

# **ECONOMIC CONTRIBUTION OF THE SUGARBEET INDUSTRY TO THE ECONOMY OF MINNESOTA, NORTH DAKOTA, AND EASTERN MONTANA**

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## **INTRODUCTION**

Agriculture has historically been an important sector of the economy in North Dakota and Minnesota. North Dakota's agriculture sector is dominated by crop production, while in Minnesota, crop and livestock production are more equal in importance. North Dakota typically is considered a small grain-producing state while Minnesota is among the national leaders in the production several row crops, notably corn and soybeans. In addition to many traditional crops, Minnesota and North Dakota also rank nationally in sugarbeet production. However, sugarbeets continue to be produced in a relatively small geographic area with relatively limited acreage.

Agricultural industries confined to small geographical areas with limited acreage can be overlooked by those not associated with the growing region or industry. The sugarbeet industry has been shown to be a major agricultural influence in North Dakota and Minnesota. These factors, along with continued debate over the future of national sugar policies, recent unilateral and bilateral trade negotiations involving sugar, and increased sugarbeet production and processing capacity in the region, have prompted a re-evaluation of the industry's economic importance. A reassessment of the industry's economic importance to the region would be helpful to demonstrate the economic implications of future policy changes affecting domestic sugar industries and document the economic effect of recent industry expansions.

## **PROCEDURES**

The purpose of this study is to estimate the economic contribution of the sugarbeet industry to the economies of North Dakota, Minnesota, and eastern Montana. Analysis of the sugarbeet industry required (1) estimating expenditures and revenues from sugarbeet production, (2) obtaining information on sugarbeet processing and marketing expenditures, and (3) using input-output analysis to determine the secondary economic impacts.

Sugarbeet production budgets were used to estimate costs and returns from growing sugarbeets in the three states. The three sugarbeet cooperatives located in eastern North Dakota (Minn-Dak Farmers Cooperative) and Minnesota (American Crystal Sugar Company and Southern Minnesota Beet Sugar Cooperative) and United Sugars Corporation in Minnesota were asked to provide the amount of processing, research, distribution, and administrative cash expenditures made within Minnesota, North Dakota, and Montana in the last fiscal year.

Direct economic impacts are typically expressed as changes in output, employment, or income that represent the initial or direct effects of a project, program, or event. Secondary economic impacts result from subsequent rounds of spending and respending within the economy. Input-output (I-O) analysis traces linkages (i.e., the amount of spending and respending) among sectors of an economy and calculates the total business activity resulting from a direct impact in a basic sector (Coon et al. 1985). An economic sector is a group of similar economic units (e.g., communications and public utilities, retail trade, etc.).

This process of spending and respending can be explained by using an example. A single dollar from a sugarbeet cooperative employee's paycheck (*households* sector) may be spent for a loaf of bread at the local store (*retail trade* sector); the store uses part of that dollar to pay for the next shipment of bread (*transportation* and *agricultural processing* sectors) and part to pay the store employee (*households* sector) who shelved or sold the bread; the bread supplier uses part of that dollar to pay for the grain used to make the bread (*agriculture-crops* sector) ... and so.

## RESULTS

The economic contribution from the sugarbeet industry was estimated from production revenues and processing expenditures, which represent the direct economic impacts of the industry. Subsequently, the direct impacts were used with an input-output model to estimate the secondary economic effects. Total business activity (direct and secondary impacts) was used to estimate tax revenues and secondary employment.

### Direct Impacts

Seven counties in eastern North Dakota collectively produced about 4.5 million tons of sugarbeets in 2002. Two counties in western North Dakota produced about 300,000 tons of sugarbeets. Minnesota had over 23 counties that collectively produced 8.8 million tons of sugarbeets in 2002. In northeastern Montana, five counties produced about 530,000 tons of sugarbeets in 2002. The combined growing regions in eastern Montana, western and eastern North Dakota, and Minnesota planted nearly 800,000 acres of sugarbeets in 2002. One-third of the region's planted acreage was in North Dakota, 63 percent in Minnesota, and the remaining 4 percent in eastern Montana. The three sugar cooperatives reported processing about 14.5 million tons of sugarbeets and reported 776,348 planted acres of sugarbeets in 2003.

Sugarbeet acreage in Minnesota and North Dakota has steadily increased since 1970 (Figure 1). Similarly, sugarbeet tonnage also has steadily increased over the last three decades (Figure 2). U.S. sugarbeet tonnage declined gradually from 1970 through the early 1980s, but has gradually increased since the mid 1980s. Overall, U.S. sugarbeet tonnage in recent years has been similar to levels in the early 1970s. As a result of U.S. production remaining relatively stable since 1970 and production in Minnesota and North Dakota consistently increasing over the same period, the share of U.S. production raised in Minnesota and North Dakota has continued to increase (Figure 1, Figure 2). In 2002, Minnesota and North Dakota accounted for nearly 54 percent of U.S. planted acreage and 49 percent of total U.S. sugarbeet production.

Total direct impacts from sugarbeet production were estimated at \$870.02 per acre or \$675.4 million. Variable costs (i.e., outlays for seed, herbicide, fertilizer, chemical, custom hire, etc. that change with the level of production) were estimated at \$468.47 per acre. Fixed costs (i.e., expenses that do not change with the level of production, such as land debt payments, farm utilities, and machinery overhead) were estimated to be \$168.47 per acre. Total expenses were estimated at \$636.94 per acre. Net returns were estimated at \$233.08 per acre.

Total cash expenditures made to entities in the tri-state area by the processing cooperatives and sugar marketing alliances in Minnesota, North Dakota, and eastern Montana were \$1.065 billion in fiscal 2003. However, \$663.6 million represented payments to growers and was reflected in the direct impacts attributable to sugarbeet production. Direct economic impacts from the cooperatives were \$401.5 million. Approximately 60 percent of the direct impacts from the processing component of the industry was generated in Minnesota. North Dakota and Montana received about 30 percent and 10 percent of processor expenditures, respectively. The processing and marketing cooperatives also were directly responsible for 2,628 full-time equivalent jobs in fiscal 2003.

Total direct impacts from the sugarbeet industry (production, processing, and marketing) in Minnesota, North Dakota, and eastern Montana were estimated at \$1.077 billion in fiscal 2003 (Table 1). Sugarbeet production accounted for 63 percent (\$675.4 million) of all direct impacts, while sugarbeet processing and marketing accounted for 37 percent (\$401.5 million) of all direct impacts. Based on planted sugarbeet acreage in the study region, about 63 percent, 33 percent, and 4 percent of the direct impacts from sugarbeet production were generated in Minnesota, North Dakota, and eastern Montana, respectively. Similarly, based on expenditures made in each state by the processing cooperatives, about 60 percent, 30 percent, and 10 percent of the direct impacts from processing were captured in Minnesota, North Dakota, and eastern Montana, respectively (Table 1).

Total direct impacts in Minnesota were estimated at \$665.6 million (\$240.1 million from processors and \$425.5 million from growers). Total direct impacts in North Dakota were estimated at \$342.3 million (\$120.2 million from processors and \$222.1 million from growers). Total direct impacts in Montana were estimated at \$68.9 million (\$41.1 million from processors and \$27.8 million from producers) (Table 1).

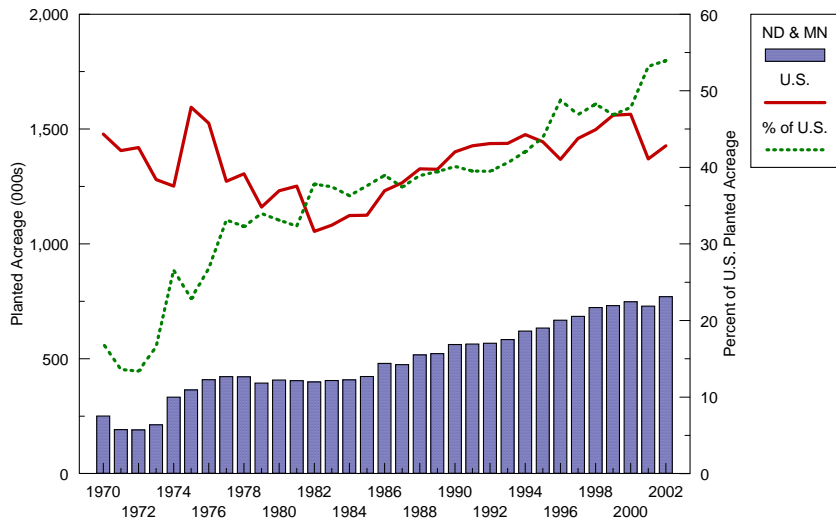


Figure 1. Planted Sugarbeet Acreage, United States, Minnesota and North Dakota, 1970 through 2002

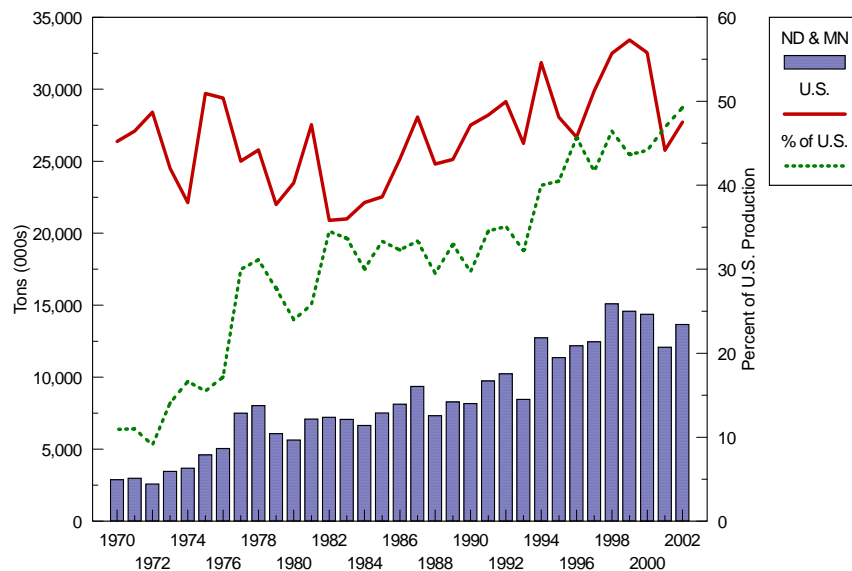


Figure 2. Sugarbeet Production, United States, Minnesota and North Dakota, 1970 through 2002

### Secondary Impacts

The secondary impacts of the sugarbeet industry were estimated using the North Dakota Input-Output Model. The North Dakota Input-Output Model traces linkages among sectors of an economy and calculates total business activity resulting from a direct impact in a basic sector (Coon et al. 1985). The model embodies interdependence coefficients or multipliers that measure the level of total gross business volume (gross receipts) generated in each sector of the regional economy from an additional dollar of sales to final demand in a given sector. The input-output model applies the expenditures from the sugarbeet industry to these interdependence coefficients. Resulting levels of business activity were used to estimate secondary (indirect and induced) employment, based on historic relationships.

Table 1. Total Direct Impacts of the Sugarbeet Industry, by State and Component of the Industry, 2003

Industry Component	Minnesota	North Dakota	Eastern Montana	Totals <sup>a</sup>	
				000s \$	
Processing/Marketing	240,136	120,184	41,139	401,459	37.3%
State Share	59.8%	29.9%	10.2%		
Production	425,493	222,094	27,849	675,436	62.7%
State Share	63.0%	32.9%	4.1%		
Total (all activities) <sup>a</sup>	665,628	342,278	68,988	1,076,895	
State Share	61.8%	31.8%	6.4%		

<sup>a</sup> Columns and rows may not sum due to rounding.

Total direct impacts of \$1.077 billion from the sugarbeet industry in Minnesota, North Dakota, and eastern Montana generated about \$2 billion in secondary impacts (Table 2). Secondary economic impacts were greatest in the *Households* (\$1.08 billion), *Retail Trade* (\$874 million), *Finance, Insurance, and Real Estate* (\$253 million), *Communications and Public Utilities* (\$148 million), and *Construction* (\$128 million) sectors. The economic activity in the *Households* sector represents economy-wide personal income resulting from industry expenditures and their subsequent secondary effects. Each dollar of direct impacts generated \$1.85 in secondary impacts.

Table 2. Direct, Secondary, and Total Economic Impacts of the Sugarbeet Industry in Minnesota, North Dakota, and Eastern Montana, 2003

Economic Sector	Industry Impacts		
	Direct	Secondary	Total
	----- 000s \$ -----		
Construction	58,371	69,733	128,104
Transportation	55,912	10,945	66,857
Communication and Public Utilities	52,550	95,217	147,767
Ag Processing and Misc Mnf	38,251	72,065	110,316
Retail Trade	288,331	585,966	874,297
Finance, Insurance, and Real Estate	123,012	129,781	252,793
Business and Personal Services	25,824	49,593	75,417
Professional and Social Services	11,374	70,578	91,952
Households (personal income)	408,285	671,469	1,079,754
Government	14,985	97,396	112,381
Other sectors <sup>a</sup>	0	135,331	135,331
Total	1,076,895	1,988,074	3,064,969
Direct Employment (full-time jobs)			2,628
Secondary Employment (full-time jobs)			29,258

<sup>a</sup> Includes Agriculture-crops, Agriculture-livestock, and Nonmetal Mining sectors.

## Tax Revenue

The sugarbeet cooperatives and growers paid an estimated \$11.5 million in property taxes in Minnesota, North Dakota, and eastern Montana in 2003. Property taxes were included in the direct impacts. Other state and local tax collections were estimated separately for Minnesota, North Dakota, and Montana. Tax revenue generated by the sugarbeet industry in North Dakota included \$12.8 million in sales and use taxes, \$4.4 million in personal income taxes, and \$1.7 million in corporate income taxes in fiscal 2003. The sugarbeet industry in Minnesota generated \$15.5 million in sales and use taxes, \$23.3 million in personal income taxes, and \$3.1 million in corporate income taxes in fiscal 2003. Tax collections in Montana included \$1.5 million in personal income taxes and \$0.3 million in corporate income taxes. Total tax collections generated by the sugarbeet industry in fiscal 2003 from sales and use, personal income, and corporate income taxes in the tri-state region were about \$62.6 million.

## Employment

Sugarbeet cooperatives and marketing alliances were directly responsible for 2,628 full-time equivalent jobs in 2003. Secondary employment generated by the sugarbeet industry was estimated using input-output analysis. An additional 29,258 full-time equivalent secondary jobs were generated by the sugarbeet industry in Minnesota, North Dakota, and eastern Montana in 2003. Secondary jobs represent employment outside of the sugarbeet industry, but employment that is created from the economic activity of the sugarbeet industry.

The number of jobs created directly from sugarbeet production would include growers and other hired labor. However, full-time equivalents were unknown and are difficult to estimate because most sugarbeet farmers also raise other crops, and if they did not raise sugarbeets, likely would remain employed raising other crops. Also, sugarbeet labor requirements are seasonal, fluctuating with weeding and harvest situations, and typically are met by employing a large number of temporary workers for relatively short periods.

## Total Economic Impacts

Total business activity from sugarbeet industry expenditures and returns in Minnesota, North Dakota, and eastern Montana was estimated at nearly \$3.1 billion in fiscal 2003 (Table 2). The sectors of the tri-state economy with the greatest total economic impact included the *Households* (economy-wide personal income) (\$1.1 billion), *Retail Trade* (\$874 million), *Finance, Insurance, and Real Estate* (\$253 million), *Communications and Public Utilities* (\$148 million), *Construction* (\$128 million), and *Government* (\$135 million) sectors.

The sugarbeet cooperatives and marketing alliances were directly responsible for 2,628 full-time equivalent jobs and indirectly supported an additional 29,258 full-time equivalent jobs. The sugarbeet industry also generated about \$62.6 million in tax revenue in North Dakota, Minnesota, and Montana (not including property taxes).

## Previous Industry Impacts

Previous estimates of the economic contribution of the sugarbeet industry were compared to analyze the changing economic importance of the industry. Three prior studies examining the economic contribution of the sugarbeet industry in eastern North Dakota and Minnesota have employed similar methodologies at various points in time. Thus, comparisons of previous estimates can be made by adjusting previous industry estimates to reflect real dollars (effects of inflation removed).

Adjusting previous estimates of industry size for inflation, and removing the influences of Sidney Sugars Incorporated from current figures, revealed that the sugarbeet industry exhibited real growth (size has increased after adjusting for inflation) over the last 15 years (Table 3). Since 1987, planted acreage and tons processed have increased 60 percent and 97 percent, respectively. Planted acreage in 1987 was about 460,000 acres, while planted acreage in 2003 increased to 735,348 acres. Correspondingly, in real terms (inflation removed), gross business volume generated by the sugarbeet industry in eastern North Dakota and Minnesota has increased by nearly 6 percent since 1997, 31 percent since 1992, and over 76 percent since 1987. Tax revenue generated by the industry has increased by 93 percent since 1987, 35 percent since 1992, and 2 percent since 1997.

Table 3. Economic Size of the Sugarbeet Industry in Minnesota, North Dakota, and Eastern Montana, Selected Years

Economic Indicators	Sugarbeet Industry Activity in Various Years <sup>a</sup>			
	1987	1992	1997	2003
Gross Business Volume (000s nominal \$)	985,709	1,635,800	2,321,500	3,064,969
Gross Business Volume (000s 2003 \$) <sup>b</sup>	1,596,600	2,145,300	2,661,400	3,064,969
Direct Employment (full-time jobs) <sup>c</sup>	2,175	2,410	2,486	2,475
Secondary Employment (full-time jobs)	14,898	20,914	26,848	29,258
Tax Revenue Generated (000s 2003 \$)	34,050	44,070	58,470	62,611
Planted Acreage	460,000	554,400	654,400	776,300
Economic Impact per Acre (2003 \$)	3,471	3,870	4,067	3,948
Tons of Sugarbeets Processed <sup>d</sup>	7,000,000	9,273,819	11,690,823	14,525,889
Economic Impact per Ton (2003 \$)	228.09	231.33	227.65	211.00
Gross Business Volume by State (2003 \$)				
Minnesota	na	1,426,600	1,715,200	1,918,909
North Dakota		718,700	946,200	949,261
Eastern Montana	na	na	na	196,799

na--not available.

<sup>a</sup> Sources for previous studies: 1987, Coon and Leistriz (1988); 1992, Bangsund and Leistriz (1993); 1997, Bangsund and Leistriz (1998). Producer net returns and expenditures made by marketing activities were excluded from Coon and Leistriz (1988). Expenditures made by marketing activities were excluded from Bangsund and Leistriz (1993). Estimates of industry impacts in 2003 differ from previous studies by including sugarbeet production in northwestern North Dakota and northeastern Montana, expenditures in the tri-state region by Sidney Sugars Incorporated, and expenditures in Montana by processing and marketing cooperatives in eastern North Dakota and Minnesota.

<sup>b</sup> Adjusted for inflation using the Consumer Price Index (U.S. Department of Labor 2004).

<sup>c</sup> Employment in Montana was subtracted from the 2003 figure.

<sup>d</sup> Exact tonnage of sugarbeets processed was not available from Coon and Leistriz (1988).

Changes in direct employment were mixed from 1987 to 2003. Direct employment within the industry grew by nearly 11 percent from 1987 to 1992, and by 3 percent from 1992 to 1997. However, employment in 2003, after removing the effects of Sidney Sugars Incorporated, was 4 percent lower than in 1998.

Secondary employment supported by the business activity generated by the sugarbeet industry increased by nearly 41 percent from 1987 to 1992 and increased by 28 percent from 1992 to 1998. However, secondary employment decreased by 24 percent from 1997 to 2003. The decrease in secondary employment was not due to less overall economic activity (e.g., gross business volume increased by 6 percent in real terms over the same period), but rather the decrease was reflective of changes in productivity ratios used to estimate secondary employment. The relative change in productivity ratios from 1997 to 2003 was greater than the relative change in the industry's gross business volume. For example, the average amount of economy-wide business activity required

to support one secondary job rose from \$86,500 (average of all sectors influenced by the sugarbeet industry) in 1997 to \$135,500 in 2003, a 60 percent increase. Thus, even though the industry generated a 6 percent increase in inflation-adjusted gross business volume, the number of secondary jobs supported by the industry decreased because, in percentage terms, the average amount of business activity required to support a secondary job increased by 60 percent.

Subtle changes in physical measures (i.e., impact per ton, impact per acre) of the industry's impact occurred from 1987 to 2003. Gross business volume per planted acre increased in real terms from 1987 to 1992 and from 1992 to 1998. However, gross business volume per planted acre, after adjusting for inflation, decreased from 1997 to 2003. The amount of business activity per planted acre, excluding effects associated with Sidney Sugars Incorporated, was estimated at nearly \$3,824 in 2003, a 6 percent decrease from inflation-adjusted figures for 1997. Similarly, in real terms, the gross business volume per ton of sugarbeets processed went from \$228 per ton in 1997 to \$208 per ton in 2003. In previous studies, the gross business volume per ton (in real terms) of sugarbeets processed was higher than current estimates. Both measures, gross business volume per ton processed and per acre planted, after correcting for inflation, showed decreases from 1997 to 2003. Potential reasons for the change might be attributable to such things as annual difference in yield, shrink, and spoilage, varying levels of sugar content, spending patterns by the industry within the study region, and changes in sugar prices.

Physically, the sugarbeet industry in eastern North Dakota and Minnesota has grown in the last decade as evidenced by increases in acres planted, tons of sugarbeets harvested and processed, and volume of sugar marketed. Recent expansions have been substantial as sugarbeet acreage increased by 81,000 acres or by 12 percent in eastern North Dakota and Minnesota from 1997 to 2003. Also, sugarbeets processed increased by 1.85 million tons or by 16 percent over the same period. Yet, the gross business volume associated with the industry within the study region increased by only 6 percent. Physical growth, in percentage terms, of the industry in recent years has exceeded economic growth.

Several reasons contribute to the situation where physical growth exceeds economic growth. First, not all physical measures of the industry (acreage, tonnage) translate into linear changes in economic size, as processors do not incur proportional increases in all expenditures with proportional increases in processing activity. Second, the degree to which processors purchase inputs and services from entities outside of the study region can affect the impact of the industry since the primary mechanism used to measure the economic contribution of the sugarbeet industry is an assessment of expenditures made within the study region. If the volume of those purchases changes, or if additional inputs, once available locally, now require purchasing from entities outside of the study region, the net effect can lead to slippage in the amount of expenditures made in the regional economy. Third, changes in sugar prices can lead to changes in revenues for processors and growers. The economic size of the industry over time has been adjusted to reflect changes in the purchasing power of the dollar (inflation). If the same correction for inflation is performed on wholesale prices of refined beet sugar in the Midwest, average annual sugar prices show a 16 percent decrease from 1997 to 2003 (U.S. Department of Agriculture 2004). Finally, yields can influence the economic and physical measures of the industry. Although published sugarbeet yields were not available for 2003, an examination of yields from 1997 through 2002 reveal little change in average production per acre in both North Dakota and Minnesota. As a result, production per acre has remained mostly unchanged from 1997 to 2002. Stagnant yields, combined with lower real prices, also have contributed to slippage between physical and economic measures of the industry. Thus, future changes in the economic importance of the sugarbeet industry not only hinge on physical size, such as acreage and tonnage produced, but will also rely on prices received for industry outputs and spending patterns by industry processors within the regional economy.

## SUMMARY

The sugarbeet industry analyzed in this study is geographically limited to the Red River Valley of North Dakota and Minnesota, west central Minnesota, and northwestern North Dakota/northeastern Montana. Within these areas, sugarbeets are produced and processed into refined sugar. The industry is concentrated geographically and structurally, which boosts the economic effect of the industry on local economies. However, because sugarbeets are produced in a relatively small geographic area compared to other traditional crops within the three states and with relatively few acres, the economic impact generated by the industry can be overlooked or underestimated.

Expenditures from processing and marketing activities and combined expenditures and net returns from sugarbeet production in the tri-state region were estimated at \$1.077 billion in fiscal 2003. The \$1.077 billion in direct impacts, based on input-output analysis, generated another \$2 billion in secondary impacts. The sugarbeet industry employed 2,628 full-time equivalent workers and, based on total business activity, supported an additional 29,258 full-time equivalent jobs in the tri-state area. Total economic activity (direct and secondary impacts) was estimated at \$3.065 billion in 2003, including \$1.08 billion in economy-wide personal income and \$874 million in annual retail sales. Also, the sugarbeet industry generated about \$62.6 million in tax revenue, including tax collections of \$41.9 million in Minnesota, \$18.9 million in North Dakota, and \$1.8 million in Montana. Minnesota had the largest share of the industry's gross business volume (\$1.9 billion or 63 percent), followed by North Dakota (\$945 million or 31 percent) and Montana (\$197 million or 6 percent).

Each acre of sugarbeets planted generated about \$3,948 in total business activity (production, processing, marketing, and secondary impacts) or, expressed alternatively, each ton of sugarbeets processed generated about \$211 in total business activity.

Examinations of previous studies of the economic contribution of the sugarbeet industry revealed that the industry has experienced substantial real growth (i.e., effects of inflation were removed) in the last 15 years. When removing acreage, production, and economic activity associated with Sidney Sugars Incorporated, in Sidney, Montana, planted acreage in eastern North Dakota and Minnesota has increased 60 percent from 1987 to 2003, and increased 12 percent from 1997 to 2003. Correspondingly, tons of sugarbeets processed increased by 93 percent from 1987 to 2003 and by 16 percent from 1997 to 2003. In real terms, gross business volume generated by the industry in Minnesota and North Dakota has increased 6 percent since 1997 and 76 percent since 1987.

The sugarbeet industry in Minnesota, North Dakota, and eastern Montana contributes substantially to the tri-state economy. Not only was the dollar volume of business activity considerable, but most processing plants are located in rural areas of the three states. Even though the sugarbeet industry has processing plants located throughout the sugarbeet-growing area, the size of the sugarbeet-growing area suggests much of its economic activity affects local economies. Expenditures for crop inputs and returns to growers, which represent a majority of the economic activity, are evenly distributed throughout the growing area. Substantial impacts in two major sectors of the economy, *Households* and *Retail Trade*, help to support this conclusion. In contrast, economic activity in other sectors of the economy may represent a concentration of economic activity in one or two major cities or with a few large firms (e.g., *Communications and Public Utilities*).

Although the sugarbeet industry in Minnesota, North Dakota, and eastern Montana is not large in terms of acres or geographic area, if measured in terms of personal income, retail sales, total business activity, tax revenue collections, and employment (direct and secondary), its economic contribution is highly apparent. The industry is an important and substantial contributor to both local economies and the tri-state regional economy.



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## ACKNOWLEDGMENTS

Our appreciation and thanks are extended to Brian Ingulsrud and Ron Peterson, American Crystal Sugar Company; Jeff Plathe and Ron Bailey, Southern Minnesota Beet Sugar Cooperative; Steve Caspers and Bruce Fronning, Minn-Dak Farmers Cooperative, and Paul Wengronowitz and Rhonda Wirtz, United Sugars Corporation; for their cooperation and efforts in providing financial information. The information supplied by the sugarbeet cooperatives was critical to analyzing the economic size of the industry.

Special thanks are extended to Dave Berg, American Crystal Sugar Company, for his organizational efforts in the early stages of the study and for providing industry contacts for data collection.

Financial support was provided by the Sugarbeet Research and Education Board of Minnesota and North Dakota and the North Dakota State Board of Agricultural Research and Education. We express our appreciation to these organizations for their support.

The authors assume responsibility for any errors of omission, logic, or otherwise. Any opinions, findings, and conclusions expressed in this publication are those of the authors and do not necessarily reflect the view of the Department of Agribusiness and Applied Economics, North Dakota State University, the Sugarbeet Research and Education Board, or the North Dakota State Board of Agricultural Research and Education.

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