When Shall We Sell Our Corn?

G. S. Shepherd

Iowa State College
When Shall We Sell Our Corn?

By G. S. Shepherd

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

C. F. Curtiss, Director

AGRICULTURAL ECONOMICS SECTION

AMES, IOWA
Summary

The cost of storing corn in the crib on the farm is made up of three main items, shrink, interest and insurance, and destruction by vermin.

The biggest item of cost is the shrink, or loss of moisture. This amounts to about 10 percent.

This shrink, however, is offset or more than offset by the higher price received for the improved grade which results from the shrink.

Interest and insurance come to nearly half a cent a bushel a month. It costs half a cent a bushel, therefore, to store corn, if the loss by vermin, or the cost of a rat-proof crib, is not included. If it is included, the total cost of storing corn is a cent a bushel a month.

On the average, the price of corn rises from winter to summer more than enough to cover this cost.

After big crops, the price of corn usually rises more than it does after small crops. After small crops, the price of corn may not rise enough to cover the cost of storing.

It is advisable, then, to store corn after a big or average crop, but not after a crop 95 percent of average size, or smaller. This rule worked 21 times out of the last 23 years.

If the price of No. 3 yellow corn does not rise above say 90 cents at Chicago this winter, the chances are 11 to 1 that it will pay better to store corn until next summer than to sell it this winter.
When Shall We Sell Our Corn?

By G. S. Shepherd

Iowa this year (1928) is harvesting the second largest crop of corn she ever had. The December 1 government estimate places it at 476 million bushels. This is 50 million bushels more than an average crop—a corn surplus of 12 percent.

Nature has had her say in the matter. The question now is, how shall Iowa farmers use this bumper corn crop so as to get the most out of it? There are several different ways open. The problem is to choose between them.

Most of the corn will be fed on the farms where it was grown. A lot of corn will be sold as cash grain, however, and the question is raised, would it pay to sell it right after harvest, or would it pay better to hold it until next summer?

In order to answer this question, we need to know two things. First, how much does it cost to store corn? And, second, may the market price of corn be expected to rise more than enough to cover this cost? Our discussion will deal with these two questions one at a time, taking up the matter of costs first and the price rise second.¹

At several points along the way, questions will be encountered which branch off into somewhat detailed discussions. These discussions are essential to a proper understanding of the subject, but they temporarily lead the train of thought off the main track. Whenever they occur, therefore, they have been removed to the Appendix at the end of the circular.

The Cost of Storing Corn

The cost of storing corn is made up of three main items. They are:

1. Shrink, or loss of moisture.
2. Interest and insurance.
3. Loss from vermin, rats and mice.

Against these costs, we have two gains to take into account:

1. The rise in grade that accompanies the shrink.
2. The seasonal rise in price from winter to summer.

¹The subject has been handled in this manner in two previous circulars in the Current Economic Series of the Iowa Experiment Station. One was Report No. 1, Profits and Costs of Storing Corn on Iowa Farms; the other was Report No. 4, The Bumper Corn Crop Surplus. Both of these publications are now out of print. The occasion is taken at this time to revise them and bring their subject matter down to date in the present circular. Both the preceding and the present circulars have been prepared under the supervision of P. L. Miller, Assistant Chief, Agricultural Economics Section, Iowa Agricultural Experiment Station.
We shall start with the costs, taking them up in the order of their importance. The most important cost item is the shrink. Since the rise in grade goes hand in hand with the shrink, we shall deal with it next after the shrink.

Then we will take up the rest of the costs and conclude with consideration of the market price rise from winter to summer.

1. SHRINK, OR LOSS OF MOISTURE

By this is meant the shrink of corn in the crib on the farm, for it is shown in Appendix $A$ at the end of this circular that the farm, and not the terminal elevator, is the best place at which to store corn.

Corn put into the crib in the fall usually contains from 20 to 25 percent moisture, and in years of late or wet season may have well over 25 percent. It dries out in the crib by the following summer to about 13 percent moisture. The "loss" by shrink thus appears to run all the way from 7 to 17 percent.

In a previous mimeographed circular, we dealt with the question of shrink on the basis of experiments conducted at the Illinois Agricultural Experiment Station with cribs full of corn on the cob. It was found that the loss in weight thru evaporation of moisture, from winter to summer, averaged about 16 percent. After midsummer evaporation ceased, the moisture content remaining roughly constant thereafter at 12 or 13 percent.

Table 1 shows this shrink by months. It makes plain that most of the shrink takes place in the three early summer months, April, May and June.

This figure of 16 percent includes the shrink of the cob. It has been found, however, that the cobs ordinarily contain considerably more moisture than the grain when the corn is first

<table>
<thead>
<tr>
<th>Month</th>
<th>Percent Shrink</th>
<th>Total Percent Shrink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov.</td>
<td>1.33</td>
<td>1.33</td>
</tr>
<tr>
<td>Dec.</td>
<td>1.33</td>
<td>3.26</td>
</tr>
<tr>
<td>Jan.</td>
<td>1.90</td>
<td>4.16</td>
</tr>
<tr>
<td>Feb.</td>
<td>1.32</td>
<td>5.48</td>
</tr>
<tr>
<td>Mar.</td>
<td>1.47</td>
<td>6.95</td>
</tr>
<tr>
<td>Apr.</td>
<td>3.04</td>
<td>9.99</td>
</tr>
<tr>
<td>May</td>
<td>3.11</td>
<td>13.10</td>
</tr>
<tr>
<td>June</td>
<td>2.19</td>
<td>15.29</td>
</tr>
<tr>
<td>July</td>
<td>.86</td>
<td>16.15</td>
</tr>
<tr>
<td>Aug.</td>
<td>.46</td>
<td>16.61</td>
</tr>
<tr>
<td>Sept.</td>
<td>.22</td>
<td>16.89</td>
</tr>
<tr>
<td>Oct.</td>
<td>.16</td>
<td>16.64</td>
</tr>
<tr>
<td>Nov.</td>
<td>.24</td>
<td>16.30</td>
</tr>
</tbody>
</table>

*From Illinois Agricultural Experiment Station Bulletin No. 183, "Prices and Shrinkage of Farm Grains."
Fig. 1. Moisture-Content and Shrink of Corn.

Figure Left: The average percentage of moisture in corn, as determined by the U.S. Department of Agriculture, based on receipts at Baltimore, Chicago and New Orleans during the period indicated. Right: New corn stored at husking time in an open crib with tight roof and slat sides at the Illinois Agricultural Experiment Station averaged 16.61 percent maximum shrinkage by August.

put into storage but less than the grain when it is taken out of storage at the end of the period. The loss of moisture from the grain, therefore, is much less than the 16 percent loss from grain and cob both.

Since most of Iowa's cash corn is sold shelled and not on the cob, it is incorrect to use the shrinkage figure of 16 percent. We are interested only in the shrink of the grain, not of the cob. How great, then, is the shrink of the grain alone?

This can be ascertained from a study of the records showing the moisture content of corn received at the different grain markets by months throughout the year. One set of records on this point is summarized on page 203 of the 1921 U.S. D. A. Year Book. There it is shown that the average moisture content of corn received at Chicago, Baltimore and New Orleans runs from 20 percent in January to 12 or 13 percent in September. The shrink of the grain, therefore, was 7 or 8 percent, as shown in fig. 1.

Another source of information is the records of one of our Iowa corn products factories showing the moisture content of the corn it purchased, by months. These figures are more representative of Iowa conditions. They show a somewhat higher
shrink, running about 10 percent. The figure would be lower than this in a dry corn year, but higher in a wet or late year.

From this information, it seems that the actual shrink, or loss of weight due to evaporation of moisture from corn grain from winter to summer averages close to 10 percent. That is, a man with 1,000 bushels of corn in December would find, if he stored it until the following summer, that he would then have only 900 bushels to sell.

2. **RISE IN GRADE**

We have just shown that corn stored from winter to summer loses in weight. We now have to reckon with the offsetting fact that it gains in quality. The same loss of water which reduces the quantity of grain raises the grade.

**TABLE II. SHELLED CORN—GRADE REQUIREMENTS FOR WHITE, YELLOW AND MIXED CORN.**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Minimum Test Weight per Bu. lbs.</th>
<th>Moisture %</th>
<th>Foreign Material &amp; Cracked Corn %</th>
<th>Damaged Corn Heat %</th>
<th>Total %</th>
<th>Damage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>55</td>
<td>14.0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>15.5</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>.1</td>
</tr>
<tr>
<td>3</td>
<td>51</td>
<td>17.5</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>.3</td>
</tr>
<tr>
<td>4</td>
<td>49</td>
<td>19.5</td>
<td>5</td>
<td>8</td>
<td>8</td>
<td>.5</td>
</tr>
<tr>
<td>5</td>
<td>47</td>
<td>21.5</td>
<td>6</td>
<td>10</td>
<td>10</td>
<td>1.0</td>
</tr>
<tr>
<td>6</td>
<td>44</td>
<td>23.0</td>
<td>7</td>
<td>15</td>
<td>15</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Sample Grade. Sample grade shall be white corn or yellow corn or mixed corn, respectively, which does not come within the requirements of any of the grades from No. 1 to No. 6, inclusive, or which has any commercially objectionable foreign odor, or is heating, hot, or is otherwise of distinctly low quality.

(1) The corn in grades Nos. 1 to 5, inclusive, shall be cool and sweet.
(2) The corn in grade No. 6 shall be cool, but may be musty and sour.

How much will the grade be raised? Most of Iowa’s corn going to market in early winter runs No. 6 or sample grade, owing to the amount of water in it. (The maximum moisture content allowable for No. 6 is 23 percent, as shown in the schedule of grade requirements in table II.) Now such corn, otherwise good, should easily make No. 2 or No. 3 by the following summer, when its moisture content will have been reduced to less than the maximum limit for No. 1.

Good corn grading No. 6 or sample grade when put into proper storage in early winter may be expected to grade No. 2 or No. 3 when it is taken out the following summer. It will come up three or four grades.

Now a rise of three grades ordinarily means a rise of 6 to 8 cents in the price that will be received for the corn. The spread between No. 6 and No. 3 at Des Moines in the early winter is shown by the price records to run from 6½ to 11½ cents. Our figure, 6 to 8 cents, is rather conservative.
This question can be approached from another and perhaps more scientific angle, as shown in Appendix B at the end of this circular, with the same results, namely, a rise of 6 to 8 cents in the price received for the better grade of corn.

We come now to an important question. Does the higher price received for the better grade offset the loss from the shrink? Let us see.

The average Iowa farm price of No. 6 corn in December is about 60 cents a bushel. A loss of 10 percent in weight due to shrink would, therefore, mean a loss in price of 6 cents.

The improvement in grade, we saw, would result in a gain of 6 or 8 cents. The loss from shrink, therefore, is offset or more than offset by the better price received for the better grade resulting from the shrink.

It is only natural that this should be the case; we would expect that the consumers of wet corn would simply offset the water they buy in it by paying a price per bushel low enough fully to offset it. They are interested in buying corn, not water. We can offset these two items one against the other, then, since they will vary together. That is, in a dry corn year the loss from shrink will be less than average, but so will the gain from grade improvement. In wet corn years both items are correspondingly larger, offsetting each other in the same way as in dry corn years.

By thus recognizing the loss from shrink as being completely offset by the gain from grade improvement, we may proceed to drop both these items out of the question from now on and thereby get a clearer view of the rest of the problem.

3. INTEREST AND INSURANCE

The third item of storage cost is the interest on the amount of money tied up in the corn and the insurance on it. These may conveniently be considered together at this point.

Interest at 7 percent on 60 cent corn would come to 4.2 cents per bushel per year, or .35 cent a month.

Insurance at the rate of 1½ percent on 60 cent corn would come to .9 cent per bushel per year, or less than .1 cent a month.

These two charges together, then amount to a little over .4 cent a month. Other incidental charges might run this up to a total of .5 cent or half a cent a month.

That is, with the three items—shrink, rise in grade, interest and insurance—taken into account, the net cost of storing corn on the farm is one-half cent per bushel a month.

4. LOSS BY RATS AND MICE

We have yet to take into account the last item of cost, the destruction by vermin. Unless the crib is of a rat-proof type, the
rats and mice will usually exact a toll which must be reckoned with as a cost.

It is rather difficult to put an average figure on this item. It varies so much from farm to farm and with different kinds of cribs. Perhaps the best way to handle this item is to give here the cost of putting up and maintaining a rat-proof crib which would not only insure that the corn would have every chance to cure up properly but would reduce the loss by vermin to a minimum. It is not probable that vermin loss amounts to much more than the cost of such a crib, for, if it did, good rat-proof cribs would probably be more generally used.

The cost of a good rat-proof crib is given in some detail in Appendix C. It is shown there that all the costs of such a crib would be covered by a charge of $24.00 a year. On the capacity of the crib, 800 bushels of shelled grain, this would amount to 3 cents a bushel a year. And if corn were ordinarily stored for six or eight months, the cost of a crib which would reduce vermin loss to the minimum would be a little less than half a cent a month.

This half a cent a month, added to the other charge of half a cent a month which covers all other cost items, makes a total net cost of carrying corn on the farm, all things included, of 1 cent a bushel a month.

Does the Price of Corn Rise Enough to Cover the Cost of Storing It?

We have seen that the cost of storing corn (including everything but the loss by vermin, or the cost of a rat-proof crib) is half a cent a month. The crib cost raises this to a cent a month. The full cost of storing corn on the farm, then, is a cent a bushel a month.

The question now is, does the price of corn ordinarily rise from winter to summer more than enough to cover the cost of storage? Let us turn to the price records and see.

Figure 2 on the next page shows the average monthly price of No. 3 yellow corn at Chicago over the 11-year period, 1906 to 1916. It also shows a similar curve for the more recent period, 1923 to 1928, inclusive.

The price curve for the period before the war rises from 60 cents in December to 73 cents in August. That is a rise of 13 cents in eight months. The curve after the war rises from 85 cents in December to $1.01 in August—a rise of 16 cents in eight months. The average profit from storing corn, therefore, was 5 cents a bushel before the war and has been 8 cents a bushel since.

Should corn, then, be stored every year? The answer is, no. On the average, it pays to store corn; but individual years differ
from the average, and there are some years when it does not pay to store. Averages alone are not enough for us to go by.

Nowadays we need more detailed information. We want to know how closely each year resembles the average. If there is much variation, and if in some years corn would be stored at a loss instead of a gain, we should like to know when such a year is at hand, so as to miss storing. And, on the other hand, if there is any way of foretelling what year the price of corn is likely to rise more than the average, we want to know that, too, so as to hit it.

We can throw a lot of light on this subject by plotting the price of corn for each year since 1900, omitting the abnormal war years. The data, charted in this manner, are shown in figs. 1, 2 and 3, in Appendix F. Study of these charts reveals two things.

First, it shows that there is considerable variation in the curves for different years. The "slope" of the curve upward thru the season is fairly steep in some cases; in others there is little or no slope up, the curve remaining almost flat. And there
seems to be no regularity in the occurrence of these different slopes.

Second, we find that there is some order behind this irregularity. If the years are divided into two groups, with the prices following big corn crops in one group and the prices following small crops in the other, most of the steeply sloped curves will be found in the bumper crop group, and most of the flat curves will fall into the small crop group. The charts in the Appendix show the years divided into these two groups on this basis.

This same information is shown in fig. 3 below on this page in the form of two averages. One is the average monthly prices just after big crops (crops bigger than average). The other is the average monthly prices just after small crops (crops smaller than average). This shows clearly that big crops depress prices in the winter about 8 cents lower than small crops do, tho both rise to about the same price by the following August.

That is, after a big crop, corn prices rise throughout the season more than they do after a small crop. The reasons why this should be so are discussed in Appendix E. We shall simply note here that it does happen and point out what it means to the farmer who is considering whether or not to store some of his corn. It means that instead of storing corn every year, it pays better to store corn after big crops but not after small crops. Stated more fully and precisely, it will be found that it pays

![Graph](image-url)
to store corn after big or average crops, but not after crops below 95 percent of average size.

It is interesting to go thru the 23 years graphed in Appendix D to see how this rule works out in practice; that is, storing corn every year except those when the crop is only 95 percent in size, or smaller. We find that it would have been profitable to store (or in one or two cases, just an even break) 18 years. We should have refrained from storing, and thereby avoided a loss (after the 1901, the 1913 and the 1924 crop), three years. And we should have gone astray and incurred a loss from storing or from not storing (after the 1909 and the 1925 crops) twice.

In brief, by storing every year except those when the crop in the United States was 95 percent or smaller, we should have gained 21 times and lost 2 times out of a total of 23 years. That's a good batting average, a pretty good rule to follow in the search for bigger profits on the farm.

How About This Year?

We have just seen that if our analysis has been correct, the chances are about 11 to 1 that storing corn this year (1928-29) will pay.

But for all we know, this year may be the 1 out of the 11 when it does not pay. Can we take out the small element of chance which still remains?

We can't. The best we can do is to point out certain features of the situation this year for the bearing they may have on the prospective price of corn from November, 1928, to October, 1929. Some of them are favorable, some are not. Which
will predominate will become clear as time progresses and the different factors wax or wane in strength.

First of all, the size of the U. S. crop is 2,895 million bushels—nearly 5 percent larger than average. That is the biggest single influence, pointing toward the expectation that the price rise will be greater than normal. The oats crop and barley crop are both distinctly above average size, which will further contribute to the same effect. The small carry-over of old corn from the 1927 crop will only partially offset the effect of the large yield.

Another rather important influence, however, is working
against the effect of the big crops. It is the position of the year with reference to the corn-hog price ratio cycle. At the present time we are approaching a prospective minor peak in the cycle. That is, the price of hogs, within the next year, is expected to be high relative to the price of corn. If we look back over the records of previous years, we shall discover that in such years the price of corn tends to rise less than normal thru the season. This was true of the year 1905-1906, of 1909-1910, of 1913-1914 and, especially, of 1925-1926.

The latter year, 1925-1926, during which the 1925 corn crop was being disposed of, is of particular interest to us because conditions now are very much like they were then. The size of the corn crop, the stocks of old corn, the total production of the three feed grains, the position on the corn hog cycle, are now practically the same as they were then.

If we turn to the chart of the price for 1925-1926, however, we find that the price of corn that year did not rise enough to cover the cost of storing. The price actually fell until June, after which it rose sharply but still not enough to cover the cost of storage. Storing corn that year was not profitable.

The feeding situation, of course, will have its influence. The effect of a smaller fall pig crop this year, however, will probably be roughly offset by a larger spring pig crop next spring. But cattle prices this year are likely to be much higher than they were in 1925-1926, and the demand for corn to feed to beef cattle will be stronger than it was then.

Again, the European corn crop is less than half the size of the 1926 crop and is 22 percent smaller than last year. This in combination with the fact that the remaining corn surplus in Argentina is small, indicates that the export demand for corn will be stronger than usual. These two elements may be sufficient to give us a normal seasonal price rise, in spite of the influence of the corn-hog price cycle previously noted. It must be remembered, however, that the price raising effect of the short crop in Argentina will last only thru the winter and will be replaced by a depressing effect next spring if the next Argentina crop appears by then to be of normal size.

A word of warning should be given in closing. The average price of corn at Chicago since the war years has started at 85 cents in December and risen to $1.01 by the following August. The feed crop this year being 5 percent bigger than average, we should expect to sell it at a price 7 cents below 85 cents at this time, namely 78 cents a bushel.

The price so far, however, since the first of November, has ranged between 80 cents and 85 cents, chiefly on account of small receipts from the country. One of the reasons for the light re-
receipts is that the quality of corn is good this year, and the air is full of talk about holding grain. The writer recently listened to a radio speaker broadcasting an appeal to farmers to go on a blind holding program until corn had reached $1.10.

Let no one be misled into over-optimism on that score. Appendix D of this circular points out that if holding in general is overdone and market receipts during the winter are light, the price is raised in the winter all right, but it is correspondingly depressed the next summer so that holding is done at a loss. A normal price for No. 3 yellow corn at Chicago for the next few months should be somewhere between 80 and 85 cents. Should corn be held until the price runs over say 90 cents at Chicago during the winter, the probability must be faced that when it is sent to market next summer, the price then will not have risen high enough to cover the cost of holding. Farmers should watch the receipts of corn at the primary markets for the next few months. If they have run much lighter than usual, that should be taken as a warning that more corn is being held in the country than usual, and this will have a depressing effect on prices next summer.
APPENDIX

Appendix A

Should Corn Be Stored on the Farm or at the Terminal?

The best place to store corn is on the farm where it was grown. There are two or three reasons why this is true.

The first reason is that we are considering winter storage here; that is, putting corn into storage in the early winter, when it contains considerable moisture. The limit of moisture content for safe storage at the terminal elevators is about 17 percent in the winter and 13 percent in the summer. In the early winter, our Iowa corn ordinarily runs from 20 to 25 percent moisture. It would go out of condition if shelled and put into terminal storage then.

However, the corn could be safely stored if it were first artificially dried. But the operation of drying costs from 2 cents to 4 cents a bushel and, in addition to this cost, the shipper must naturally bear the loss in weight from drying and general handling. Further, not only does kiln drying drive off the moisture, but for every 1 percent of moisture driven off, about 1/4 of 1 percent of corn oil goes off with it. And finally, the process of drying generally renders the grain unsatisfactory for industrial purposes, either because of the starch being partly broken down, or because of the germ being killed. Most industrial firms will not accept kiln dried corn; it must be disposed of at a discount to feeders.

The second reason is that even if the corn were dry enough to store at the terminal, the storage charges there are higher than they are on the farm. The unloading charge, which also includes 10 days free storage, is 1½ cents a bushel. The storage charge thereafter is 1/20 cents a day, nearly 1½ cents a month. Shrinkage is not a factor here, however, since the same number of pounds of corn that were weighed into storage are weighed out.

The third reason is that the most strategic market location for Iowa corn is the farm where it was grown. There is some advantage in having grain in store at the terminal, where it can be sold on a bulge at a moment’s notice, but grain on the farm in Iowa, surrounded as it is by a ring of markets, is in a position to take advantage of the highest on-track bids from perhaps half a dozen alternative sources at any time. Grain in store at a terminal market has to be sold there, though that market may never offer the highest price of all the available markets during the period of storage.

Appendix B

Effect of Improvement in Grade on Price

During the winter, the industries discount for moisture at the rate of from 1 to 1½ cents for every 1 percent of moisture above 19.5 percent. This 19.5 percent is the maximum moisture content allowable for No. 4 grade and the discount is deducted from the No. 4 price.

The discount on corn running 23 percent moisture would, therefore, be 23 minus 19.5 percent, which is 3.5 percent, multiplied by 1.25 cents. That makes 4.4 cents. That is, the price paid for corn with 23 percent moisture would be 4.4 cents below the No. 4 price. Adding to this the spread of about 2 cents between No. 4 and No. 3, the latter being the
grade that good corn grading 23 percent moisture in the winter would probably make by summer, we get a total of from 6 to 7 cents. This is the same figure as that at which we arrived in the body of the text.

Appendix C

The Cost of a Corn Crib

The crib cost is calculated as made up of two items—interest on investment, and depreciation or replacement charge.

The cost of the crib will depend upon several things; upon the material the type of crib and the care given it. The figure used in this discussion is based on the cost of a standard type of crib. The cost of any other type desired can be figured up in a similar manner and substituted.

A good standard type of crib has a shingled, slant roof, concrete floor and wooden slat sides. Such a crib, big enough to hold a sufficient amount of ear corn to yield 800 bushels of shelled corn, would have a floor 8 x 24 feet, a rear height of 8 feet and a front height of 12 feet. The materials—lumber, cement and gravel—required to build a crib of this size, at present retail prices at Ames, would cost $143. Hardware, paint, labor and minor subsequent repairs would bring this figure close to $200. The annual interest charge on this amount at 7 percent would be $14. This would be 1½ cents per bushel per year.

The annual replacement charge, on the basis of a normal life of 25 years, would be 1 cent per bushel per year. Finally, the insurance on the crib itself would run between .2 cent and .3 cent per bushel per year. If the crib is used to capacity, the crib cost thus amounts to 3 cents per bushel per year.

The annual charge per bushel for the most expensive type of crib, a large, permanent hollow tile structure with an estimated life of at least 50 years, would be 3.5 cents. This may be taken as the extreme upper limit of crib cost. On the other hand, a crib of the type we have described on this page would cost less than 3 cents per bushel if it were two or three times as large as the one we have taken.

Farmers who are interested in detailed plans for corn cribs can secure them by writing to the Agricultural Engineering Section of the Iowa Agricultural Experiment Station, Ames, Iowa.

Appendix D

Storing Corn from One Crop Year to Another

Some additional considerations are involved in storing from a bumper crop year over into another crop year.

In the first place, both the two important items of shrink and rise in grade may be dropped entirely out of the question. After August of the first year there is no further shrink and, therefore, no further change in grade from that source. There may be a slight general deterioration, but if the corn was sound when first put into storage and properly stored, the deterioration will be small.

Interest and insurance continue the same as for winter to summer storage, namely ½ cent a month.

Vermin destruction may become worse as the pests get established.

2From Iowa State College, Current Economic Series Report No. 4, the Bumper Corn Crop Surplus. (Now out of print.)
but the cost of a good crib which should prevent such loss will continue to run at 3 cents a bushel a year.

We saw that the crib charge for winter to summer storage would be one-sixth of 3 cents, or one-half cent a month. For year to year storage, it is probable that the crib would be used on the average only once in two years; that is, from a large to a small crop, but not from a small to a large crop. Two years' crib cost then, or 6 cents, would be charged against one year's storage. This would bring the crib charge for year to year storage to \( \frac{1}{2} \) cent a month, the same as for winter to summer storage.

The total storage cost, then, would be 1 cent a bushel a month, or 12 cents for the full year.

As for the other question, whether the rise in price from one year to another is likely to be more than enough to cover the costs of storage, this much may be said:

By far the most important influence on the price of corn is the size of the corn and oats, or feeds, crop. It has been found, too, that a change in the size of the crop results, on the average, in a change in price in the other direction nearly one and one-half times as great as the change in the size of the crop. That is, for a crop 10 percent smaller than average, we expect a price 14 percent higher than average. The same thing holds true for large crops, except that the price fall becomes greater than 1.4 as the crop becomes larger and larger.

Since it costs about 12 cents to store corn over from a big crop year, the price of corn in the succeeding year should be at least 12 cents more than the price in the big crop year. Applying the arithmetical rule above stated, then such storage should be based on the expectation of the next crop year being at least 8 percent smaller than the one from which such storage is being considered.

The question is, then, should we expect to get a crop 8 percent smaller after storing from a crop that is 104 percent of normal or better, expecting one of the next two crops to fall to 96 percent of normal or lower; or should we store only when the bumper crop is 108 percent of normal or better, expecting one of the next two crops to be 100 percent normal?

This question will not be hard to answer if we go thru the price records and see what would have been the result in each case. Noting the size of the big crop in each case, the first fact that stands out is that in 27 years there were only 7 in which the feeds production was 108 percent or higher; and still further, if, to play safe, 109 percent were taken as the rule, there were only three years with crops 109 percent or higher in size.

This means that if the 108 percent rule had been followed, corn would have been stored in only a quarter of the total number of years during which the crib was being paid for out of the proceeds of storage. And this, in turn, means that the annual crib charge of 3 cents would have to be multiplied, not by two, but by four. That is, it would have been 12 cents per storage year instead of 6 cents, and this would cut into the net profits considerably.

Furthermore, if the 109 percent rule had been adopted, that would have meant that the crib would have been used in only 3 cases out of the 27, or one-ninth of the total number of years. This would necessitate multiplying the annual crib charge of 3 cents by nine, making a crib charge of 27 cents a year instead of 6 cents. This figure would be clearly prohibitive.

---

*From Report No. 4, Page 19, previously mentioned.*
This simply means that in this case, as with most fixed investments, once the investment in a fixed asset has been made it pays to use it as much as possible. It means that whenever the production of feeds goes up to 104 percent, it is wise to use the storage facilities that have been provided, in the expectation of a crop less than 96 percent in size either the next year or the year after that; a profit can be realized in either case, since the crop would be held over that long anyway. The spread will be the 8 percent required to make such storage profitable. We simply expect to get our 8 percent smaller crop from a change in crop size from 104 percent to 96 percent rather than from 108 percent to 100 percent.

In storing from a bumper crop over to the following crop year, it will be found that it pays best to hold until August of the second year. This simply insures that full advantage will be taken of the seasonal price rise in the second year. Such storage will thus usually run from December of the bumper crop year to August nearly two years later, a period of 20 months.

We have found that the full cost of storing corn is a cent a bushel 3 months. Twenty months' storage will, therefore, cost 20 cents. The price of corn must rise more than 20 cents over the period, then, if the storage is to yield a profit.

Let us go thru the years from 1900 down to the present, comparing the price in December of the bumper crop years, when corn would have been put into storage, with the price in August 20 months later, when the corn would have been taken out of storage and sold. We shall then be able to say how often a profit would have been made by storing corn from bumper crops.

For the period since the war, as we have seen, the cost of such storage would be 20 cents a bushel. For the years before the war, however, the price level was only two-thirds of the present price level, and the cost would have been only about two-thirds the present amount. For that period, therefore, we should use 14 cents or 15 cents instead of 20 cents.

Going thru the years on this basis, we get interesting results, which are tabulated in table I. It shows that the crib would have been used to store corn over from 12 bumper crop years out of the total of 28 years since 1900. Eight times out of the twelve, a good profit would have been made over all expenses; twice the storer would have broken even; and twice he would have lost. The total net gain over the whole period would have been $1.31 a bushel. This is equivalent to getting nearly 5 cents a bushel more for corn every year since 1900.

**TABLE I INDICATED GAINS AND LOSSES PER BUSHEL OF CORN STORED; CRIB USED TO CAPACITY.**

<table>
<thead>
<tr>
<th>Crop Year</th>
<th>Net Gains</th>
<th>Net Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1906</td>
<td>10c</td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td></td>
<td>10c</td>
</tr>
<tr>
<td>1905</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1906</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>1910</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>1912</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>1915</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>1920</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>1922</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1925</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>163</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>
Appendix E

Effect of Receipts of Corn at the Market Upon the Price Throughout the Season

Evidence is at hand to show that since 1885 the seasonal price rise has steadily been growing greater. In the Federal Trade Commission report on the grain trade, Vol. VI, page 70, the 30-year period, 1885 to 1915, has been divided into three decades and the seasonal price rise for each decade separately found. And we may find the average seasonal price rise for the two nearly normal recent years, 1921-22 and 1922-23, by reference to the graphs of recent years shown in previous pages of this appendix. If the price rise from winter to summer for these periods be expressed in each case as a percentage of the January price, the results may be tabulated as shown below:

<table>
<thead>
<tr>
<th>Period</th>
<th>1885-1895</th>
<th>1895-1905</th>
<th>1905-1915</th>
<th>1922-1923</th>
</tr>
</thead>
<tbody>
<tr>
<td>First decade</td>
<td>14%</td>
<td>18%</td>
<td>22%</td>
<td>29%</td>
</tr>
<tr>
<td>Second decade</td>
<td>15%</td>
<td>18%</td>
<td>22%</td>
<td>29%</td>
</tr>
<tr>
<td>Third decade</td>
<td>15%</td>
<td>18%</td>
<td>22%</td>
<td>29%</td>
</tr>
</tbody>
</table>

*From Reports Nos. 1 and 4, previously mentioned.*

That is, the rise has more than doubled since 1885. What has been the reason for this increase? Some data given on page 85 of the same report give us a clue. These data show that, if the corn crop disposal year be regarded as running from November to the following October and this 12-month period divided into two halves, then the proportion of the year's total receipts received in each of the two halves for the decades considered before, is as shown below. We have added a fourth period, 1922 to 1925, inclusive.

<table>
<thead>
<tr>
<th>Per Cent Inspected in Chicago</th>
<th>First 6 Months</th>
<th>Second 6 Months</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>First decade, 1885 to 1895</td>
<td>39</td>
<td>61</td>
<td>100</td>
</tr>
<tr>
<td>Second decade, 1895 to 1905</td>
<td>41.5</td>
<td>58.5</td>
<td>100</td>
</tr>
<tr>
<td>Third decade, 1905 to 1915</td>
<td>54</td>
<td>46</td>
<td>100</td>
</tr>
<tr>
<td>1922 to 1925</td>
<td>58.9</td>
<td>41.1</td>
<td>100</td>
</tr>
</tbody>
</table>

This shows that there has been a change since the early days. Until 1905, an average of three-fifths of the corn marketed thru Chicago did not reach Chicago until the second half of the disposal season; only recently have the winter marketings outweighed the summer, but now the proportions in the first decade are almost reversed. That is, about three-fifths of the corn sent to Chicago gets there in the first half of the season, from November to April, inclusive.

Without going into the causes of this heavier winter marketing of corn of recent years, we may simply draw attention to the connection between this fact and the fact of the increased seasonal swing of recent years that has accompanied it. It means several things.

It means that the storage of corn is not profitable purely in itself, so to speak; it is chiefly profitable because enough farmers do not practice it—because nearly 60 percent of the corn that goes to market gets there too soon, in the winter half of the year.

If farmers now were to hold their corn for the summer months to as great an extent as they did in the '90's, and the same "flattening"
of the seasonal curve resulted, it would mean that they would generally hold at a loss. The price rise from December to August would be so much less than occurs now that altho a somewhat higher price would be secured by holding until summer, it might cost more than this rise to get it. Farmers would hold, but at a loss. As the situation is now, however, farmers appear to sell too soon, at a loss.

The ideal situation would be for farmers not to sell heavily in the winter, but to hold just enough over to the following summer so that the resulting price rise would just cover the cost of storing.

The question might be asked, why does this condition not exist now? The reasons are numerous. Some of them are: Some farmers have not the facilities for storing; others are renting, with contracts expiring March 1, so they have to sell their corn before that date; others have corn that might not store well because of its high moisture content; others feel that “a bird in the hand is worth two in the bush”—that 55 cents cash for wet corn in the winter is better than the possibility of 85 cents for dry corn the following summer; they may have lost money once or twice storing after a short crop year, or at some other unfavorable time; and so on.
Appendix F

CORN: FARM STORAGE COSTS COMPARED WITH THE MONTHLY PRICE OF NO.3 YELLOW AT CHICAGO

BIG CROP YEARS

[Graphs showing price and storage costs over time for various years, labeled with percentage and year.

Price --- Storage Costs

The % figures refer to size of crop.

100% means average size crop.
CORN: FARM STORAGE COSTS COMPARED WITH THE MONTHLY PRICE OF No.3 YELLOW AT CHICAGO

SMALL CROP YEARS

PRICE——— STORAGE COSTS  THE % FIGURES REFER TO SIZE OF CROP
100% MEANS AVERAGE SIZE CROP
CORN: FARM STORAGE COSTS COMPARED WITH THE MONTHLY PRICE OF No. 3 YELLOW AT CHICAGO YEARS SINCE THE WAR

PRICE ——— THE % FIGURES REFER TO SIZE OF CROP
STORAGE COSTS ——— 100% MEANS AVERAGE SIZE