



An economic study of the beet sugar industry in Montana--a regional analysis
by Willard Horace Godfrey

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY in Agricultural Economics
Montana State University
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Abstract:

The sugar beet and sugar cane industry in the United States produces approximately 40 percent of domestic annual consumption. Sixty percent of the United States' sugar supplies are imported from off mainland sources as well as foreign countries. This situation places the U.S. in a precarious position should foreign sugar supplies be restricted from the domestic market for one reason or another.

Because Montana supplies 6.4 percent of domestic sugar demands any change in the world or domestic market channels affecting the U.S. will also influence the Montana sugar industry. The problem of this research was to estimate potential Montana sugar supplies at alternative beet prices for 1980.

Five sugar beet production regions in Montana were examined. A variable price linear programming model was used to ascertain collective farmer production response. Two basic models were developed for each region. One was a regional model and the other a typical farm analysis.

The results of the analysis suggest that sugar beet production in the specified regions could be expanded from the present 65,000 to between 127,000 and 184,000 acres at \$17.50 per ton (projected 1980 price). These responses are probable if government controls are not restricting, if all producers have an equal desire to grow sugar beets, and if sugar refinery capacity is unlimited.

Regional and typical farm responses were compared. The regional model estimates are smaller than similar estimates made from aggregating benchmark farm responses. The decision to use a regional or typical farm as the responding unit in future research is dependent upon the amount of information needed about an individual group of producers and their response to economic stimuli. Regional models result in aggregate supply estimates at a low research cost that may serve for policy decisions just as well as alternative methods of measuring production response.

There are three sugar factories in Montana and all are expected to be enlarged by 1980 to an aggregate slicing capacity of 13,500 tons per day. Other ways of expanding Montana's capacity of manufacturers' sugar are (1) adding a new factory, (2) storing thick sugar juices for future processing, and (3) increasing the storage life of the sugar beet.

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IN MONTANA - A REGIONAL ANALYSIS

by

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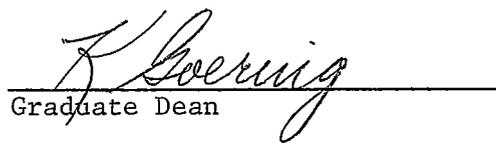
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Approved:


Head, Major Department


Chairman, Examining Committee


Graduate Dean

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ABSTRACT

The sugar beet and sugar cane industry in the United States produces approximately 40 percent of domestic annual consumption. Sixty percent of the United States' sugar supplies are imported from off mainland sources as well as foreign countries. This situation places the U.S. in a precarious position should foreign sugar supplies be restricted from the domestic market for one reason or another.

Because Montana supplies 6.4 percent of domestic sugar demands any change in the world or domestic market channels affecting the U.S. will also influence the Montana sugar industry. The problem of this research was to estimate potential Montana sugar supplies at alternative beet prices for 1980.

Five sugar beet production regions in Montana were examined. A variable price linear programming model was used to ascertain collective farmer production response. Two basic models were developed for each region. One was a regional model and the other a typical farm analysis.

The results of the analysis suggest that sugar beet production in the specified regions could be expanded from the present 65,000 to between 127,000 and 184,000 acres at \$17.50 per ton (projected 1980 price). These responses are probable if government controls are not restricting, if all producers have an equal desire to grow sugar beets, and if sugar refinery capacity is unlimited.

Regional and typical farm responses were compared. The regional model estimates are smaller than similar estimates made from aggregating benchmark farm responses. The decision to use a regional or typical farm as the responding unit in future research is dependent upon the amount of information needed about an individual group of producers and their response to economic stimuli. Regional models result in aggregate supply estimates at a low research cost that may serve for policy decisions just as well as alternative methods of measuring production response.

There are three sugar factories in Montana and all are expected to be enlarged by 1980 to an aggregate slicing capacity of 13,500 tons per day. Other ways of expanding Montana's capacity of manufacturers' sugar are (1) adding a new factory, (2) storing thick sugar juices for future processing, and (3) increasing the storage life of the sugar beet.

CHAPTER I

INTRODUCTION

Sugar or shurkara, as it was initially found in the ancient writings of the Hindus of India, referred to those substances sweet to the taste. Sugar, a white or colorless crystal when purified, constitutes a major ingredient in the diet of many people in the world.

The group of compounds called sugars are more generally classified as carbohydrates. There are two basic groups of sugars, glucose or monoses ($C_6H_{12}O_6$) and saccharoses or bioses ($C_{12}H_{22}O_{11}$). Glucose is referred to as grape sugar whereas saccharoses is more commonly called cane sugar. 1/ The latter group (saccharoses) is of importance in this research because it represents the primary source of sucrose.

Sucrose and lactose (milk sugar) are the chief constituents of the cane sugar group. The main sources of sucrose sugar are sugar beets, sugar cane, sugar maple, and sugar palm. 2/ Sugar cane and sugar beets account for the major portion of world sugar supplies.

Oliver de Serres, a french agronomist, discovered in 1705 that beet roots contained sugar. However, it was not until 1755 that Marggrof, a Prussian chemist, obtained sugar crystals from a beet through

1/ -- John Geddes McIntosh, The Technology of Sugar, New York; D. Van Nostrand Company, 1903; pp. 1-2.

2/ Ibid., pp. 1-2.

experimental procedures and proceeded to exploit the discovery. 3/ Achaid, a student of Marggraf, invented and perfected a method for commercially extracting sugar from beets in 1799. His small factory at Cunern, Silesia, is considered to be the first commercially oriented beet sugar processing plant. 4/

Sugar from cane is reported to have been used in a crude form in China during the year 760 B. C. 5/ Explorers introduced sugar cane to North America in 1493 and to the United States (Louisiana) in 1751. 6/

World Sugar Production

Sugar cane production is limited mostly to those countries lying in a region between 35 degrees north latitude and 35 degrees south latitude. Sugar beet production is found mostly in the United States and Europe located as far as 50 degrees north latitude (Figure 1). A small part of world sugar beet production is located outside these areas.

3/ Harry A. Austin, History and Development of the Beet Sugar Industry, Washington, D. C., United States Beet Sugar Association, 1928, pp. 11-12.

4/ Ibid., pp. 11-12.

5/ W. G. Taggart and E. C. Simon, "A Brief Discussion of the History of Sugar Cane: Its Culture, Breeding, Harvesting, Manufacturing, and Products", Louisiana State Department of Agriculture and Immigration (Fourth Edition), 1939, pp. 1-20.

6/ John H. Martin and Warren H. Leonard, Principles of Field Crop Production, New York; The Macmillan Company, 1955, p. 438.

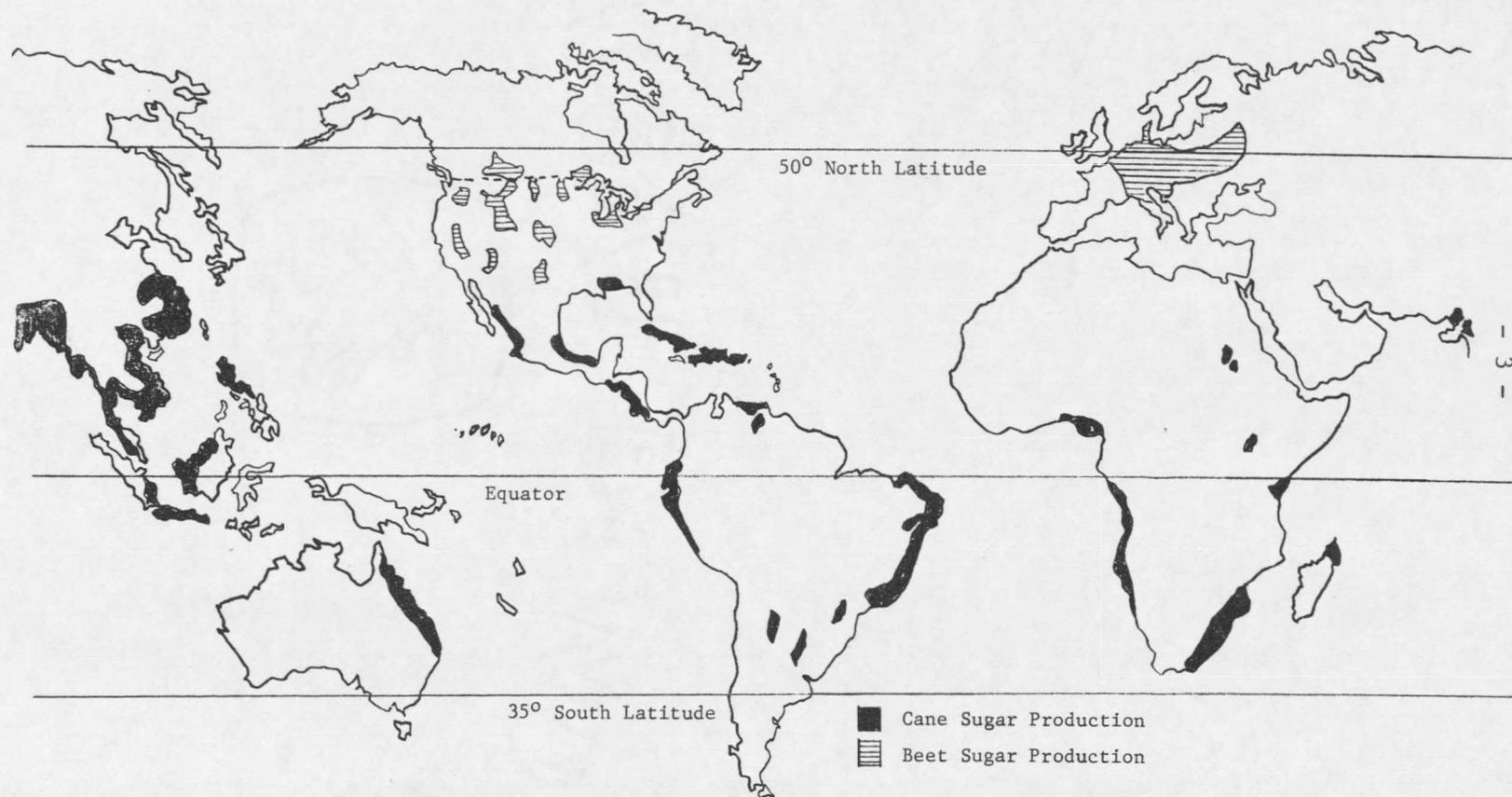


Figure 1. Location of World Sugar Beet and Sugar Cane Producing Areas.

The average annual world production of centrifugal sugar from 1960 through 1966 was 60.9 million short tons. 7/ 8/ The projected 1967-68 world centrifugal sugar production is nearly 72 million short tons. 9/ Cuba is the largest North American producer of sugar followed by the United States and Mexico. The Foreign Agricultural Service estimates that 1968 North American sugar production will be 17.2 million short tons, a 5 percent decrease from 1966-67. 10/ The United States sugar industry accounted for an average of 27 percent of world sugar production between 1960 and 1967. Asia and Western Europe followed with 16 and 15 percent respectively.

According to recent reports, the production of sugar in 1968 in Asia, Western Europe, and Russia is expected to increase while in the United States, production is estimated to decrease. 11/ These reports indicate that sugar production in Asia will increase 16.6 percent while

7/ Centrifugal and non-centrifugal are names given to sugars based on the method of refining. The difference between the two methods of refining is dependent on the way that impurities are removed from sugar juices.

8/ Sugar ton measurement generally used in the United States is referred to as a short ton or 2,000 pounds. Great Britain commonly uses the long ton measurement or 2,240 pounds.

9/ United States Department of Agriculture, Foreign Agricultural Service Foreign Agricultural Circular, Sugar, FS 4-67; Washington, D. C., December 1967, pp. 10-11.

10/ Ibid., pp. 10-11.

11/ Ibid., pp. 10-11.

United States production will fall 24 percent. In fact, all major sugar producing countries in North America are expected to have diminished absolute production in 1968.

United States Sugar Production

An attempt was made in the United States to grow sugar beets and extract sugar for domestic use in 1836. The first beet sugar refinery was established at Northampton, Massachusetts, in 1838. ^{12/} Cane sugar, however, was first refined in the United States in Louisiana in 1791.

The sugar industry in the United States has continued to expand since the early attempts to grow cane and sugar beets for the purpose of extracting sugar for domestic use. Beet sugar production is currently found in 18 states (Table I). Cane sugar is produced mostly in Louisiana and Florida. However, cane growers in Georgia, Alabama, and Texas produce sugar cane for syrup. ^{13/}

The beet sugar industry of the United States included 60 refining factories in 1967. ^{14/} Colorado and California account for 22 factories and 35 percent of all refining capacity in the United States. There were three sugar refining factories located in Montana in 1967.

^{12/} Austin, op. cit., p. 17.

^{13/} Martin, op. cit., p. 437.

^{14/} United States Beet Sugar Association, American Beet Sugar Companies, 1967-1968, Washington, D. C., p. 5.

TABLE I. BEET SUGAR PRODUCTION IN THE UNITED STATES 1967. a/

State	1967 (Cwt. Refined)	Percent of Total
California	10,290,720	20.5
Colorado	7,780,841	15.5
Idaho	5,965,837	11.9
Minnesota	3,814,006	7.6
Montana	3,217,765	6.4
Michigan	2,861,937	5.7
Washington	2,809,554	5.6
Oregon	2,291,747	4.6
Wyoming	2,184,938	4.3
Nebraska	2,125,020	4.2
Texas	1,576,423	3.1
Utah	1,462,287	2.8
North Dakota	1,341,353	2.7
Ohio	1,256,655	2.5
Iowa	577,786	1.1
Arizona	560,000	1.1
Maine	112,207	.2
New York	78,195	.2
Total	50,307,253	100.0

a/ Source: United States Beet Sugar Association, Washington, D. C.,
March 13, 1968.

