Summary

Recent trends in dairying in Minnesota have been toward fewer but larger dairy herds and increased production per cow.

The many new techniques introduced into dairy production may involve increased capital investment but may reduce labor requirements.

Since labor is a limiting factor on most farms, the study reported was designed to determine potential labor economies resulting from increased size of herd and adoption of new techniques of production.

Because dairy labor requirements are characterized by seasonal variations, labor inputs for the pasture- and barn-feeding seasons are shown separately.

The percentage distribution of labor utilization by crops and for miscellaneous operations in southern Minnesota is shown as a basis for locating periods of heavy or slack labor demand.

Illustrations are presented of how these data can be used effectively in selecting the operations and the size of herd that best fit any particular farm.
# CONTENTS

<table>
<thead>
<tr>
<th>OVERALL DEVELOPMENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>5</td>
</tr>
<tr>
<td>Acreage</td>
<td>5</td>
</tr>
<tr>
<td>Yield per Acre</td>
<td>6</td>
</tr>
<tr>
<td>Per Capita Consumption</td>
<td>6</td>
</tr>
<tr>
<td>Shifts in Sweet Corn Marketed</td>
<td>7</td>
</tr>
<tr>
<td>Fresh Market</td>
<td>7</td>
</tr>
<tr>
<td>Processed Sweet Corn</td>
<td>7</td>
</tr>
<tr>
<td>PLACE IN THE MIDWEST FARM ECONOMY</td>
<td>8</td>
</tr>
<tr>
<td>Developments</td>
<td>9</td>
</tr>
<tr>
<td>THE INDUSTRY IN THE DECADE AHEAD</td>
<td>9</td>
</tr>
<tr>
<td>Sweet Corn for Processing</td>
<td>10</td>
</tr>
<tr>
<td>Supply in the Midwest</td>
<td>11</td>
</tr>
<tr>
<td>Regional Competition</td>
<td>12</td>
</tr>
<tr>
<td>Role of the Processor</td>
<td>12</td>
</tr>
<tr>
<td>Farmer-Growers' Share</td>
<td>13</td>
</tr>
<tr>
<td>Sweet Corn for Fresh Market</td>
<td>14</td>
</tr>
<tr>
<td>Future Place in the Midwest Farm Economy</td>
<td>14</td>
</tr>
</tbody>
</table>
The Midwest Sweet Corn Industry

Richard A. Andrews

In the past three decades, the sweet corn industry has undergone a marked change both in type of product marketed and in area of production. Frozen sweet corn has been introduced and its market expanded. Sweet corn for fresh market has increased in importance. White cream-style canned sweet corn production has declined, while golden cream-style and golden whole-kernel sweet corn production has increased. Wisconsin, Minnesota, and several far western states have risen in importance as producing areas of sweet corn for processing, and Florida, Texas, and California have risen in importance as producing areas of sweet corn for fresh market.

To keep abreast of these industry developments, several Midwest regional studies have been made covering the economic aspects of marketing of fresh market sweet corn, the grade yield-price relationship of raw sweet corn sold to processors, and an analysis of the pricing systems used in grower-processor markets. To round out the work on the sweet corn industry in the North Central States, it seemed desirable to look at the overall industry in the current setting and consider its potentialities.

The primary purpose of this report is to summarize the most important developments in the sweet corn industry, and to describe the present and prospective economic status of the sweet corn industry in the Midwest farm economy in the decade ahead. The material presented here is taken from the technical bulletin entitled The Sweet Corn Industry in the Midwest Farm Economy (Minnesota Agricultural Experiment Station Technical Bulletin 232 and North Central Regional Publication 95).

Overall Developments

Sweet corn produced for fresh market and sweet corn produced for processing are unrelated products in several ways. Sweet corn for processing is usually produced under a contract agreement which describes conditions for crop production and disposal. On the other hand, almost all sweet corn for fresh market is produced for open market sale. As for marketing and consumption, it is the comparison of a highly perishable item with a semidurable item.

Production

United States production of sweet corn for processing (canning and freezing) increased an average of 28 thousand tons per year from 1918 to 1957 (figure 1). The increase was threefold—from 0.5 million tons at the beginning of the period to about 1.5 million at the end. Since 1919, the production of fresh market sweet corn increased from 0.15 million tons per year to about 0.7 million.
tons—an average of 16 thousand tons per year.

**Acreage**

The harvested acreage of sweet corn for processing increased 7 thousand acres a year from 1918 to 1957 in the United States. Year-to-year variations in acreage are often 10 times the yearly average increase. The presence of a 5- to 7-year cycle explains a large part of the fluctuations in harvested acreages.

The cycle is related to processors' inventories. The calendar year of low harvested acreage is the year of large inventory carries.

Carryover stocks are built up during years of high crop yields and by canners corresponding to favorable product prices. Once produced, stocks are held into a second market season in hopes of a more favorable price.

**Yield per Acre**

Yields vary between commonly used white and yellow varieties and even among yellow varieties themselves. It is commonly accepted that yields also vary according to quality of pack and to style of pack as between cream-style and whole-kernel. In viewing sweet corn yields over time, any change in type of product demanded must be considered as possibly influencing yield trends.

A shift in type of product from white to yellow varieties and from canned to frozen (on a fresh, farm-weight base) occurred during the period under consideration. There is no way to observe what has happened to quality because no uniform system of grading has been extensively used and recorded.

Aside from yearly fluctuation, the United States average yield of sweet corn for processing remained at a fairly constant level of 2.2 tons per acre from 1918 to 1959. Yields have climbed during the past 15 years to a position about 40 percent higher than that of the pre-World War II period of 1935-39.

**Per Capita Consumption**

Both population increases and increase in per capita consumption contributed to the expansion of the sweet corn industry. Between the periods 1920-24 and 1955-57, per capita consumption of all sweet corn (on a fresh, farm-weight base) increased from 11.3 pounds to 24.1 pounds.

Fresh sweet corn consumption increased about three times to 8.1 pounds per capita in 1955-57. canned sweet corn consumption held rather constant between 1920 and 1939 at 8 to 9 pounds, then moved up to a higher plateau of 12 to 13 pounds during World War II. Frozen sweet corn was developed during the 1930's. Per capita consumption has increased steadily, reaching 2.5 pounds in 1955-57. Even though proportional increases in consumption were greater for fresh and frozen, canned sweet corn still comprises well over half the 24 pounds per capita consumption of all types.

**Shifts in Sweet Corn Marketed**

During the last three decades, the sweet corn industry experienced variety developments, new processing techniques, insect problems and development of problem solutions, improvements in transportation, and new technologies in general. Many new developments had an impact on type of product marketed. It is important to note some of the major changes in the marketing of sweet corn.

**Fresh Market**

A significant change in fresh market sweet corn marketings is the rise in importance of out-of-season production. Winter, early spring, and fall volume rose from 15 percent of the fresh market production in 1949 to 30 percent in 1956. The shift in relative importance is explained primarily by the faster increases in winter, early spring, and fall production. Only early summer production decreased between 1949 and 1957. Late spring and late summer production increased moderately and maintained their positions in the year-round market of 8 and 50 percent respectively.

**Processed Sweet Corn**

Historically, production techniques and variety developments have determined the style of canned corn marketed.

Until the late 1920's, most sweet corn canned consisted of white varieties. Inequality and high-yielding yellow varieties were not available. Improved strains and hybrids of yellow varieties were introdaced beginning in the late 1920's. When corn kernels were cut from the cob by hand during the pioneer canning days, it was possible to can either cream-style or whole-kernel. But as canning operations were mechanized, early technology favored cream-style corn. A mechanical cream-style cutter was invented in 1875. While whole-kernel cutters were on the scene before 1920, the development of vacuum-packed foods in the mid-1920's created the need for an improved whole-kernel cutter. With this development in the late 1920's, technology no longer determined style of cut. Then, because consumers preferred golden whole-kernel corn, the style of sweet corn packed shifted from predominantly white cream-style to golden whole-kernel (figure 2). The white cream-style pack decreased from about 50 percent of the total pack in 1934 to less than 10 percent in 1957. The golden whole-kernel pack increased from about 12 percent of the total in 1934 to over 50 percent in 1957. White whole-kernel decreased from about 9 percent of the total pack to about 3 percent. Golden cream-style increased from a little less than 30 percent to about 40 percent between 1934 and 1957.

A style of canned corn not often mentioned is corn on the cob. It reached some degree of popularity prior to World
War II, when frozen foods were in their infancy. After the war, frozen foods became more popular and widespread, and frozen corn on the cob took over the processed cob market.

Place in the Midwest Farm Economy

Income from sweet corn averages over 25 million dollars per year, which, taken by itself, contributes substantially to Midwest farm income. However, this is frozen corn on the cob took over from the sale of cash crops alone.

To look at sweet corn's importance in the Midwest farm economy, all commercial vegetable crops must be considered, as well as sweet corn's position in individual states. Annual income from principal vegetables was reported by the United States Department of Agriculture to be about 136 million dollars during the 1954-56 period. This is about 5 percent of the annual income from all cash crops sold in the Midwest for the three years, and indicates that all commercial vegetables, although important, are minor sources of farm income.

Sweet corn is important both as a cash crop and as a principal vegetable in Wisconsin and Minnesota, while in Illinois and Iowa it is important only as a principal vegetable. In Wisconsin, about 5 percent of the income from cash crop sales and about 20 percent of principal vegetable crops are from sweet corn. In Minnesota, over 1 percent of the income from cash crops and about half the expected income from principal vegetable sales are from sweet corn. In Ohio, Indiana, Michigan, and Kansas, its relative position is minute.

Sweet corn's position in Midwest agriculture is further indicated by the number of farms and acres involved. About 28 thousand of 1.2 million farmers in the seven leading sweet corn producing states grew sweet corn commercially in 1954. In the Midwest states for which acres are reported, only 0.4 million acres of sweet corn were harvested as compared with 15.5 million acres of all harvested crops. Even in the state of Wisconsin, only 7.5 thousand of 153.6 thousand farmers grew sweet corn on 1 out of 100 acres. Thus, in the state and the Midwest aggregate picture, sweet corn plays a minor role in the total farm economy. On the other hand, its production is concentrated in a few counties and thus is important to the localized farm economy. Over half the acreage is located in 32 Midwest counties.

Developments

Most of the Midwest sweet corn is produced for canning. Although sweet corn for fresh market is widely produced in small quantities for local consumption, as well as by a few large-scale operators for more distant markets, it makes up about 10 percent of the total Midwest production. When compared with other producing areas, the Midwest, in contrast to its leading position in canned corn, is the least important frozen sweet corn producing area.

The shift in type of product canned from the white cream-style to golden whole-kernel was accompanied by an important shift in production within the Midwest. Newly developed yellow sweet corn varieties are higher yielding under present production conditions in northern Illinois, Wisconsin, and Minnesota than under conditions of the older sweet corn producing areas in Ohio, Indiana, east central Illinois, Iowa, and Nebraska. This explains in part why Wisconsin and Minnesota have expanded production considerably while Ohio, Indiana, Iowa, and Nebraska have reduced production (table 1, below; figure 3, page 10).

The Industry in the Decade Ahead

Many changes have occurred in the sweet corn industry in the last three decades. The vacuum-type of pack was developed and expanded, new high-yielding varieties were developed, canned sweet corn on the cob was developed...
(only to be replaced by the frozen product), and freezing techniques were developed and improved. The type of canned product demanded shifted from a white cream-style type to a golden whole-kernel type, a quick-cook canning process was developed, major shifts in production areas of sweet corn for processing occurred, and "out-of-season" fresh market production increased. Change in type of finished product demanded was the most important force affecting sweet corn for fresh market.

Sweet Corn for Processing

As indicated by past experience, change in the type of finished product processed is likely to occur in the next decade. The effect on demand for all processed sweet corn, on the other hand, is likely to be negligible, with the new type of processed finished sweet corn product substituted for some other older item. The increasing demand for canned sweet corn that has occurred in the past three decades was associated with a rising real income, increasing consumption of all processed vegetables, and a growing population. An analysis of demand failed to demonstrate that the change in type of finished canned product called for was associated with the increasing demand. In other words, the golden whole-kernel style appears to have been substituted for white styles while demand for all canned sweet corn increased.

A change in type of product processed, from canned to frozen, or to some new process, such as irradiation, is more likely to effect a change in some processing plant equipment, rather than to modify drastically the prospective developments in sweet corn production for processing. Projections indicate a 20- to 40-percent rise in demand in the decade ahead (figures 4 and 5). Two prospective technological developments may upset this projection. These are: (1) improvement of frozen corn on the cob type of finished product to give it a fresh corn on the cob quality; and (2) quality maintenance improvements of fresh market sweet corn, carrying the "freshly picked" characteristics through to the consumer. Improved frozen corn on the cob could place it in a more favorable competitive position with fresh market sweet corn, particularly the out-of-season type. An increased demand for sweet corn for processing could result from such a development. If so, actual demand for sweet corn for processing would expand by a greater amount than the above potential. On the other hand, developments favoring out-of-season fresh production could result in the fresh product being substituted for the processed product, with potential expansion not materializing.

Fig. 3. Between 1918 and 1957, the production of sweet corn for processing shifted within the Midwest from Ohio, Indiana, Iowa, and Nebraska to Illinois, Wisconsin, and Minnesota.

Supply in the Midwest. Production of sweet corn for processing in the Midwest appears very responsive to price change. An analysis of farmers' production response indicates a 1-percent change in price could result in a 2- to 4-percent change in quantity of sweet corn offered. Increased Midwest output of sweet corn for processing thus appears possible with but little increase in price.

Improved farm technology historically has expanded supply, i.e., shifted supply, increasing quantities offered at the various prevailing prices. Between pre- and post-World War II periods, sweet corn production in Wisconsin increased about 500 percent while its price, relative to prices of other farm commodities, decreased 10 percent; in Minnesota, production increased 80 percent while its relative price fell about 6 percent. The shift in sweet corn supply in these two leading states indicates the possibility of increased output at no increase in price. Put another way, expanding demand for sweet corn will not necessarily mean increased prices for the raw product. Sup-
ply may increase equivalently at the same time, leaving prices unchanged in the Midwest.

More important in the Midwest output picture is the relative advantage in sweet corn production that Wisconsin and Minnesota have over other Midwest states. Per acre yields obtained in Minnesota are higher than those in other Midwest states. Yields obtained in Wisconsin are about the same as those in the remaining states. But because the type of product differs among the Midwest states, the observed yields obtained by growers in Minnesota and Wisconsin are lower than a comparable yield for similar products. After adjustment for difference in type of product, Wisconsin and Minnesota have a yield advantage.

A survey of farmer-growers was made in six selected areas in Illinois, Wisconsin, and Minnesota to collect information on returns from farm crop alternatives. The comparison of per acre returns from sweet corn with other alternatives indicates that its income advantage over soybeans is greater in Wisconsin and Minnesota than in east central Illinois. In comparison to field corn, it has a greater advantage in Wisconsin than in both Minnesota and Illinois.

Regional Competition. The Midwest states have maintained a fairly stable share of around 70 percent in the United States processed sweet corn market (figure 6). A spectacular rise in Western production in the past two decades was offset by a decline of eastern producers' market share. Eastern producers barely maintained the prewar actual production level. The Midwest maintained its position in the United States market through capturing the East's share of an expanding demand. Where new technologies and large-scale production techniques (such as eight-row tillage equipment) are more adaptable to Midwest production conditions, the Midwest appears in a position to continue to capture the East's share in an expanding demand.

High transportation costs of the finished product are a part of Midwest producers' market disadvantage. In the other Midwest states, transportation costs and higher raw product costs for Midwest producers in Midwest and southern markets. A column of sparsely populated states from Minnesota to Texas have a "continental divide," separating western producers from producers in other parts of the United States.

An increasing share in the prospective increasing United States demand is the most likely outlook for the Midwest taken as a whole. Projections indicate that Midwest output will increase by a third in the decade ahead.

Role of the Processor. The processor's key role in sweet corn for processing is that of integrating two markets, the raw product market and the finished product market, bringing both into harmony. Operational advantage in the raw product market (processor-grower market) is obtained by seeking a least-cost combination of transportation and raw product costs. Where the processor is the single buyer or one of a few buyers in the processor-grower market, the processor procurement policies and prices paid growers are modified chiefly by farmers' crop alternatives. Competitive advantage in the finished product market comes from differentiating the finished product and creating a unique demand for it. Large processors place major emphasis on product marketing activities, and modify their raw product market activities accordingly.

Product competition is often substituted for price competition in the finished product market; advertising and competitive research for different types of the finished product are a part of the industry. Shifts in type of finished product sold are likely to occur as prices of the finished product are not new to the industry, a shift in demand for all canned sweet corn does not follow. Substitutes for the sweet corn finished product are being improved at the same time to neutralize the effect of product change and/or product improvement. The net result of product competition may be only encouragement of increased concentration of processing in a few firms.

Farmer-Growers' Share. How farmers will fare in future developments is of major importance to them. In the first place, a greater demand for the raw product may not indicate an increase in demand for acreage. A large portion of the increase in demand for the raw product may be satisfied from increases in yield. Yield in the post-World War II years increased about 30 percent. A 30-percent additional yield increase in the decade ahead would expand output by about the same amount as demand increases, resulting in no significant change in demand for crop acreage.

The second factor determining how farmers will fare in prospective demand is how much sweet corn for processing will be produced with processors' resources. This will be determined by the relationship between the cost of the raw product obtained from farmers and the cost of raw product obtained from processors' resources. Many and different types of cost enter the picture; that of actual production is but one. A processor can profitably produce sweet corn with his own resources so long as his cost of delivery to the plant is less than the price paid growers plus cost of fieldman services, cost of other services provided growers, and overhead costs of recording growers' accounts. Also, other cost factors to be considered are the risk aversion to be found in the assurance of a source of raw product, and the improvement of the processor's bargaining position in the market.

Processors, under the present market structure, may obtain a portion of the raw product from their own resources even though their average production costs are higher than those of farmers. The more important cost factors determining processor raw product produc-
tion are contract rent and farmers' alternati
es. Forces influencing farmers' alternat
es also modify contract rents in the same directions—i.e., higher prices for
crop alternatives increase the price pro
cessors must pay farmers to produce sweet
corn, while, at the same time, higher
prices of crop alternatives tend to in
crease contract rent charge. In the ab
sence of technological change, farmers
could expect to share proportionally with
processors in future developments.

A more serious threat to the farmers
is the adoption of production technolo
gies. The adoption of supercapacity equip
ment (e.g., eight-row tillage equipment) may modify the processor's cost structure so that he will increase
his production. The balancing force is
increased adoption of technologies by
farmers. However, adoption of technolo
gies by some farmers is not likely to keep
pace with adoption by the larger pro
cessors. Large processors employ research
staffs to develop and adapt new technolo
gies, and often the processors are in a bet
ner capital position, when compared with
farmers as a whole, to adopt the new technologies.

Some expansion in processor produc
tion can be expected under conditions of
moderate prosperity and rapid techno
logical change in sweet corn production for processing because the processor is in the better position to introduce tech
nologies than is the farmer.

Sweet Corn for Fresh Market

Important changes appear to be under
way in all fresh market vegetable produc
tion, with production shifting from near
by truck farms to more distant specialized
farms, and with an increase in out-of
season production. Around the largest
cities, expanding suburbs have taken up
farmland previously in vegetable crops. Expansion of chainstore operation into
smaller communities and servicing of the
chain retail outlet from centrally located
depots have shrunk market outlets of the
truck gardeners supplying these smaller
urban centers.

A spectacular increase in Midwest fresh
market corn production is not likely. Sweet corn for fresh market is a bulky
crop and involves high costs when it is
shipped long distances. The market sea
son for Midwest-produced fresh market
sweet corn is short and the product is
grown in most other areas during the
Midwest production periods. Sizable ex
pansion into new market outlets outside
the Midwest would not be anticipated.

Expansion in demand for Midwest
produced sweet corn for fresh market would be expected to follow population increase and a rise in real income within
the Midwest.

Future Place in the Midwest
Farm Economy

Sweet corn will continue to play about
the same role in the total Midwest farm
economy in the decade ahead as it has
dplayed during the past decade.

In the Midwest states, sweet corn has
its most important place in the Wiscon
sin farm economy. And in view of Wis
cconsin's comparative advantage in sweet
corn production, its importance is likely
to increase as production shifts within
the Midwest to better-adapted areas.

In other Midwest states, sweet corn will
continue to become a more impor
tant crop to localized farm economies having a comparative production advan
tage, particularly, at present, in the sou
thern half of Minnesota and select areas in
northern Iowa and northern Illinois.

Agricultural research in land-grant col
leges is usually related to farm commodi
ties produced in the state. As shifts in
production areas occur emphasis on re
search will change accordingly. The shift
in research emphasis lessens the possi
bility of a reversal of the trend, for re
versing the trend depends, in part, upon
the breeding of sweet corn varieties that are
(1) higher yielding in warmer cli
mates, and (2) equally as acceptable to
consumers as present varieties.