71	1116.36	261.83	65.56	253.02	38.64	-38.10
-0.0033	3856.35	-42.02	757.07	202.02	-151.43	221.36	33.44	-41.10
0.0000	402.29	-36.57	91.43	73.14	-292.57	73.14	18.29	-36.57
0.0033	-444.85	-87.33	-381.50	91.58	-693.79	169.60	25.12	-46.24
0.0067	-537.03	-107.31	-638.66	59.26	-902.12	148.50	21.70	-48.44
0.0100	-579.57	-124.60	-794.02	37.81	-1007.69	130.11	18.63	-50.44
0.0133	-606.40	-139.30	-887.29	22.61	-1068.34	114.14	15.83	-52.26
0.0167	-626.01	-151.79	-947.49	11.01	-1108.64	100.34	13.25	-53.93
0.0200	-641.49	-162.44	-989.20	1.63	-1138.10	88.40	10.85	-55.47
0.0233	-654.24	-171.61	-1019.73	-6.31	-1160.93	78.05	8.60	-56.88
0.0267	-665.01	-179.58	-1043.04	-13.23	-1179.29	69.04	6.50	-58.19
0.0300	-674.25	-186.56	-1061.40	-19.41	-1194.43	61.13	4.52	-59.41
0.0333	-682.27	-192.74	-1076.25	-25.01	-1207.13	54.15	2.65	-60.55
0.0367	-689.28	-198.25	-1088.50	-30.13	-1217.93	47.95	0.88	-61.61
0.0400	-695.47	-203.20	-1098.76	-34.84	-1227.21	42.39	-0.78	-62.61

Table 3
Certainty Equivalents at Various ARAC Levels (Scenario 2a – New Policy – Corn Base)

ARAC	Onion	Cabbage	Cantaloupe	Watermelon	Honeydew	Cotton	Corn	G. Sorghum
-0.0400	4829.19	126.38	1589.95	488.17	577.89	496.27	121.75	8.67
-0.0367	4818.79	121.03	1580.50	480.67	567.43	485.99	114.61	3.41
-0.0333	4806.37	115.04	1569.26	472.06	554.87	473.80	106.68	-1.96
-0.0300	4791.28	108.25	1555.67	462.12	539.54	459.16	97.96	-7.35
-0.0267	4772.60	100.51	1538.89	450.55	520.39	441.40	88.62	-12.64
-0.0233	4748.94	91.55	1517.64	436.97	495.83	419.71	78.93	-17.73
-0.0200	4718.10	81.06	1489.87	420.74	463.26	393.28	69.29	-22.53
-0.0167	4676.38	68.64	1452.05	400.85	418.21	361.72	60.18	-26.99
-0.0133	4616.84	53.81	1397.52	375.50	352.64	325.91	51.94	-31.07
-0.0100	4524.19	36.16	1311.76	341.64	251.99	288.53	44.76	-34.77
-0.0067	4353.87	15.57	1155.60	295.26	95.52	253.02	38.64	-38.10
-0.0033	3888.99	-7.39	795.42	235.68	-116.79	221.36	33.44	-41.10
0.0000	420.57	-36.57	146.29	73.14	-182.86	73.14	18.29	-36.57
0.0033	-410.51	-54.35	-349.48	125.24	-662.79	169.60	25.12	-46.24
0.0067	-502.50	-75.22	-604.16	92.54	-873.49	148.50	21.70	-48.44
0.0100	-544.87	-93.37	-756.40	70.68	-980.72	130.11	18.63	-50.44
0.0133	-571.42	-108.93	-847.49	55.07	-1042.67	114.14	15.83	-52.26
0.0167	-590.64	-122.25	-906.17	43.05	-1084.03	100.34	13.25	-53.93
0.0200	-605.68	-133.73	-946.76	33.20	-1114.32	88.40	10.85	-55.47
0.0233	-617.99	-143.69	-976.45	24.76	-1137.79	78.05	8.60	-56.88
0.0267	-628.35	-152.42	-999.12	17.29	-1156.65	69.04	6.50	-58.19
0.0300	-637.24	-160.12	-1017.00	10.56	-1172.16	61.13	4.52	-59.41
0.0333	-644.96	-166.96	-1031.48	4.40	-1185.14	54.15	2.65	-60.55
0.0367	-651.72	-173.08	-1043.45	-1.26	-1196.14	47.95	0.88	-61.61
0.0400	-657.70	-178.58	-1053.51	-6.48	-1205.58	42.39	-0.78	-62.61

Table 4
Certainty Equivalents at Various ARAC Levels (Scenario 2b – New Policy – Cotton Base)

ARAC	Onion	Cabbage	Cantaloupe	Watermelon	Honeydew	Cotton	Corn	G. Sorghum
-0.0400	4918.20	208.69	1679.50	576.14	674.02	496.27	121.75	8.67
-0.0367	4907.78	203.85	1669.69	568.45	663.55	485.99	114.61	3.41
-0.0333	4895.30	198.34	1658.04	559.69	651.00	473.80	106.68	-1.96
-0.0300	4880.12	192.03	1643.98	549.66	635.65	459.16	97.96	-7.35
-0.0267	4861.28	184.73	1626.65	538.10	616.49	441.40	88.62	-12.64
-0.0233	4837.34	176.18	1604.78	524.63	591.89	419.71	78.93	-17.73
-0.0200	4806.03	166.06	1576.30	508.64	559.20	393.28	69.29	-22.53
-0.0167	4763.56	153.97	1537.68	489.05	513.87	361.72	60.18	-26.99
-0.0133	4702.87	139.46	1482.26	463.98	447.56	325.91	51.94	-31.07
-0.0100	4608.68	122.14	1395.55	430.23	345.02	288.53	44.76	-34.77
-0.0067	4436.73	101.92	1238.44	383.60	184.72	253.02	38.64	-38.10
-0.0033	3971.13	79.40	877.90	323.42	-30.37	221.36	33.44	-41.10
0.0000	566.86	0.00	219.43	91.43	-73.14	73.14	18.29	-36.57
0.0033	-323.13	33.34	-259.38	212.37	-572.87	169.60	25.12	-46.24
0.0067	-415.17	12.86	-515.59	179.63	-780.67	148.50	21.70	-48.44
0.0100	-457.59	-4.92	-670.68	157.63	-885.82	130.11	18.63	-50.44
0.0133	-484.30	-20.07	-763.91	141.76	-946.09	114.14	15.83	-52.26
0.0167	-503.78	-32.92	-824.11	129.39	-986.07	100.34	13.25	-53.93
0.0200	-519.12	-43.87	-865.82	119.15	-1015.26	88.40	10.85	-55.47
0.0233	-531.73	-53.24	-896.35	110.30	-1037.90	78.05	8.60	-56.88
0.0267	-542.36	-61.33	-919.66	102.43	-1056.13	69.04	6.50	-58.19
0.0300	-551.48	-68.37	-938.03	95.30	-1071.18	61.13	4.52	-59.41
0.0333	-559.39	-74.54	-952.87	88.79	-1083.83	54.15	2.65	-60.55
0.0367	-566.31	-80.00	-965.12	82.79	-1094.60	47.95	0.88	-61.61
0.0400	-572.41	-84.85	-975.38	77.27	-1103.86	42.39	-0.78	-62.61

Table 5

Certainty Equivalents at Various ARAC Levels (Scenario 2c – New Policy – Sorghum Base)

ARAC	Onion	Cabbage	Cantaloupe	Watermelon	Honeydew	Cotton	Corn	G. Sorghum
-0.0400	4828.56	117.95	1592.59	486.90	577.31	496.27	121.75	8.67
-0.0367	4818.14	113.05	1582.78	479.14	566.84	485.99	114.61	3.41
-0.0333	4805.68	107.50	1571.13	470.25	554.29	473.80	106.68	-1.96
-0.0300	4790.51	101.17	1557.07	460.03	538.95	459.16	97.96	-7.35
-0.0267	4771.69	93.85	1539.74	448.21	519.79	441.40	88.62	-12.64
-0.0233	4747.80	85.31	1517.86	434.39	495.20	419.71	78.93	-17.73
-0.0200	4716.59	75.21	1489.37	417.99	462.56	393.28	69.29	-22.53
-0.0167	4674.27	63.14	1450.73	397.97	417.35	361.72	60.18	-26.99
-0.0133	4613.85	48.64	1395.27	372.51	351.38	325.91	51.94	-31.07
-0.0100	4520.03	31.29	1308.51	338.51	249.78	288.53	44.76	-34.77
-0.0067	4348.47	11.00	1151.39	291.87	91.70	253.02	38.64	-38.10
-0.0033	3882.87	-11.63	790.48	231.95	-121.22	221.36	33.44	-41.10
0.0000	420.57	-36.57	146.29	73.14	-219.43	73.14	18.29	-36.57
0.0033	-414.28	-57.86	-352.35	121.53	-666.34	169.60	25.12	-46.24
0.0067	-506.33	-78.34	-608.32	89.19	-876.41	148.50	21.70	-48.44
0.0100	-548.71	-96.10	-762.09	67.73	-983.11	130.11	18.63	-50.44
0.0133	-575.32	-111.24	-854.18	52.54	-1044.62	114.14	15.83	-52.26
0.0167	-594.65	-124.14	-913.53	40.99	-1085.62	100.34	13.25	-53.93
0.0200	-609.84	-135.18	-954.59	31.65	-1115.64	88.40	10.85	-55.47
0.0233	-622.29	-144.72	-984.64	23.76	-1138.91	78.05	8.60	-56.88
0.0267	-632.79	-153.04	-1007.59	16.88	-1157.61	69.04	6.50	-58.19
0.0300	-641.79	-160.34	-1025.68	10.73	-1173.02	61.13	4.52	-59.41
0.0333	-649.60	-166.82	-1040.33	5.17	-1185.92	54.15	2.65	-60.55
0.0367	-656.43	-172.60	-1052.43	0.07	-1196.88	47.95	0.88	-61.61
0.0400	-662.45	-177.80	-1062.58	-4.63	-1206.27	42.39	-0.78	-62.61

Table 6

Ranking Based on CE (Highest to Lowest)

	Scenario 1	Scenario 2a	Scenario 2b	Scenario 2c
ARAC -.04	ON	ON	ON	ON
	CP	CP	CP	CP
	HD	HD	HD	HD
	CT	CT	WM	CT
	WM	WM	CT	WM
	CN	CB	CB	CN
	CB	CN	CN	CB
	GS	GS	GS	GS
ARAC 0	ON	ON	ON	ON
	CP	CP	CP	CP
	WM_1	WM_3	WM	WM_5
	CT_1	CT_3	CT	CT_5
	CN	CN	CN	CN
	GS_2	GS_4	CB	GS_6
	CB_2	CB_4	GS	CB_6
	HD	HD	HD	HD
ARAC .04	CT	CT	WM	CT
	CN	CN	CT	CN
	WM	WM	CN	WM
	GS	GS	GS	GS
	CB	CB	CB	CB
	ON	ON	ON	ON
	CP	CP	CP	CP
	HD	HD	HD	HD

Matching subscripts denote equal CEs and therefore equal ranking (i.e. WM and CT are both ranked 3rd in scenario 1, ARAC 0).

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