IMPACTS OF ETHANOL PRODUCTION FROM CORN
ON AGRICULTURE AND THE FOOD SYSTEM[1]

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Action by Congress in October 1990 has important implications for ethanol production and for the corn industry. The Clean Air Act amendments of 1990 mandated oxygenated gasoline fuels in certain cities by 1992 and reformulated gasoline in the nation's most air-polluted cities by 1995. The Omnibus Reconciliation Act of 1990 extended the blender tax credit and excise tax exemption to the year 2000.

The federal excise tax exemption, along with subsidies in a number of states, will provide the basis for growth in ethanol use along with expanding demand for gasoline. The impact of the Clean Air Act on ethanol demand is much more difficult to assess. The purpose of this paper is not to analyze the extent to which ethanol will be employed to meet the Clean Air Act requirements, but to provide some dimensions to the impacts expanded ethanol production could have on agriculture and the food industry.

To do this, the Baseline and the Clean Air Act alternatives incorporated in a 1990 study by GRC Economics for the National Corn Growers Association were applied to a model of U.S. agriculture (GRC Economics). AGMOD is an econometric model of U.S. agriculture developed in the past five years at Michigan State University (Ferris, 1989). The model is designed to generate annual projections on major field crops and livestock to the year 2000. Farm income and food prices are other outputs of the model.

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[1]Presented at a conference on "Ethanol and Public Policy: A Hearing," sponsored by the Hubert H. Humphrey Institute of Public Affairs, Minneapolis, MN, November 4, 1991.

AGMOD is used for long-range planning and budgeting and also for farm policy analysis. An attribute of models such as this is that alternative scenarios can be quickly examined. As new information about the prospects for ethanol emerge, the model projections can be easily updated.

Ethanol Production and By-products

The U.S. Department of Agriculture estimated that about 1,300 million bushels of corn were used for food and industrial purposes in the year beginning September 1, 1989 (USDA, Feed). Of this amount, 1,005 million bushels, or about three-fourths, were processed by wet milling. Among the wet-milled products, 380 million bushels were processed for high fructose corn syrup (HFCS), 215 million bushels for glucose and dextrose, 180 million bushels for starch and 230 million bushels for alcohol. In dry milling, 140 million bushels of corn were processed for alcohol and 161 million bushels for dry-milled and alkaline-cooked products. In all, 370 million bushels of corn were processed into alcohol, 4.9 percent of the 1989 corn crop.

Major by-products of the wet milling process are corn gluten feed, corn gluten meal and corn oil. Corn gluten meal, at about 60 percent protein, is directly competitive with other high protein feeds such as soybean meal (about 44 percent protein). Corn gluten feed, at about 21 percent protein, would be considered a "middle protein" feed and would be substitutable for either energy or protein feeds. Corn oil would be a close substitute for soybean oil and other vegetable oils and, in turn, would have effects on the general fats and oils market.

The by-product of the dry milling process is an animal feed--distiller's dried grain with solubles (DDGS). This is another middle protein feed at about 30 percent protein.

Given the recent federal exemption from the excise tax, Kane and Le Blanc estimate that ethanol produced with existing technology is competitive if crude oil trades at $24 per barrel or higher (Kane). This assumes farm corn prices around $2.00 per bushel and prices on the by-product feeds at recent levels. If state-of-the-art technology is used, the competitive crude oil

price drops to $20 and with possible technological improvements, the competitive price could drop to $18 per barrel. With state-of-the-art technology <u>without</u> the federal subsidy, ethanol would not be competitive unless crude oil prices reach at least $40 per barrel.

Very likely, crude oil prices will remain under $40 per barrel and corn prices will remain over $2.00 per bushel at the farm. In this analysis, the U.S. refiners' acquisition costs for crude oil are projected to increase from around $20 per barrel in 1991 to the low $30's by the year 2000. Corn prices under the Baseline projection range from $2.30 per bushel to $3.00 in this period. Prices on the by-product feeds might well increase if the expanded output of corn gluten feed and meal is exported. Also, new technology will improve the conversion efficiency of corn into ethanol. But, in all probability, the excise tax exemption will continue to be required to make ethanol production profitable. Whether ethanol can compete with alternatives under the Clean Air Act is a question not addressed in this paper. The projected prices of crude oil, corn and by-product feeds outlined here represent the type of information needed to make that assessment.

Issues

The passage of the Clean Air Act was a remarkable effort on the part of the Administration and Congress to address a major environmental problem. Continuing the excise tax exemption on ethanol-blended gasoline also represented a commitment to support cleaner air. As with most legislation involving regulations and subsidies, efforts to advance the public interest involves benefits to some and losses to others. Seldom is everyone better off as a result of new legislation. Public policy makers face difficult choices and have to weigh the pros and cons.

Enlightened public policy decisions require some evaluation of the extent to which certain sectors benefit and other sectors lose. The decision to maintain and expand ethanol production involves gainers and losers, and this analysis is an attempt to delineate the multiple impacts and

quantify them. From a description of the industry, we would presume the following developments and issues.

1. Corn prices will be higher and soybean prices lower. While corn and soybeans are commonly grown on the same farm, some soybean producers, particularly those in the South, do not have much of a corn base.

2. Cash crop producers will gain at the expense of livestock producers who buy feed grain. While many livestock producers grow a sizeable portion of their own feed grain, the specialized operators, such as the commercial feedlots and poultry producers, depend on the market for their feed requirements. This situation also has regional effects with the Corn Belt gaining relative to the West and Southeast.

3. The European Community (EC) will face increased costs for their Common Agricultural Policy (CAP) as more corn gluten feed and meal is shipped to that market. Nearly all of the increased production of this feed in the U.S. during the 1980's was exported to the EC. This is because this market is the most profitable. Like soybeans and soybean meal, corn gluten feed and meal are not subject to the variable levy as are feed grains and wheat. The high priced grains in the EC hold up the price on by-product feeds which actually serve as substitutes for energy in a major way, as well as a source of protein. This substitution reduces the demands for the indigenous grains and increases the support costs. Even the current level of corn gluten feed and meal exports is drawing heavy criticism from the EC. Should we use this situation as a bargaining chip under GATT?

4. South America, which exports soybeans and soybean meal, and other nations exporting vegetable oils would face increased competition from U.S. exports of the by-product feeds and corn oil. World market prices would be depressed on these products as well.

For South America, the negative impacts on soybean prices would be partly offset by higher grain prices.

5. Expanded ethanol production will tend to shift costs from taxpayers to consumers. Higher corn prices will reduce deficiency payments, but will eventually result in higher food prices.

6. The sugarbeet and sugarcane industries would likely gain from the ethanol program. Higher corn prices and possibly lower prices on corn gluten feeds and meal would raise the net raw material costs for the production of HFCS. Processors using sweeteners would shift from HFCS to sugar. Sugar prices are not likely to increase, assuming that the support price will remain fairly constant in nominal terms.

7. A number of other considerations could be listed--relevant, but not analyzed, in this paper.

   (a) Less dependence on foreign energy, an argument with popular support.

   (b) Substitution of renewable for limited resources, also with popular appeal.

   (c) Economic development with a focus on rural areas. In addition to the benefits from the construction of new facilities, employment and income multipliers of 2.5-3.0 are common for industries such as this (Ferris, 1990).

AGMOD Analysis

The essence of the model analysis is presented in Tables 1-9. Underlying these projections are assumptions about population, income growth, inflation and interest rates and farm programs. For the U.S., real disposable incomes were projected to increase slowly in 1992 and 1993 and converge to 1.3 percent per year. Outside of the U.S., real per capita income growth was forecast to increase at about 1 percent per year--generally regarded as a conservative projection. Inflation in consumer prices was generated at 4-6 percent per year and real interest rates on farm mortgages at 6 percent.

The essential features of the 1990 Farm Bill are presumed to continue through the 1990's with target prices held at 1991 levels. About half of the land in the Conservation Reserve was assumed to return to production by the year 2000. The increased corn gluten feed and meal production is presumed to be exported.

The use of corn in ethanol production under the "Baseline" and "Program" alternatives is presented in Table 1. These are August 1990 estimates of GRC Economics. While the National Corn Growers Association has postulated even higher projections under the Program, other sources point to more modest demands on ethanol under the Clean Air Act. Assumed in this projection set is that the expansion will be shared by both the wet and dry milling industries. Under the Program scenario, nearly 10 percent of the total utilization of feed grains could be for ethanol by the year 2000, compared to just over 5 percent if ethanol is unaffected by the Clean Air Act.

As expected, corn and other feed grain production is enhanced by the Program (Table 2). Corn production in the mid to latter part of the decade would increase by 4-6 percent over the Baseline with soybean production down as much as 4-5 percent. Wheat production would be reduced slightly as higher prices on corn and grain sorghum would attract wheat acres. Corn prices would run 4-8 percent higher and soybeans as much as 17-18 percent lower (Table 3). This extreme price effect on soybeans would be short-lived as producers would respond and by the end of the decade, prices could even be higher than the baseline. Wheat prices would be higher as land shifts to feed grains and feeding of wheat to livestock increases.

The program would have minor impacts on exports of feed grain and wheat -- mostly negative due to higher prices which encourage foreign producers to expand (Table 4). Soybean exports are initially reduced from the Baseline, recover and then fall back. The expansion in wet milling projected would result in exports of corn gluten feed and meal running as much as a third over the Baseline. The 12 million metric tons projected to the year 2000 under the

Program represent about 380 million bushels in soybeans measured in protein equivalents. This is over half of the projected exports of soybeans.

As indicated in Table 5, prices of soybean meal and the by-product feeds will register minor changes if the increased output of corn gluten feed and meal were exported to Europe. Higher corn prices help maintain the high and middle protein feed markets, even though domestic supplies of DDGS would be increased.

On the other hand, the soybean sector will feel much more pressure from the vegetable oil market (Table 6). Corn oil production would increase by 25-30 percent. While corn oil production would remain relatively minor compared with soybean oil (about 15 percent), the impact of this additional supply and the accumulation of soybean carryover could drive both soybean oil and corn oil prices down sharply in some years.

Besides the prospective large increase in exports of corn gluten feed and meal to the EC, other international implications of expanded ethanol production can be observed in Table 7. The growth in area harvested for soybeans in South America would tend to be slowed with soybean hectares running 5-10 percent below the Baseline for several years. This would be at least partially offset by slightly higher areas in coarse grain and wheat outside the U.S.

Expanded corn use for ethanol could have some counter-intuitive impacts on net cash farm income. As indicated in Table 8, net cash farm income is projected to lag the Baseline until late in the decade. This prospect can be traced to: (1) reduced direct government payments to feed grain and wheat producers; (2) higher cash expenses due to rising feed prices; and (3) lower soybean prices. Until 1997, prices received by farmers for corn, while above the Baseline, are also below the projected target price of $2.75 per bushel. This increased return from the market is partially offset by reduced deficiency payments to participants in the Feed Grain Program. Similar developments are indicated for wheat producers, except under this scenario, wheat prices

do not reach the $4.00 per bushel target price by the end of the decade. As corn prices move above the target price toward the end of the decade, the net cash income is positively affected.

Note the savings in government costs beginning in 1992 (Table 8). These savings would more than offset reduced revenues to the Federal Highway Trust Fund.

Higher feed grain prices would eventually be translated into higher livestock prices and the Consumer Price Index on Food. A more rapid response would be generated by higher wheat prices, although the effect would be minor since farmers receive less than 10 percent of the retail price of cereals. Lower vegetable oil prices would partially offset the impact of livestock and cereal prices on CPI for food. The net effect of the expanded ethanol output would amount to about .2-.5 percent higher retail food prices than under the Baseline.

Capacity of Corn Industry to Fulfill Ethanol Demands

In the scenario described above, about 80 million acres of corn for grain would be required by the year 2000. This assumes that yields will climb linearly by an average of nearly 2 bushels per acre per year. Harvested area of corn would be about 5 million acres above the previous peak in 1985, but would not exceed previous peaks in harvested acres plus land set aside from corn production in the Feed Grain Program.

Ending stocks of feed grain would remain at a relatively comfortable level, but only a limited number of acres could be retrieved from land idled under government programs. As shown in Table 9, ending stocks of feed grain as a percent of annual utilization would average nearly 20 percent from 1993 to 2000 under the Program scenario. This might be regarded as an indication of the success of the Program in avoiding surpluses. Indeed one of the arguments for the ethanol program back in the late 1980's was to help rid the nation of the chronic surplus problem in agriculture. Unfavorable weather since that time has turned attention more to possible tightness in supplies. A carryover level of 10 percent is generally regarded as "pipeline"--minimum amounts needed to carry on the business of feeding livestock and handling

export shipments. Reoccurrence of severe droughts in this period would be accompanied by volatile corn markets and possible disruptions of supplies with ethanol processors under some pressure to bid corn away from the livestock industry.

The projected carryover level on wheat would also be considered on the low side by historical standards, but likely close to the targets of policy makers. On the other hand, ending carryover of soybeans moves up in the last half of the decade to levels much above those observed in the past. This is a major reason for depressed prices on soybeans and soybean oil.

Alternative Scenarios

Two alternative scenarios were examined, one in which all of the increased production of corn gluten feed and meal was absorbed by the U.S. livestock industry and the other a scenario of a higher economic growth rate abroad. The conclusions from the initial analysis would be modified as follows:

If exports of corn gluten feed and meal were held constant over the projection period at levels near those experienced recently, prices on these by-products would be under pressure even in the Baseline. By 1995, prices on corn gluten feed would be about $100 per ton, nearly $40 less than in the scenario of expanding exports. This difference would widen toward the end of the decade. The Clean Air Act would put even more pressure on corn gluten feed prices and would tend to hold these prices under $100 through the decade.

The negative price impact on soybean meal and corn markets would tend to be offset by increased exports.

Parenthetically, some questions have been raised about whether the U.S. livestock industry could absorb the increased amounts of corn gluten feed and meal that may emerge from the Clean Air Act. Studies by animal nutritionists such as Ensminger and Olentine indicate that these by-product feeds are readily substitutable in livestock rations (Ensminger). Cattle would be the most likely outlet for corn gluten feed.

Should real incomes per capita outside the U.S. increase by 1.5 percent per year rather than 1.0 percent, U.S. exports of feed grain, soybeans and products and wheat would be enhanced and prices stronger. Of particular interest is whether feed grain supplies might be so tight to be disruptive to livestock producers under the Clean Air Act and also to increase farm prices enough to raise some concerns about higher food prices.

The conclusion is that the livestock industry would adjust to rising feed prices by cutting output, feed grain acreage would expand, and carryover levels on feed grain would still drop somewhat below that in the slower economic growth scenario. By 1997, ending stocks of feed grain would approach the pipeline level of 10 percent. With the level of livestock output somewhat less, food prices would be higher than in the Program alternative with the slower economic growth. By the year 2000, the CPI for food would be about 205.6, about 1.5 percent higher than under the slower economic growth scenario.

Conclusions

The Clean Air Act as well as the ongoing excise tax exemption represent public policy decisions which have broad implications to several sectors of U.S. agriculture and to international relations, as well as to the health and budgets of U.S. consumers. U.S. agriculture should be able to accommodate the rate of expansion in ethanol production postulated in this analysis without undue pressure on the land base, livestock profits and consumer food prices. Nevertheless, feed grain supplies will be more vulnerable to uncertain weather.

Future public policy decisions related to the role of ethanol in the energy sector will require a careful assessment of the benefits versus the costs. Attention, too, should be given to this program as negotiations proceed in GATT, the North American Free Trade Agreement and other arenas of international trade discussions.

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Table 1

ASSUMED EFFECT OF 1990 ETHANOL LEGISLATION ON USE OF CORN FOR ETHANOL PRODUCTION

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
WET MILLED														
Baseline	Mil bu	210	222	230	237	283	292	298	311	329	348	361	379	398
Program	"	210	222	230	237	431	479	534	657	658	684	691	718	745
Change	"	0	0	0	0	148	187	236	346	329	336	330	339	347
DRY MILLED														
Baseline	Mil bu	139	140	140	141	172	177	182	189	201	212	219	231	242
Program	"	139	140	140	141	268	292	325	400	400	417	421	437	453
Change	"	0	0	0	0	96	115	143	211	199	205	202	206	211
TOTAL														
Baseline	Mil bu	349	362	370	378	455	469	480	500	530	560	580	610	640
Program	"	349	362	370	378	699	771	859	1057	1058	1101	1112	1155	1198
Change	"	0	0	0	0	244	302	379	557	528	541	532	545	558
TOTAL CORN USE IN ETHANOL AS A PERCENT OF FEED GRAIN UTILIZATION														
Baseline	%	4.06	3.79	4.03	4.06	4.75	4.81	4.75	4.70	4.85	4.96	5.05	5.20	5.34
Program	%	4.06	3.79	4.03	4.06	7.14	7.71	8.22	9.49	9.28	9.31	9.34	9.45	9.67

Table 2

EFFECT OF 1990 ETHANOL LEGISLATION ON PRODUCTION OF CORN, OTHER FEED GRAIN, SOYBEANS AND WHEAT

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CORN														
Baseline	Mil bu	4929	7525	7933	7479	8738	9099	9227	9318	9737	9885	10051	10419	10873
Program	Mil bu	4929	7525	7933	7479	8739	9197	9585	9774	10186	10477	10605	10872	11245
Percent change	%	0.0	0.0	0.0	0.0	0.0	1.1	3.9	4.9	4.6	6.0	5.5	4.4	3.4
OTHER FEED GRAIN														
Baseline	Mil MT	24.1	30.0	28.9	28.0	29.6	28.7	27.4	27.0	27.9	28.2	28.9	29.8	30.7
Program	Mil MT	24.1	30.0	28.9	28.0	29.6	29.2	28.1	27.7	28.6	29.2	29.7	30.7	31.4
Percent change	%	0.0	0.0	0.0	0.0	-0.0	1.8	2.8	2.6	2.7	3.7	2.8	3.2	2.3
SOYBEANS														
Baseline	Mil bu	1549	1924	1926	1934	2017	2021	2000	2026	2094	2202	2296	2377	2414
Program	Mil bu	1549	1924	1926	1934	2017	2007	1982	1993	2007	2077	2179	2263	2307
Percent change	%	0.0	0.0	0.0	0.0	-0.0	-0.7	-0.9	-1.6	-4.2	-5.7	-5.1	-4.8	-4.4
WHEAT														
Baseline	Mil bu	1812	2037	2736	1981	2558	2671	2785	2876	2978	3055	3175	3271	3365
Program	Mil bu	1812	2037	2736	1981	2558	2675	2795	2864	2949	3037	3197	3261	3359
Percent change	%	0.0	0.0	0.0	0.0	0.0	0.1	0.4	-0.4	-1.0	-0.6	0.7	-0.3	-0.2

Table 3

EFFECT OF 1990 ETHANOL LEGISLATION ON FARM PRICES OF MAJOR CROPS

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CORN														
Baseline	$/Bu	2.54	2.36	2.30	2.31	2.43	2.38	2.39	2.58	2.46	2.60	2.74	2.90	2.99
Program	$/Bu	2.54	2.36	2.30	2.31	2.51	2.49	2.48	2.69	2.65	2.81	2.94	3.12	3.23
Percent change	%	0.0	0.0	0.0	0.0	3.5	4.7	4.0	4.5	7.8	8.3	7.1	7.5	7.9
SOYBEANS														
Baseline	$/Bu	7.42	5.69	5.75	6.12	5.46	5.03	5.42	6.75	7.86	8.04	7.46	6.65	6.23
Program	$/Bu	7.42	5.69	5.75	6.12	5.25	4.99	5.16	5.59	6.42	7.36	7.46	7.03	6.49
Percent change	%	0.0	0.0	0.0	-0.0	-3.8	-1.0	-4.8	-17.1	-18.4	-8.4	0.0	5.8	4.2
WHEAT														
Baseline	$/Bu	3.72	3.72	2.61	2.98	3.33	3.55	3.48	3.49	3.25	3.31	3.39	3.48	3.70
Program	$/Bu	3.72	3.72	2.61	2.98	3.35	3.62	3.56	3.60	3.42	3.65	3.59	3.83	3.93
Percent change	%	0.0	0.0	0.0	0.0	0.5	2.0	2.4	2.9	5.2	10.2	6.2	10.3	6.2

Table 4

EFFECT OF 1990 ETHANOL LEGISLATION ON U.S. EXPORTS OF FEED GRAIN, SOYBEANS, WHEAT AND CORN GLUTEN FEEDS

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
FEED GRAIN														
Baseline	Mil MT	61	70	51	52	59	62	70	81	88	93	98	105	109
Program	Mil MT	61	70	51	52	59	62	70	81	88	93	97	103	107
Percent change	%	0.0	0.0	0.0	0.0	0.2	0.1	0.5	-0.5	-0.4	-0.0	-1.3	-1.5	-2.2
SOYBEANS														
Baseline	Mil bu	527	623	560	666	628	691	752	776	741	704	717	780	844
Program	Mil bu	527	623	560	666	602	663	718	744	754	723	700	722	760
Percent change	%	0.0	0.0	0.0	0.0	-4.1	-4.1	-4.4	-4.1	1.8	2.8	-2.4	-7.5	-10.0
WHEAT														
Baseline	Mil bu	1419	1233	1068	1130	1242	1361	1469	1525	1527	1590	1661	1722	1747
Program	Mil bu	1419	1233	1068	1130	1245	1366	1467	1522	1523	1575	1643	1702	1722
Percent change	%	0.0	0.0	0.0	0.0	0.2	0.4	-0.1	-0.2	-0.3	-1.0	-1.1	-1.2	-1.5
CORN GLUTEN FEEDS														
Baseline	1000 MT	5611	6278	6594	6733	7353	7526	7674	7881	8130	8387	8594	8843	9100
Program	1000 MT	5611	6278	6594	6733	8592	9092	9651	10779	10886	11201	11358	11682	12007
Percent change	%	0.0	0.0	0.0	0.0	16.9	20.8	25.8	36.8	33.9	33.6	32.2	32.1	31.9

Table 5

EFFECT OF 1990 ETHANOL LEGISLATION ON PRICES OF HIGH AND MIDDLE PROTEIN FEEDS

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
SOYBEAN MEAL, 44% (DECATUR, IL)														
Baseline	$/Ton	233	174	170	183	176	176	187	210	219	220	219	220	222
Program	$/Ton	233	174	170	183	177	176	184	203	218	230	232	233	233
Percent change	%	0.0	0.0	0.0	0.0	0.2	0.2	-1.5	-3.4	-0.4	4.8	6.0	5.9	5.1
CORN GLUTEN MEAL, 60% (IL POINTS)														
Baseline	$/Ton	282	258	236	294	290	292	309	341	355	361	365	373	381
Program	$/Ton	282	258	236	294	290	293	306	333	355	375	382	389	395
Percent change	%	0.0	0.0	0.0	0.0	0.3	0.4	-0.9	-2.2	0.0	3.7	4.4	4.3	3.8
CORN GLUTEN FEED, 21% (IL POINTS)														
Baseline	$/Ton	117	101	98	117	119	120	126	139	143	149	155	162	168
Program	$/Ton	117	101	98	117	121	123	127	140	146	157	163	170	176
Percent change	%	0.0	0.0	0.0	0.0	1.6	2.1	1.0	0.4	2.7	5.0	5.0	5.1	4.9
DISTILLER'S DRIED GRAINS (LAWRENCEBURG, IN)														
Baseline	$/Ton	141	124	124	122	120	120	125	139	142	144	146	149	151
Program	$/Ton	141	124	124	122	122	121	125	137	144	153	155	158	160
Percent change	%	0.0	0.0	0.0	0.0	1.1	1.4	-0.1	-1.4	1.5	5.7	6.3	6.3	5.9

Table 6

EFFECT OF 1990 ETHANOL LEGISLATION ON PRODUCTION OF CORN OIL AND PRICES OF SOYBEAN AND CORN OIL

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CORN OIL PRODUCTION														
Baseline	Mil Lbs	1415	1459	1600	1524	1608	1636	1659	1693	1735	1778	1812	1853	1897
Program	Mil Lbs	1415	1459	1600	1524	1831	1918	2015	2216	2232	2285	2310	2365	2421
Percent change	%	0.0	0.0	0.0	0.0	13.9	17.3	21.5	30.9	28.6	28.5	27.5	27.6	27.6
PRICE OF SOYBEAN OIL (DECATUR, IL)														
Baseline	Cents/Lb	21.1	22.3	21.0	21.4	16.6	12.6	13.9	21.6	30.4	31.9	26.6	18.5	14.0
Program	Cents/Lb	21.1	22.3	21.0	21.4	14.5	12.0	12.0	12.0	16.7	23.1	23.8	19.4	14.1
Percent change	%	0.0	0.0	0.0	-0.0	-12.6	-4.4	-13.7	-44.4	-45.0	-27.7	-10.6	4.7	0.2
PRICE OF CORN OIL (WET MILL, CHICAGO, IL)														
Baseline	Cents/Lb	21.0	24.8	20.2	21.1	16.3	13.5	13.7	21.2	29.9	31.3	26.1	21.6	19.3
Program	Cents/Lb	21.0	24.8	20.2	21.1	14.3	11.8	11.8	11.8	16.4	22.7	23.4	19.1	13.8
Percent change	%	0.0	0.0	0.0	-0.0	-12.6	-12.7	-13.7	-44.4	-45.0	-27.7	-10.6	-11.6	-28.3

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Table 7

EFFECT OF 1990 ETHANOL LEGISLATION ON AREA HARVESTED FOR COARSE GRAIN AND WHEAT OUTSIDE THE U.S. AND FOR SOYBEANS IN SOUTH AMERICA

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
COARSE GRAIN ABROAD														
Baseline	Mil Ha	293	284	282	282	281	283	281	277	275	275	275	275	277
Program	Mil Ha	293	284	282	282	281	283	281	277	276	276	277	277	279
Percent change	%	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	0.2	0.3	0.5	0.7	0.8
WHEAT ABROAD														
Baseline	Mil Ha	197	200	203	201	200	198	199	203	206	206	207	209	212
Program	Mil Ha	197	200	203	201	200	198	200	203	206	207	207	209	212
Percent change	%	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.1	0.2	0.1	0.1	0.2
SOYBEANS IN SOUTH AMERICA														
Baseline	Mil Ha	16.2	16.4	14.4	14.6	14.8	14.5	14.5	15.6	17.4	19.3	20.2	20.2	19.7
Program	Mil Ha	16.2	16.4	14.4	14.6	14.7	14.2	14.1	14.7	15.6	17.3	18.7	19.5	19.5
Percent change	%	0.0	0.0	0.0	-0.0	-0.7	-1.8	-2.6	-5.9	-10.1	-10.4	-7.3	-3.4	-1.1

Table 8

EFFECT OF 1990 ETHANOL LEGISLATION ON NET CASH FARM INCOME AND CONSUMER FOOD PRICES

ITEM	UNIT	YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NET CASH FARM INCOME														
Baseline	Bil $	57.4	58.3	59.7	55.0	49.1	50.0	57.5	64.0	70.2	74.6	73.0	68.7	65.1
Program	Bil $	57.4	58.3	59.7	55.0	49.0	50.0	57.4	62.7	66.7	71.3	73.3	73.1	70.8
Change	Bil $	0.0	0.0	0.0	0.0	-0.1	-0.0	-0.1	-1.4	-3.6	-3.3	0.3	4.4	5.7
DIRECT GOVERNMENT PAYMENTS TO FARMERS														
Baseline	Bil $	14.5	10.9	9.3	9.1	7.6	6.8	7.1	6.4	6.3	6.3	4.6	3.1	2.5
Program	Bil $	14.5	10.9	9.3	9.1	7.3	5.9	6.0	5.5	4.6	3.7	2.9	2.3	1.6
Change	Bil $	0.0	0.0	0.0	0.0	-0.3	-1.0	-1.1	-0.9	-1.7	-2.6	-1.7	-0.9	-0.8
CONSUMER FOOD PRICE INDEX (1982-84=100)														
Baseline	Index	118.2	125.1	132.4	135.9	139.3	144.0	150.4	158.5	167.9	176.9	185.5	193.7	201.6
Program	Index	118.2	125.1	132.4	135.9	139.3	144.2	150.8	158.9	168.2	177.2	186.1	194.4	202.6
Percent change	%	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.2	0.3	0.4	0.5

Table 9

EFFECT OF 1990 ETHANOL LEGISLATION ON ENDING STOCKS OF FEED GRAIN, SOYBEANS AND WHEAT AS A PERCENT OF ANNUAL UTILIZATION

ITEM	UNIT	CROP YEARS												
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
FEED GRAIN														
Baseline	%	30.2	18.7	20.7	18.0	21.3	26.3	27.8	24.4	23.3	20.3	17.8	16.6	17.6
Program	%	30.2	18.7	20.7	18.0	18.7	22.2	24.1	20.6	19.8	17.8	17.0	15.8	16.8
Percentage point change	%	0.0	0.0	0.0	0.0	-2.6	-4.1	-3.7	-3.8	-3.5	-2.5	-0.9	-0.9	-0.8
SOYBEANS														
Baseline	%	10.9	12.8	17.7	15.0	22.5	23.4	18.3	12.6	10.8	15.5	22.3	27.5	29.6
Program	%	10.9	12.8	17.7	15.0	25.9	28.7	25.6	21.3	15.4	14.5	18.9	24.7	29.1
Percentage point change	%	0.0	0.0	0.0	-0.0	3.3	5.3	7.2	8.7	4.6	-1.0	-3.4	-2.8	-0.5
WHEAT														
Baseline	%	29.3	24.1	35.3	21.0	26.1	31.0	33.5	35.5	32.5	32.7	30.8	27.8	27.2
Program	%	29.3	24.1	35.3	21.0	25.6	29.2	31.1	32.5	29.1	31.0	29.2	28.5	27.6
Percentage point change	%	0.0	0.0	0.0	0.0	-0.4	-1.8	-2.4	-3.0	-3.3	-1.7	-1.6	0.7	0.5