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Handling and marketing Iowa sweet potatoes

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HANDLING & MARKETING
IOWA SWEET POTATOES

Sweet MUSCATINE BEST Potatoes
MUSCATINE ISLAND CO-OP. ASS'N.
MUSCATINE
IOWA

Erwin et al.: Handling and marketing Iowa sweet potatoes.
ACKNOWLEDGMENT

In making this study, the authors have drawn freely upon the daily market reports and other statistical data from the Agricultural Marketing Service and the Bureau of Agricultural Economics, and acknowledgment is hereby made to the U. S. Department of Agriculture as the source of these data instead of repeating the same citation throughout the manuscript. To Mr. A. B. Farlinger, Chicago representative of the Marketing Service, we are especially indebted for many courtesies.
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SUMMARY

1. Sweet potatoes are the second most important vegetable grown in the United States. They are grown commercially in a few limited areas including southeastern Iowa. Sweet potatoes are divided into two classes, wet-fleshed and dry-fleshed. Both classes are grown in Iowa, the dry-fleshed predominating.

2. Iowa does not produce enough sweet potatoes to meet the needs of her own consumers; Iowa prices are high enough to draw shipments from other areas, some of them rather distant. Iowa sweet potato growers, because of their proximity to the markets, have the advantage of comparatively low transportation costs, but their production costs are higher.

3. The bulk of the crop is marketed uncured in September and October, during the harvesting period. Cured sweet potatoes rate higher in quality than the uncured, because curing facilitates the conversion of starch to sugar.

4. The most marked price advance of the entire season usually occurs during November and December. Thereafter, the price generally remains fairly constant, within a limited range, until the end of the marketing season the following spring.

5. Under a program of temporary storage—until about December—the grower could realize on the major price advance and yet avoid the hazards incident to moving a sensitive product in severe winter weather. Price advances after December do not appear sufficient to warrant holding for the late winter market.

6. Iowa growers have an opportunity to improve their returns by a program of: (a) Temporary storage, (b) grading, branding and advertising their product, (c) improving their packaging practices and (d) using their culls for stock feed.
Handling and Marketing
Iowa Sweet Potatoes

By A. T. Erwin, Geoffrey Shepherd and P. A. Minges

Among vegetable crops of the United States, sweet potatoes rank second in value only to white potatoes. In 1939, a total of 862,000 acres was harvested, producing 72,679,000 bushels with a farm value of $54,413,000. In most southern states, sweet potatoes have a position in the diet similar to that of white potatoes in the North and East.

In recent years, carlot shipments of southern-grown sweet potatoes from Louisiana to northern markets have increased because of improvements in storage and other facilities, providing a more even distribution throughout the year.

Acreages have remained fairly constant in the Midwest, with some increase in Illinois, Indiana and Iowa. In the strictly commercial areas of the Northeast, acreages remain fairly stable, because expansion is limited by soil conditions and the strong competitive position of other vegetables grown in these areas. This is not true in New Jersey, where acreages have increased since 1933.

Although production of sweet potatoes for home use is widespread, most of the receipts of commercial sweet potatoes at the terminal markets come from the three areas shown in fig. 1. In the Middle Atlantic section, comprising New Jersey, Delaware, Maryland and Virginia, the dry-fleshed variety known as the Jersey type is widely grown. In the Gulf Coast area, the Sunset section of Louisiana leads, growing a wet-fleshed variety known as Porto Rico. Both types are grown in the Central States area. In Tennessee and southern Missouri, the wet-fleshed Nancy Hall is cultivated, but the dry-fleshed Jersey type leads in southern Indiana, southeastern Iowa and some sections of Illinois.

1Project 585 of the Iowa Agricultural Experiment Station.
2The senior and third author assume responsibility for the horticultural phases of marketing, and the second author assumes responsibility for the economic interpretations presented in this study.

Published by Iowa State University Digital Repository, 1941
Sweet potato production is well adapted to the warm, sandy soils of southeastern Iowa. The marketing of the crop is more complex than that of most vegetables. Unless the crop is sold immediately after harvest, when prices are lowest, it must be cured and stored under exacting conditions, or it will deteriorate rapidly. Other marketing problems include: Meeting consumer preferences, forecasting

**TABLE 1. FARM VALUE OF LEADING COMMERCIAL VEGETABLES IN IOWA IN 1939.**

<table>
<thead>
<tr>
<th>Crop</th>
<th>Value</th>
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<tbody>
<tr>
<td>Irish potatoes</td>
<td>$4,200,000</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>277,430</td>
</tr>
<tr>
<td>Sweet corn</td>
<td>255,150</td>
</tr>
<tr>
<td><strong>Sweet potatoes</strong></td>
<td><strong>243,000</strong></td>
</tr>
<tr>
<td>Onions</td>
<td>160,600</td>
</tr>
<tr>
<td>Cabbage</td>
<td>98,280</td>
</tr>
<tr>
<td>Watermelons</td>
<td>56,880</td>
</tr>
<tr>
<td>Cantaloupes</td>
<td>52,800</td>
</tr>
</tbody>
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*Agricultural Statistics, 1940, p. 263, 284, 218, 274, 239, 194, 288 and 198.*
seasonal price behavior, interpreting changes in transporting and selling agencies, and meeting competition from other producing areas.

Sweet potatoes are divided into two market classes according to the character of their flesh. The Jersey dry-fleshed type contains a greater percentage of starch than such wet-fleshed types as Nancy Hall and Porto Rico, which have more dextrin and sugar. When they are cooked, the dry-fleshed potatoes have firm, dry flesh, whereas the wet-fleshed types have a moist, pasty flesh. Most of the sweet potatoes grown in Iowa are dry-fleshed.

SWEET POTATO PRODUCTION IN IOWA

The production of sweet potatoes occupies an important place in the vegetable crop industry of southeastern Iowa, where the acreage harvested during the past 5 years averaged about 3,000 acres. The value of this crop, compared with other vegetables of the state in 1939, is shown in table 1.

Sweet potato production is best adapted to sandy soil. There are about 75,000 acres of sandy land in southeastern Iowa, and the possibilities in sweet potato production there are worth thorough exploration. The industry centers in the 2,000-acre Muscatine area, where the crop has been grown for many years.3

Although Iowa production has been increasing for a decade or more, there still are not enough sweet potatoes produced in Iowa to meet consumer demands in this state. Shipments from outside the state into Des Moines and Sioux City, two of the principal markets for the crop in Iowa, averaged 112 carloads a year during 1934-39 (see fig. 2).

During 1925-30, production in Iowa increased 10 percent. During 1930-35 it increased 18 percent, and it is thought that the 1940 census will show a similar increase for the past 5 years. Reduction in acreages of watermelons on sandy soil because of melon wilt probably is an important factor in the increase.

3“‘A large quantity of sweet potatoes are raised in this county (Muscatine). A large tract of county near this city, known as Muscatine Island, from the sandy character of its soil, is particularly fitted for these delicious esculents. They always find a ready market at high prices in this city.'” Altman, Henry Jr., Iowa State Agr. Soc., p. 339. 1858.
INFLUENCES ON MARKETING

COMPETING AREAS

Figure 2 shows the number of carloads of sweet potatoes shipped to Des Moines and Sioux City each year from 1934 to 1939. The graph does not show shipments from Illinois, Kansas and Missouri. Sweet potatoes are brought

Fig. 2. Number of carlot unloads of sweet potatoes on the Des Moines and Sioux City markets for the years 1934-1939.
into Iowa from those states by truck. Louisiana and Virginia have been important sources of supply for these two Iowa cities since 1932, when declines in shipments from other states began. Louisiana shipped 4.5 percent of the carloads received in Des Moines and Sioux City in 1928, and this figure increased to 47 percent by 1937. Apparently, the competition from producers in other states is increasing.

SEASONAL PRICE VARIATION

For most fruits and vegetables the average price for a season frequently means very little to individual producing sections. There is a marked seasonal variation in most prices, and different areas market their products at different times during the season.

The marketing season for sweet potatoes in Iowa overlaps the marketing season in several of the competing states. This makes it necessary to plan carefully the time

![Graph showing average weekly wholesale prices for sweet potatoes in less than carlots on Chicago markets for years 1933-38.](image)
of marketing. The seasonal movement of prices is important as an indicator of the most favorable marketing periods. Figure 3 presents the average weekly prices on the Chicago market during 1933-38. The trend of prices was downward in October and hit bottom during the heavy movement occurring in that month. (The period of lowest prices varies from year to year, depending upon seasonal conditions.)

The greatest price rise occurs in November. The price rises 13 percent on the average during that month. The price rises further during December. After the major advance in November and December the price rises more slowly, and levels off by the end of January.

After November, the prices are mainly those of cured sweet potatoes, and part of the seasonal rise occurs because curing improves both the handling and eating quality of the product.

About 88 percent of the Iowa crop is marketed during months when the supply from other states is at its peak—in the latter part of September, all through October and in early November. Figure 3 shows that this puts Iowa producers at a disadvantage. They cannot get their product to market in time to catch the higher prices generally prevailing early in September, most of it being sold at the bottom of the market.4

The problem of whether to sell the potatoes as soon as they are harvested or to store them for some time involves several factors. The active growing season in Iowa is about 145 days, the minimum for sweet potatoes. To get best yields, digging must be deferred until about the middle of September, which leaves only a month of frost-free weather in which to harvest the crop. This period is entirely too short for harvesting, grading, packing and marketing. Adequate storage space to enable growers to complete harvesting before Oct. 15 is a serious need of many growers in the Muscatine area. Many growers now rush their crops to market during the harvest season, when the market is overloaded and prices are low.

4This statement is not based on shipment statistics but on the knowledge that most of the crop is sold without storage, directly from the field.
But storage has its shortcomings too. Sweet potatoes are highly sensitive to temperature changes, and if they were stored until January or February, they might suffer damage from the cold weather. Furthermore, there is not much object in holding after December, for the price rises very little after that month.

A program of temporary storage through December only, therefore, seems the best policy, considering the possibility of losses and the small gain in price when the crop is kept in storage longer.

TRANSPORTATION TO MARKET

From one shipping point in the Muscatine area from which 40 railroad cars of sweet potatoes were billed out in 1928, only five were shipped in 1938. The decline in railroad shipments has been accompanied by an equal increase in shipments by truck.

The fact that the truckers pay cash has been an inducement; also they serve the small grower who has not been in a position to ship in carload lots.

During the present season (1940) there has been a very definite shift in terminal market shipments from trucks to railroads. Island growers estimate that fully 75 percent of the 1940 crop moved by rail instead of truck as heretofore. Three important factors have contributed to this end: One is the policy of the labor unions in requiring that the movement of commodities at the terminal markets be performed by union labor only. Under this program it has been necessary for non-union trucks arriving in these markets to reload the shipment on a union truck for transporting across the city. This procedure involves one extra handling and obviously makes motor transportation more expensive.

The second factor is the reduction to certain terminal points of the minimum weight on a carload shipment of sweet potatoes from 30,000 to 18,000 pounds. This reduction has facilitated the movement of the crop by rail, since many of the dealers would order the smaller car when they were not in a position to handle a large one.

The third factor is the speeding up of freight car de-
liveries on the terminal markets. On some markets the time involved has been so shortened that the total time required for rail shipment is no longer than for motor transportation. This trend back to shipments by rail eliminates the trucker as a merchant; it enables the Bureau of Markets, by checking carload movements, to guide shippers to markets which are not overstocked, and enables the shipper to plan his marketing in advance.

Perhaps, over a long period of time, the truck operator will continue to hold the nearby markets, but the longer hauls to terminal markets will be handled by railroads. A cooperative marketing association recently formed by the vegetable growers at Muscatine enables smaller growers to pool their shipments in carloads, thus freeing them from the necessity of selling to truckers. Perhaps the association’s most important weakness is a lack of a uniform standard of grading among the members. Some members practice careful grading and others do not. Due to the lack of platform inspection, off-grades receive the same price, under the pool, as do the good grades. The remedy, which practically all cooperatives have had to adopt, is competent and unbiased platform inspection of grades, by either an association representative or a federal inspector.

**PRICES IN IOWA AND COMPETING STATES**

A large portion of the price paid by Iowa consumers for out-of-state sweet potatoes goes to cover transportation costs, because the principal states shipping into Iowa are a long distance from our markets. A comparison of base freight rates on carload shipments of sweet potatoes to Des Moines from five important commercial areas shows that on a bushel basis, the rate from Virginia, an important shipping point, is 33.5 cents. Louisiana producers pay 35.5 a bushel; Alabama producers, 41.5 and Tennessee producers, 24 cents a bushel. (Freight charges from Louisiana to Des Moines are but little higher than from Virginia to Des Moines, although Virginia’s shipping point is almost twice as far away.)

The cost of shipping sweet potatoes from Muscatine to Des Moines by rail in carload lots now is about 10 cents a
bushel. Thus Iowa producers have an advantage both in proximity to market and in lower shipping costs. Such advantages are also open to adjacent states (Kansas, Illinois and Missouri) from which sweet potatoes are marketed into Iowa directly by truck.

The significant increase in shipments of sweet potatoes from Louisiana and Virginia into Iowa in recent years suggests that these states are in a favorable competitive position. The explanation is to be found partly in a comparison of prices at the farm in each state concerned (see fig. 4) and partially in differences in production costs. For the period under study, the average annual farm price of sweet potatoes was considerably higher in Iowa than in the South. Average annual difference between farm prices in

![Chart showing farm prices of sweet potatoes in cents per bushel from 1928 to 1938 for Iowa, Tennessee, Louisiana, and Virginia.]

Fig. 4. Average farm price of sweet potatoes for states indicated for the years 1929-38.
Iowa and in competing states, such as Tennessee, ranged from 35.4 cents a bushel to 62.6 cents a bushel. The price received by Iowa sweet potato growers generally exceeded the price paid producers in competing states by an amount greater than the cost of shipping into Iowa markets from these states.

Although data on the cost of producing sweet potatoes in the Muscatine area are not available, it is probable that these costs are higher than in the southern states. One of the principal cost items is labor, and in the South labor is both plentiful and inexpensive. The temperate climate of the South makes storage costs lower.

With these advantages alone, southern producers may be expected to maintain their position in Iowa markets unless improvements in the quality of Iowa sweet potatoes, plus an aggressive advertising campaign, give them preference over the southern product.

**GEOGRAPHICAL DISTRIBUTION**

The shift from railroads to trucks as a transporting agency resulted in important changes in the channels of distribution of sweet potatoes. Under rail shipments, cars were consigned to terminal markets, and local shipments carried the product from there to grocers and others in the surrounding territory. When trucks came into general use, truckloads in many instances went directly to the retailer, the trucker serving as both an agency of transportation and a wholesaler.

During this study an effort was made to determine the destination of truck shipments. Some truckers were secretive, fearing that such information might fall into the hands of a competitor who would break into his route. Others explained that their destination was near or far, according to local market conditions. Unlike muskmelons, sweet potatoes are not highly perishable, so if one city is supplied the trucker drives on to the next until he has disposed of a load.

The truck license indicates the point of origin of a truck and in a general way the territory of distribution. Informa-
tion gained from this source reveals that the bulk of the Iowa sweet potato crop going out of state moves East or North, and practically none goes West or South. Cities in northern Illinois are important outlets for the trucking trade. Two important terminal points for rail and truck shipments are Chicago and the Twin Cities. From Minneapolis and St. Paul, smaller towns in Minnesota and the Dakotas are served. Local cities of central and eastern Iowa and the corresponding area on the Illinois side of the Mississippi River provide an outlet for much of the crop.

CONSUMPTION

Average per capita consumption of sweet potatoes in the United States during 1934-37 was 23.6 pounds, compared with 134 pounds of white potatoes. In the North and East, the difference is even greater. The reverse is true in the South.

One explanation for the difference in consumption may be the greater “mark-up” over the wholesale price for sweet potatoes than for white potatoes. Sweet potatoes are more difficult to keep in good condition than white potatoes. Consumers, therefore, buy sweet potatoes in small lots of a few pounds, rather than by pecks, bushels or 100-pound lots; this makes them more expensive for the retailer to handle.

A program for increasing the consumption of sweet potatoes in Iowa might include the three following essentials: A product of high quality represented by a definite brand should be marketed; grading should be such that a uniform pack could be marketed and an advertising and sales program should be followed.

HANDLING AND PACKAGING

MARKETING IN BULK

Marketing sweet potatoes in bulk, especially in an uncured state, is a bad practice. Few merchants will carry this class of stock, which is handled mostly by truck peddlers selling from house-to-house. Sweet potatoes in bulk have poor keeping quality; half of them may decay a few days after they are purchased.
CONTAINERS

Sweet potatoes come to Iowa markets in baskets, barrels, crates, hampers and in bulk. In the Muscatine area, bushel baskets are used. Virginia stock arrives in barrels. Louisiana has introduced a 50-pound rectangular crate which is gaining favor. An important advantage is that the weight of the upper tiers is borne by the frames of the containers below instead of by the potatoes in the lower containers as is the case with baskets. The crates also are more economical of space.

Public carriers are interested in containers from the standpoint of safety in transit and the avoidance of damage claims. Dahill\(^5\) states: "It has been our experience that the rectangular packages have given best results from a loss and damage standpoint. The containers, however, must be loaded in accordance with loading rules prescribed in the tariff, stripped and braced properly; under these conditions we find the results to be fairly satisfactory. Of course, rectangular packages have a certain rigidity and are able to withstand shocks in a car, and so are capable of protecting their contents somewhat better than a round flexible package.

"Successful use of a basket depends on the proper fastening of the cover in place; that is, with fasteners secured at four points around the perimeter. The use of fasteners in this manner serves mainly to hold the cover to the basket itself. Then again, the baskets must be properly loaded in the cars as tightly as possible. From our experience the best results are obtained by using the end-to-end offset loading method."

One advantage of baskets is that they are readily available in either small or large lots. Their disadvantage lies in the fact that they are a "bulge" package, as mentioned above. Basket caps and liners, though little used, are an important advantage as a protection against bruising. They are widely used for apples, though the skin of an uncured sweet potato is much tenderer than that of an apple.

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\(^{5}\)Dahill, Edward. Chief Engineer, Freight Container Bureau, Assoc. of American Railroads. (Letter to senior author, March 29, 1939.)
The Muscatine Island Field Station made trial shipments in 1939 of baskets with caps. The commission house to which they were consigned reported favorably upon these shipments and commented upon the value of the caps in protecting potatoes from bruising. The cost of the corrugated basket cap is approximately 1 cent a piece.

The bushel of 50 pounds is the unit of measure for sweet potatoes in Iowa. The number of pounds constituting a legal bushel varies widely in different states. For this reason a shift from the bushel to the pound for other vegetables has resulted (white potatoes and onions are important examples). Sweet potatoes are one of the few important commodities which still are sold on a bushel basis.

CONSUMER PACKAGES

For many products the use of small containers, so-called consumer packages, is gaining favor. The unit of purchase from the jobber is also the unit of sale to the consumer. The consumer tends to buy in larger quantities than he would otherwise.

An open net bag or glassine container is preferred, because consumers like to see what they buy. Marketing sweet potatoes in a 10-pound bag has been tried, with questionable results. Probably the most serious objection to this form of marketing is the susceptibility of the sweet potato to bruising. Such damage requires regrading and is expensive with this type of container.

OVERWEIGHT

There are two objections to overloading a basket. It causes an excessive bulge and an uneven distribution of weight on the contents of the tier of baskets underneath, resulting in bruising. A grower who overloads gives away produce. A basket with a gross weight of 58 pounds contains upwards of 4 pounds excess weight above a reasonable allowance for shrinkage and basket weight. The potatoes are handled by the retailer by the pound, and he buys from the jobber on a basis of a basket with a net weight of 50 pounds. Thus the grower is throwing in 8 percent by weight for which he receives nothing.
In marketing uncured sweet potatoes, an allowance of 2 pounds should be made for shrinkage in transit; therefore, a basket should be filled to weigh 52 pounds net if it is to be sold immediately.

**GRADING**

Grading means placing the different lots in their proper classes in accordance with a uniform scale of specifications. These specifications may be established by the trade or by the U. S. Department of Agriculture.

One of the first requisites for the successful marketing of sweet potatoes is the maintenance of uniform quality in packaging. Because several distinct classes of buyers are found in the larger markets, they may demand different grades of potatoes. But it is essential for each grade to be uniform if it is to meet the consumer’s demand at the price which they can afford to pay. Three important advantages for grading are: (a) It makes buying and selling easier, (b) it increases the value and (c) it facilitates the physical handling of the crop. Grading aids the movement of the crop, inasmuch as the retailer may order by telephone, specifying the quantities of a given grade. It also enables the retailer, without the expense of checking each package, to determine the price to the consumer.

Wholesalers and truck operators are the chief buyers of sweet potatoes. The truck trade demands what might be termed a commercial grade, that is, a combination of No. 1 and No. 2 (field run with culls removed.)

Hotels and restaurants are the leading customers for a fancy grade. Because the demand is limited, additional returns for a fancy grade are not commensurate with cost of production, despite a higher price.

Wholesalers mainly are interested in a No. 1 grade. Grocers, serving low-income groups report that their best trade is in No. 2 sweet potatoes.

A local grower often believes that buyers discriminate against his product and that shipped-in goods command a higher price. In flavor and sugar content, the shipped-in products probably are not superior to home-grown potatoes—they may be inferior—but there is often an important dif-
ference in grade. This is because the expense of transportation compels the long-distance shipper to sort carefully.

In cooperative marketing, poor grading by some of the members tends to penalize the better class of growers and gives the poor packer a better price than he is entitled to.

Housewives discriminate against oversized sweet potatoes even more than they do against undersized ones. Experiments conducted at the Muscatine Island Field Station have shown that size can be controlled by spacing within the row. Results at the Muscatine Station indicate that on Buckner sands oversized sweet potatoes can be largely eliminated, and maximum yields are procured, by using a spacing of about 14 inches.

With a certain tolerance, grades are standardized in accordance with the specifications established by the Bureau of Markets. In years of an oversupply, buyers enforce strict grading and allow but little tolerance, while in years of scarcity a maximum tolerance may be accepted without question. Information regarding the standard grades for sweet potatoes may be obtained from the Bureau of Markets, U. S. Department of Agriculture.

The proportion of No. 2's and culls of a given variety varies from year to year, because the percentage below No. 1 grade depends upon the quality of the crop. In Iowa, varieties of the Jersey type average higher in "primes" than the moist-fleshed types, such as Nancy Hall and Porto Rico. The roots of the Jersey type are more uniform in size and shape. Records of Muscatine plots indicate that in favorable crop years the Prolific, the leading variety grown in that area, runs about 75 percent No. 1 potatoes.

**UTILIZATION OF CULLS AS LIVESTOCK FEED**

Unmarketable sweet potatoes can be utilized as feed for livestock. Because about 25 percent of the yearly crop comprises No. 2's and "Jumbo" (very large) potatoes, for which there is only a small local demand as No. 2 seed, the question of how to use these grades is important.

Following is a statement by C. C. Culbertson, livestock
feeding specialist of the Iowa Agricultural Experiment Sta­
tion: “Sweet potatoes unsuitable for human consumption
 can be used to good advantage in the rations of certain
classes of swine. They are too bulky for small pigs, but
growing and fattening pigs over 75 pounds in weight and
mature swine will make good use of a limited amount.

“Most of the dry matter in sweet potatoes is starch,
hence they are a substitute for corn or other grain. Sweet
potatoes and corn supplemented with a good protein feed
and a high-class mineral mixture is a more efficient ration
for growing and fattening pigs than a ration in which the
sweet potatoes furnish the bulk of the carbohydrates.

“Research has shown that one usually gets the most
out of sweet potatoes for swine when they are fed in
amounts to replace not more than half the corn grain in the
ration. In other words, half a feed of corn grain plus all
of the sweet potatoes the hogs will clean up plus a protein
supplement plus a mineral mixture gives the greatest return
from the sweet potatoes.

“A full-feed of corn grain for the growing and fatten­
ing pig is about 4 pounds of No. 2 shelled corn or its equiva­
lent per 100 pounds of liveweight. Thus half a feed of corn
grain for a 100-pound pig would be 2 pounds. When the
sweet potatoes are fed in amounts as suggested it has taken
about 4 pounds of potatoes to take the place of 1 pound of
No. 2 shelled corn.”

On feeding sweet potatoes to dairy cows, there is the
advice of C. Y. Cannon, dairy husbandry specialist for the
Iowa Agricultural Experiment Station: “As with swine,

dairy cows utilizing sweet potatoes should be fed the pota­
toes in limited amounts—not more than 15 or 20 pounds
daily. Because sweet potatoes are exceptionally low in pro­
tein, having an unusually wide nutritive ratio, extra protein
feed should be included to balance the ration. If sweet
potatoes are fed regularly and for a long period of time, pro­
vision should be made to supply added calcium and phos­
phorus in the ration; sweet potatoes are low in these ele­
ments. To prevent the cows from choking, the potatoes
should be sliced or pulped before they are fed.”
EFFECT OF TIME OF PLANTING ON GRADE

The shape of sweet potatoes is greatly affected by time of planting. With Prolific, for instance, late plantings produced long roots and a greater percentage of No. 2's, while from the earliest planting a higher percentage of blocky roots and No. 1 stock was obtained. This fact is confirmed in studies by Miller and Kimbrough, who obtained similar results with the Porto Rico variety.

BRANDING

Branding establishes a dividing line between the careful shipper and the careless one; between low-grade and high-grade merchandise. With the name of the producer and the grade of the contents on each package, the wholesaler and retailer can identify and reorder products of superior merit.

Many sweet potato growers in the Muscatine area have failed to realize that branding is an important advertising medium to both the region and the individual producer. In conformity with the growing demand for a standardized pack of guaranteed quality, many states have adopted a grading and branding law. In Iowa the initiative lies entirely with the individual producer.

Indiana has adopted, under sponsorship of the State Horticultural Society, a “seal of quality.” To pack under the Hoosier seal of quality a grower must meet the following requirements: The product must be Indiana grown and packed, grading U. S. No. 1 or better; the product must be packed in new containers and federal-state inspected; the state law regarding branding and grading must be met.

The Indiana program has met with acceptance by both distributor and consumer, and Indiana Jerseys frequently are quoted 25 cents higher per basket than Iowa stock on the Chicago market.

STORAGE PROBLEMS

Iowa sweet potato producers have been criticized frequently for marketing the bulk of their crop in an uncured...
condition during harvest. It is shown in fig. 3 that prices average lower during these months than at any other time during the marketing season. This raises the question as to whether Iowa producers can benefit from storage of the crop, and subsequent orderly marketing during the winter months.

Few vegetables are as easily damaged by careless handling as sweet potatoes. The skin consists of several layers of protective cells which check the loss of water and act as a barrier against invasion by rots. To avoid skinning and bruising, sweet potatoes should be carried and
placed on the pile in the field—not tossed. Careless handling in the field leads to heavy losses in storage. Before sweet potatoes can be successfully stored, they must be properly cured.

In the curing of sweet potatoes, the starch is converted to sugar. There is also a loss of moisture and a toughening of the skin. Surface wounds are also healed by the formation of a corky layer. The ability to form a corky layer over wounds, as shown by Weimer and Harter, is influenced markedly by high temperature and high humidity. This corky layer was found to form most rapidly at 92°F. and at a relative humidity of 95 to 100 percent. The experimenters found that this layer does not form under ordinary storage temperature. Once developed, however, the layer protects the exposed surface from invasion by rot-producing fungi. Hot, dry weather at harvest time is a favorable factor in the storage quality of the crop.

In unfavorable seasons some rotting may occur in the big-stem types in storage. Results at the Muscatine Island Field Station indicate that in exceptionally bad years it has run as high as 22 percent. Also, big-stem varieties frequently show a disorder known as stem-end shrink, which, when severe, markedly lowers the market value of the product. Under adverse climatic conditions the little-stem varieties generally will stand up better in storage than the big-stems and are considered more reliable for storage.

The Shoemaker variety must be tested for several more seasons before its reliability as a storage potato can be established fully.

In the Muscatine district the commercial storage rate is 15 cents a bushel for the season or any part of it. A leading grower figures that stock out of storage should bring an advance of 25 cents a bushel over the price at digging time. This would cover the cost of storage. This figure does not allow for risks incident to handling the crop in severe weather or the possibilities of a price drop.

When conditions are ideal during the harvesting season and the storage room is properly managed, all varieties of sweet potatoes will keep fairly well. In such cases, the main loss will be from shrinkage due to moisture loss in curing, amounting to about 10 to 14 percent in the big-stem varieties and 11 to 16 percent in the little-stem group. Frequently little-stems sprout badly, causing some additional shrinkage.

**EFFECT OF FERTILIZERS ON STORAGE QUALITY**

Morgan, formerly of the Muscatine Island Field Station, conducted experiments to determine whether or not fertilizer affects the keeping quality of sweet potatoes. Applications of nitrogen, phosphate and potash resulted in potatoes that kept better in storage than those from other fertilizer treatments. The difference was not large but rather consistent; it suggests that potash influenced the keeping quality quite favorably. Morgan also noted that the storage loss from plots not fertilized was about twice that for the high-potash plots.

The variety Prolific as grown in Iowa is subject to stem-end shrink in storage, and fertilizers did not correct the trouble.

**EFFECT OF STORAGE ON FLAVOR**

Flavor in sweet potatoes is largely a matter of sweetness. The reserve material in the roots of a growing sweet potato is mostly in the form of starch. The transformation of starch into sugar begins only after the leaves are destroyed. Therein lies an important reason for the criticism that Iowa sweet potatoes are not sweet when sold immediately after being dug; the bulk of the crop moves uncured to the market a short time after digging, without a chance to “sweeten up.”

The flavor of Iowa sweet potatoes would be improved if they were cured by being placed in temporary storage and subjected to a high temperature for a few days. This treatment also would dry and toughen the skin for better handling.

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SANITATION IMPORTANT IN STORAGE HOUSES

Small, shriveled potatoes, "mummies," carry decay-producing organisms over from one season to the next and are a source of infection in many storage houses. At the close of the storage season, all false floors and slatted partitions should be removed and the whole place should be given a thorough cleaning. This should be followed by a thorough sterilization of the rooms with a spray of copper sulfate or formaldehyde.

FACTORS AFFECTING MARKETABILITY

RAINFALL AND TEMPERATURE

Normal annual rainfall for southeastern Iowa is 32.5 inches, about half of which falls during the sweet potato growing season from May to September. An adequate moisture supply is important both to total yield and the percentage of marketable potatoes.

Plenty of moisture also is a factor in the early marketing of the crop. Dry spells retard root development and may delay growth until so late in the fall that loss from freezing is probable. Irrigation is absolutely essential for the grower who wishes to make an early market.

Planting usually begins about May 10 in the Muscatine region, and harvesting is completed by Oct. 15. During this time normal mean temperatures for the summer months range from 75° to 80° F.

TIME OF HARVEST

Sweet potatoes may be harvested as soon as the roots are of marketable size. An analysis of Chicago market quotations during 1928-38 reveals that shipments of Iowa sweet potatoes generally begin about the middle of September. The reports are based on carload shipments and do not account for some earlier marketings by truck.

Some growers estimate that under favorable growth conditions there is an increase in yield of 20 bushels or more an acre per week toward the end of the growing season.
In the Muscatine area the first frost usually comes between Oct. 1 and Oct. 10. Because injury from frost tends to affect quality and cause a higher percentage of decay, leading sweet potato storage houses in that section refuse potatoes for storage after Oct. 10.

**EFFECT OF FERTILIZERS ON SUGAR CONTENT AND SHAPE OF ROOTS**

According to results secured at the Muscatine Island Field Station, varying the amount of nitrogen, phosphate or potash does not influence appreciably either the starch or sugar content of sweet potatoes.

Schermerhorn* of New Jersey found that the Jersey type of sweet potato tended to produce longer roots when treated with excessive applications of nitrogen, and Zimmerley** of Virginia noted that a downward trend in yield of primes was in evidence when more than 60 pounds of nitrogen was applied per acre. Rates up to 30 pounds of nitrogen per acre on the Muscatine plots did not affect the shape of the potatoes.

**VARIETIES**

Among points to be considered in selecting varieties are market preference, yield, season of market maturity, storage quality and susceptibility to disease.

The only way in which sweet potatoes may be classified as early and late varieties is by the time required for the roots to reach a marketable stage. Physiologically the sweet potato never becomes mature; it grows indefinitely, as it is a perennial. Therefore, the time to harvest a sweet potato is regulated largely by the size of the potato. Nevertheless, as a sweet potato reaches marketable size, some changes occur in the periderm, and a flesh color appears which improves the market quality of the potato.

Nancy Hall usually reaches marketable size, or market maturity, in the Muscatine area 10 days before Prolific.

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TRUE YAMS ARE NOT SWEET POTATOES

The true yam is a tropical food plant with starch-bearing roots, and is often confused with the sweet potato. The name is believed to be a corruption of the African word "yama," first applied to the sweet potato by Negro slaves who mistook it for the yama, or yam, of their native country.

The term yam is erroneously applied to sweet potatoes and is not a designation for any particular variety.

DRY-FLESHED VARIETIES

Big-Stem Jersey Group

PROLIFIC is the leading commercial variety grown in Iowa, including the Muscatine district. It is known in the Middle Atlantic states as the Big-Stem Jersey. Vines are medium to large, stalk heavy, roots yellow, smooth or veined, spindle-shaped; flesh is dry and light yellow. Roots are inclined to become large. Because this variety shrivels severely at the stem end when kept a few months, its storage quality is rated only fair.

CROSS SPECIAL (MUSCATINE NO. 1) has met with favorable response on the Chicago market because of its attractive orange-red color and now is being grown commercially in the Muscatine area. A mutation of Prolific, introduced by the Muscatine Island Field Station, it has a skin of deep salmon with orange-red flesh.

MARYLAND GOLDEN, a comparatively new potato, is a variety with golden skin and rich salmon-colored flesh. Its color is enhanced by cooking, and consumers are adopting it rapidly. It is more moist than the average potato of the Jersey type. Perhaps its chief fault is that it does not sprout freely and hence is not a good propagator.

PRIESTLY, although a good yielder and a well-shaped variety, turns pale gray when cooked and is therefore losing favor with the housewife, and for this reason has largely been discarded in Iowa.

11 The sweet potato is a member of the morning glory family and is known botanically as Ipomea batatas. The true yam is allied to the lily family, and is designated as Dioscorea batatas.
Little-Stem Jersey Group

LITTLE-STEM JERSEY is medium-long, well-shaped, with golden-yellow skin and lemon-yellow flesh. When cooked it is pale yellow.

NOLTE is a short, blocky potato, best adapted to the more fertile sweet potato soils. It has more color when cooked than Little-Stem Jersey and has a popular flavor. Both skin and flesh have splotches of red on a golden yellow background.

SHOEMAKER yields well under Iowa conditions and as yet has not been subjected to very serious ravages of stem rot. It is similar to the Little-Stem Jersey in flesh and skin color.

Red Jersey Group

RED JERSEY is intermediate in vine character and production between Big and Little-Stem Jersey. It is grown in limited quantities for home use, but northern markets do not favor it.

RED BERMUDA has large vines, with vigorous roots carrying pronounced ridges and veins. It is the most productive red variety grown in this section but, like Red Jersey, is not in demand on the market.

MOIST-FLESHED VARIETIES

MAMEYITA appears to have excellent storage qualities. It is a comparatively new sort in this state, and its value as a commercial variety is yet to be determined. The stems and the veins on the underside of the leaves are deep purple. Roots are spindle-shaped and smooth; skin is smooth, rose to salmon and flesh is deep salmon splashed with light red.

NANCY HALL in recent years has been displaced largely by Prolific, a heavier producer. It rates high in preference among those who prefer a wet-fleshed potato, and has two points of advantage for the Iowa grower; the roots reach remarkable size 10 days sooner than dry-fleshed
varieties and contain more sugar than Prolific. Nancy Hall ranks second to Prolific on Midwestern markets. The leaves have a purplish stain at the base of the blade extending the length of the midrib, especially on the younger growth, with light purple nodes. Roots are salmon yellow.

PORTO RICO is the leading variety on the markets of the upper Mississippi Valley in shipments from Louisiana but yields poorly in Iowa. It produces an undue proportion of No. 2′s and strings. Stem, leaf stalk and veins are deep purple; roots are light rose; flesh, light orange-yellow. Storage quality is excellent. Carload figures indicate that more than 65 percent of the wet-fleshed sweet potatoes on the market are of this variety. Porto Rico does not yield well enough in Iowa to be of commercial importance.

An attractive mutation of Porto Rico, with a deeper reddish skin and flesh has been introduced by Julian Miller, of the Louisiana Experiment Station, under the name Porto Rubio.

TRIUMPH appears early in the season on Iowa markets from Tennessee and Alabama. It stores well but produces an undue proportion of strings in Iowa. The color of the flesh, when cooked, is not attractive. Triumph holds a place on the market mainly because it is produced early, before more desirable varieties are ready. Vines are stout, veins and leaf stalks are light purple. Skin and flesh are light yellow. Roots tend to grow long in Iowa.

COMPARISON OF YIELDS

In the Muscatine district the Big-Stem Jersey varieties have proved the most reliable yielders. This probably is due primarily to the fact that they are not as seriously affected by stem rot as are little-stem types. In years when stem rot is less damaging than usual or when climatic conditions are not suited to the growth of Big Stems, the Little-Stem Jersey varieties frequently make better showings. For this reason most growers in the Muscatine district plant some of both types.

During the past 2 years, the Shoemaker, a new variety
of the little-stem group has been increasing in prominence. It compared very favorably with Prolific and Little-Stem Jersey in a test made in 1939 at the Muscatine Island Field Station.

At Conesville where the soil is less sandy and more fertile than at the Muscatine district, the little-stem varieties have proved more satisfactory. In that district the Shoemaker has largely replaced the Little-Stem Jersey type as a commercial variety. Nolte has risen to second place in acreage, chiefly because of its highly desirable flesh color which certain markets prefer.

Besides resistance to stem rot, Big-Stem Jerseys have increased because of their earliness. Prolific and Maryland Golden do not require as long a growing season and can be put on the market early. In 1939, Cross Special (Muscatine No. 1) potatoes reached marketable size by Aug. 10.

The Little-Stem Jersey group has remained in favor because of its storage qualities and the fact that certain northern markets prefer a dry yellow sweet potato. Most important varieties of this class grown here are Little-Stem Jersey and Nolte.

**CONSUMER PREFERENCE**

Preference for moist or dry-fleshed potatoes varies for different localities. Generally the moist-fleshed type is most widely used in the South. In many northern localities both types are used.

Consumer taste is more elastic in the North. Porto Rico, a moist-fleshed type, has largely displaced the dry-fleshed type on many northern markets. Sales promotion, backed by quality pack, has been important in the shift of preference. Dry-fleshed Jerseys formerly topped the Chicago market, and the price still exceeds that paid for Nancy Halls.

Porto Rico consistently leads during the winter months except for the "red soil" Jerseys from New Jersey which command a premium because of their unusual red color.

Data suggests that Porto Rico and Jersey varieties are more popular in Iowa than Nancy Hall and Triumph. Porto
Rico appears to have preference in the northwestern part of the state.

Thus it is apparent that Iowa consumers do not discriminate against either wet-fleshed or dry-fleshed sweet potatoes.