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THE EMERGING OHIO ALCOHOL INDUSTRY — IMPACTS ON AGRICULTURE

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The actors in the alcohol industry are beginning to sort themselves out. Farmer interest in producing alcohol on the farm was initially widespread. Today, however, interest has diminished as experience demonstrates that small farm stills, in general, are difficult to operate properly and are often uneconomic. At the industrial level, however, alcohol production incentives and opportunities have encouraged the initiation of an alcohol industry of some magnitude, especially with large scale distilleries. While farmers will not be producing much alcohol, they will be affected by this new industry and need to be aware of some of the changes it will bring to agriculture.

Corn is the basic energy feedstock to be used for alcohol production. The number of alcohol plants now being seriously considered will divert enough corn from traditional uses to have a substantial impact on corn and other crop and livestock production decisions. In this article, we report on alcohol production plans in Ohio, and on a preliminary analysis of the potential impact that alcohol production will have on Ohio agriculture.

The Alcohol Industry in Ohio

It is difficult to project a probable level of alcohol production for a new industry at a very early development stage. A survey, conducted by the U.S. National Alcohol Fuels Commission in the summer of 1980, identified 340 potential alcohol plants nationwide with a projected capacity of 4.5 billion gallons annually. Of this total, seven were to be located in Ohio. By contrast, the major corn producing states of Indiana, Illinois, Iowa and Minnesota had a total of 76 planned ethanol plants in the four-state area. By January of 1981, the Ohio Department of Energy had identified 14 potential plants in Ohio with a combined planned capacity of about 200 million gallons of alcohol per year. At the present time, there are firm plans for about one-half of 100 million gallons of this potential capacity to be in operation within two to three years. An additional 50 million gallon capacity is still possible, but plans are being delayed for various reasons. It is unlikely that the remaining 50 million capacity will be realized, at least by the specific industrial groups identified earlier this year. It is possible, however, that plans for additional alcohol capacity will be developed by others in the future. Also, the capacity reported above refers to commercial size plants that produce from 300,000 to 60 million gallons per year. Small, on-farm capacity has not been included in the above estimation, but would not materially affect the total planned capacity.

The factors influencing plant locations are specific for each situation. They generally include availability of existing capital structures, proximity to fuel (coal) supplies and end use considerations such as location near an oil refinery or export market. The major portion of the early alcohol production in Ohio will come from two plants in Southern Ohio, located along the Ohio River (Figure 1). For the above considerations, these plants and most other planned alcohol plants will be located outside the major corn producing areas. Thus, corn will need to be transported to these locations.

Finally, alcohol and related products can be produced in several forms for various uses. As a liquid fuel, alcohol can be mixed with gasoline in ratios of up to 20 percent alcohol or burned as a "pure fuel." The mixtures with gasoline require anhydrous alcohol, while "pure fuel" can be hydrated alcohol which contains some water and is less expensive to produce. The value of alcohol as a liquid fuel decreases as the concentration of

alcohol in gasoline mixtures increase. Thus, the most valuable alcohol product is that which is mixed with gasoline in small quantities as an additive. One of the first major plants will produce butanol, a form of alcohol used as a gasoline additive; while the other plant plans to produce anhydrous alcohol.

The Issues

As noted above, the major corn producing states are beginning to develop a significant alcohol industry using corn as the energy feedstock. Ohio has a modest share of that industry. In fact the production of 150 million gallons of alcohol per year would require about 60 million bushels of corn. In an average year that is about 15 percent of Ohio's corn crop. Other states may be committing even larger portions of their corn production to alcohol. In order to provide this extra corn, we will need to produce more, or consume and export less. Increased corn production requires decreased production of other crops. Soybeans are a likely candidate since distillers dried grain (DDGS), a high protein feed by-product of alcohol production can substitute for some of the soybean meal in livestock rations. Use of the DDGS, in turn, will cause some shifts in the economics of livestock feeding since it is not a good total substitute for soybean meal in hog and poultry rations. Ruminant animals can consume large quantities of DDGS without performance loss. Finally, the DDGS can be fed in wet or semi-dry form if fed immediately. In this case, the cost of processing is less. However, if the DDGS must be dried, stored and shipped over long distances, costs of processing increase. Thus, a major alcohol industry using corn has implications for both the type of livestock produced and the location of livestock production.

Another way to provide the extra corn for alcohol production is to cut back on livestock feeding and exports. These decisions are all related to the market prices consumers at home and abroad are willing to pay for the various products from agriculture. We have been accumstomed to meeting food and fiber demands. Now we must add a fuel demand and incorporate a new by-product feed into our calculations. These new dimensions will change some of the historic relationships between crops in the competition for land use and among classes of livestock in the use of feeds. The next section describes a model we are developing to address some of these issues. This is followed by a report of some preliminary findings.

A Model of Western Ohio

To fully assess the impact of an alcohol program on the many issues identified above, it is useful to construct a model of Ohio agriculture. We are in the process of building a full state model; however, the preliminary results reported below were generated using a model of one sector of Ohio--the western Ohio Corn Belt region (Figure 1). We have included corn grain, corn silage, soybeans, wheat, oats and hay as crop activities in the model. The livestock production activities include beef fattening, milk (dairy), lamb, pork, chicken, turkey, and eggs/layers. Also included are transportation activities, soybean processing activities, and alcohol production activities. Energy costs are separated from other production costs in order to generate a realistic alcohol fuel supply response to rising energy prices. In this way, it is possible to incorporate the rising energy prices in the cost of producing the alcohol, as well as in the price of alcohol.

An important part of the analysis is the feeding of the grain by-product (DDGS) to livestock. DDGS is a high protein feed, with a high fiber content which limits the amount that can be fed to poultry and hogs. This limits the amount of DDGS that can be substituted for soybean meal and thus the amount of soybean land that can be converted to corn. There are some alternative processing procedures that yield a more usable set of by-products. For example, by pre-processing the corn, using a wet milling procedure, different by-products are produced. They include: corn oil, corn gluten meal, and corn gluten feed. Corn oil is a good substitute for soybean oil and corn gluten meal and corn gluten feed are better substitutes for soybean meal than DDGS. Use of this process allows a greater land substitution to occur between soybeans and corn. The conventional system producing DDGS only, was used in the model for examination of the above issues. However, a separate analysis was made with the alternative processing procedure to test the impact it would have on corn-soybean substitution, commodity prices, and livestock feeding.

Commodity prices are determined in the model, with price being a function of quantity sold, including competing commodities. In developing

the model, it was assumed that other states would be producing alcohol also. Therefore, it would not be possible to "import" corn from surrounding states to produce alcohol. This assumption allows the model to generate realistic price adjustments as quantities of various commodities change in response to increased corn production for alcohol.

Several levels of alcohol production were chosen for analysis. As noted earlier, there is some certainty that Ohio will have at least a 100 million gallons per year alcohol industry within two to three years. It may be as high as 150 million gallons. Other Corn Belt states will probably exceed this amount. Ohio's production share of the 10 billion gallons of alcohl needed for a national "gasohol" program is 400 million gallons. The 100 to 400 million gallon range was chosen for study. The model was forced to produce alcohol in increments of 100 million gallons, (100, 200, 300, 400).

Crop and Land Use Changes

Clearly, with alcohol production, more land is needed for corn. The question is, which crops will give up land to allow the increased corn production? The results of this analysis are shown in Table 1. At levels of alcohol production of up to 300 million gallons, most of the substitution occurs with soybeans, since the by-product DDGS substitutes for soybean meal. At this level, soybean production has declined by 26 percent. Other crops show significantly less substitution at this level of production. However, at 300 million gallons, enough DDGS has been produced to toally replace soybean meal for those livestock rations that can use DDGS. Beyond this level, soybeans can no longer act as the safety valve to allow increased corn production, forcing the production of wheat, oats, and hay to decline significantly as corn production increases.

These changes in production are associated with changes in prices. Again, at the lower levels of alcohol production where DDGS and soybean meal are good substitutes, the price increases are small. At 300 million gallons, however, they are 9 to 17 percent greater and rise rapidly thereafter (Table 1).

Increased competition for land and rising commodity prices will also result in increased land prices. The model gives some indication of the potential magnitude of land value changes.

These are given below:

Alcohol level (million gallons)	Percent Increase in Land Value
100	3
200	12
300	30
400	68

These potential land value changes represent the increases that farmers could afford to pay for land based on commodity price increases. Clearly the actual level of land values depend on many other factors. The changes in land values also explain why corn prices increase less than other crop prices. Land represents a smaller proportion of total production cost for corn than for other crops. Thus, as land prices increase, the prices of other crops must increase more than corn to remain competitive.

Livestock Changes

Changes in livestock production and prices are less dramatic than for crops (Table 2). They reflect adjustments to somewhat lower feed supplies, higher feed prices and a change in high protein feed source as DDGS substitutes for soybean meal. The production and price changes are rather small up to the 300 million gallon level. Beyond this level, too much corn is being removed from feed supplies, feed prices are much higher, and DDGS has exceeded its substitution level with soybean meal. These factors plus competing demands for livestock products combine to push prices rapidly higher.

The substitution of DDGS for soybean meal is an important reason for the relatively minor impact of an alcohol program on both crop and livestock production at low levels of alcohol production. A detailed summary of the manner in which this substitution occurs is shown in Table 3. First, DDGS replaces all the soybean meal (SBM) fed to ruminants and is fed to swine up to the maximum allowed. Second, it replaces some of the SBM that is marketed outside of the region

Table 1

Effects of Alcohol Industry on Crop Production
Ohio Corn Belt

Commodity	Alcohol Production Level (millions of gallons) 100	200	300	400
	(Percent change in Production)			
Corn grain	+13	+24	+35	+42
Soybeans	-10	-18	-26	-28
Wheat	- 1	- 2	- 6	-12
Oats	- 1	- 7	-16	-36
Corn silage	-	- 1	- 1	- 3
Hay	- 1	- 3	- 6	-17
	(Percent change in price)			
Corn grain	+ 1	+ 3	+ 9	+21
Soybeans	+ 1	+ 5	+11	+26
Wheat	+ 1	+ 6	+13	+30
Oats	+ 2	+ 7	+17	+38

Note: Planned alcohol production capacity in Ohio was in excess of 100 million gallons as of September 1981.

Table 2

Effects of Alcohol Industry on Livestock Production
Ohio Corn Belt

Commodity	Alcohol Production Levels - 1 million gallons 100	200	300	400
	(Percent change in Production)			
Beef	-0.6	-1.0	-1.7	-2.6
Pork	-0.3	-0.5	-0.3	-0.2
Lamb	+15.8	+9.4	-4.8	-54.5
Chicken	-0.5	-0.9	-1.2	-2.4
Turkey	-0.5	-2.2	-4.0	-10.0
Eggs	-0.3	-0.5	-0.7	-0.7
Milk	+1.6	+0.8	+0.4	-2.6
	(Percent change in Price)			
Beef	+0.5	+1.9	+3.9	+8.5
Pork	0.0	+2.0	+3.9	+11.4
Lamb	-4.5	-2.0	+3.0	+19.9
Chicken	+0.5	+2.5	+4.8	+12.3
Turkey	+0.5	+2.7	+5.3	+13.6
Eggs	+0.6	+2.9	++.2	+13.1
Milk	-2.4	-1.0	0.0	+5.7

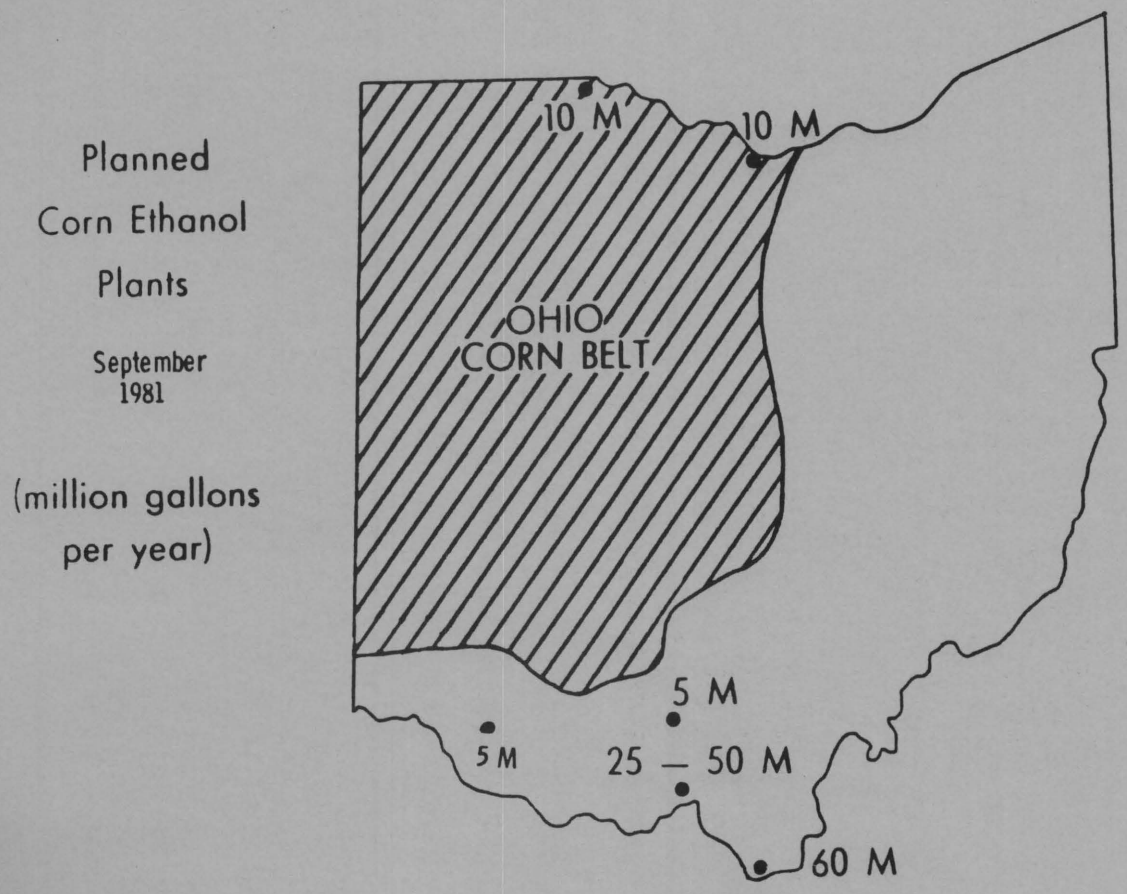
Note: Planned alcohol production capacity in Ohio was in excess of 100 million gallons as of September 1981.

Table 3

Distillers Dried Grains - Use and Price
Ohio Corn Belt

Item	Alcohol Production Level (million gallons) 0	100	200	300	400
		(000 tons)			
Soybean Meal					
Ruminants	149	0	0	0	0
Pork	244	185	185	185	185
Poultry	130	129	128	83	81
Marketed	1034	993	805	706	681
Total	1557	1307	1118	974	947
DDGS					
Ruminants	-	141	140	146	280
Pork	-	131	131	131	131
Poultry	-	-	-	86	84
Marketed	-	84	441	705	929
Total	-	356	712	1068	1424
Prices					
Soybean Meal	$187	$187	$194	$183	$198
DDGS	-	$144	$149	$122	$119

Note: Planned alcohol production capacity in Ohio was in excess of 100 million gallons as of September 1981.



until the maximum substitution takes place. DDGS is then fed to poultry up to a maximum level. At this point, no more substitution of DDGS for SBM can occur and any additional DDGS produced must be fed to ruminants as an energy feed. This use lowers its marekt value by about 20 percent.

Prices for both feeds (DDGS and SBM) increase initially as alcohol is produced, reflecting an increased scarcity of feed. When the high protein market is saturated with DDGS, prices for both feeds decline. Then as more DDGS is produced its price declines further, but the price for SBM increases as a result of its scarcity as a non-ruminent feed.

Some Additional Considerations

The results reported above assume that new land or unused land is not available, that export demand remains at present levels and that crop yields do not change. Each of these factors can change in a positive or negative way in any one year or over time. The analysis confirmed that these are important variables. For example, increased exports will result in earlier and greater price rises as more alcohol is produced. Crop prices will be more volatile in response to yield shortfalls when the additional demand for corn to produce alcohol is added. In contrast, if unused land is brought under cultivation or significant yield increases are possible, the impacts will be less.

The use of a significant portion of the feed by-product within the State of Ohio is critically dependent on the continued existance of a livestock industry. Yet recent trends indicate that fed livestock production is moving out of Ohio. Continuation of this trend will mean that more of the DDGS will have to be "exported" outside the state. This would reduce marginally the profitability of alcohol production in Ohio.

Production incentives are an important part of the alcohol program. Currently, the price of alcohol reflects a $.40 per gallon subsidy. The analysis confirmed that a subsidy is needed for alcohol to be competitive at present corn and gasoline prices. However, as energy prices rise and alcohol production levels increase, the subsidy is less effective, and may be of limited value.

Summary

A modest alcohol industry using corn is now being developed in Ohio. Planned alcohol production capacity was in excess of 100 million gallons as of September 1981. Other Corn Belt states are also developing alcohol industries. Substantial changes in land use, livestock feeding, and commodity prices will result from the additional demands put on agriculture to meet food, feed, fiber and now energy needs. Export demand, crop yield changes, and land availability will have important impacts on these changes. A close monitoring of this new industry will be needed to assist farmers, agri-industries and policy makers to make the necessary adjustments, to take advantage of the opportunities presented, and to preserve and enhance the productivity of agriculture.

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