Author's Note

This paper is an interesting example of an effective use of a land grant college integration of research, teaching, and extension (public service). It reported research results—research that was generated from addressing problems that surfaced out of extension programs that were in close contacts with business clientele. It was pertinent and timely research. Results were disseminated as they became available on a preliminary basis, making them available as operative business decisions had to be made. All of this fed back into modification in the subject-matter content of resident courses to students who would soon be making the pertinent business decisions on both farms and agricultural businesses. The paper was distributed to grain elevators, grain merchandisers and processors, and county extension agents, and was widely quoted and excerpted by numerous magazines and other trade publications, and eventually circulated throughout the Midwest. The operative title assigned to it by trade publications was "Hieronymus says, 'Get good or get out,' and few of you will survive."

It was a fun experience and may have even had an impact.

Elevator Adjustments to Corn Combines

CHAPTER 20

My comments today are going to raise more questions than they are going to answer. The general subject of change in the country elevator business is actually a whole series of topics, any one of which would take more time than is available. Further, I do not know the answers to all of the questions confronting elevators, yet the questions must be answered now. Thus I shall raise questions about a variety of subjects.

The Nature of the Change

The rapid change from the harvesting of ear corn to the harvesting of shelled corn is resulting in major changes in the processes of conditioning and storing corn. The rate of change in harvesting method is not known. We do know that in the state as a whole the quantity harvested by mechanical pickers decreased from 76.0 percent in 1962 to 65.5 percent in 1963, the amount harvested by picker-shellers remained unchanged at 7.0 percent, and the quantity harvested by corn combines increased from 17.0 to 27.5 percent. These percentages represent a lot of bushels. The increase in the quantity harvest by corn combines was 90 million bushels and brought the total of shelled corn harvested up to 259 million bushels.

One cannot accurately forecast the rate at which the change in harvesting method will proceed. It has been suggested that farmers can economically change only at the rate at which existing corn cribs become unserviceable. I should expect the rate to be much faster. Regardless of the economics, farmers want to change and will proceed to do so just about as fast as, if not faster than, they can find something to do with high-moisture shelled corn.

The change to corn combines is greatly changing the job of conditioning and storing corn. Historically, we have waited to harvest corn until it was dry enough to keep and stored it in slat cribs where it automatically further conditioned itself for indefinite-term storage after it was shelled. A storable product was harvested. Now we are changing to the harvest of a nonstorable product that is capable of nothing by way of self-conditioning or automatic improvement in keepability.

T. A. Hieronymus is professor of agricultural marketing, University of Illinois. Paper presented at the Illinois Grain Dealers' Annual Convention, Peoria, Illinois, May 20, 1964.

The change requires a new technology of conditioning and storage and very large capital investment in new equipment and facilities. From an economic point of view, it is important that this be done with the kinds of equipment and at the locations where it can be done the cheapest and that the correct decisions be made at the outset before large amounts of capital are sunk in the wrong kinds of equipment and at the wrong locations. Sunk capital must be used.

The choice of location is, I think, between farms and country elevators. I do not think it economically feasible nor likely that sufficient amounts of transportation will be made available to move the problem out of the country at harvest. The statistics of the number of boxcars available indicate that we have not had a boxcar shortage the past two falls. Rather, we have had the rapid harvest of large corn crops, in large measure wet, shelled corn. Further, I do not think that the conditioning and storage of corn can be done as economically at destination as in the country. The choice between farm and country elevator is not either all of one or all of the other. The fact is that part of the job will be done on farms and part in country elevators.

Costs on Farms and at Elevators

It is difficult to make a good tabulation of costs of conditioning and storing corn, either on farms or at elevators. Davis has calculated the farm costs that can be avoided by hiring elevators to dry and store, basis a 13,200 volume, batch-in-bin system.[1] These are fixed costs of handling and drying equipment, 2.37 cents; fixed costs storage structure, 3.80 cents; hauling and unloading, 1.45 cents; drying, 2.8 cents; insurance and treating corn, 1.40 cents; for a total of 11.82 cents of which 6.17 cents is fixed costs. To this should be added shrinkage of .5 cents and loss of weight from drying from 15.5 percent to 13 percent, 3.20 cents. The grand total is 15.52 cents. In point of fact, corn dried on farms is often taken below 13 percent so that the shrinkage factor is greater.

Other costs include interest on money invested in corn and personal property taxes. The first of these amounts to about 1/2 cent per bushel per month, and taxes are about 1.5 cents if corn is held past April 1. But these costs exist in the case of country elevator storage.

Two significant points other than the total stand out: (1) a high production of the total cost is fixed investment in facilities; and (2) the cost of the operation for the

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1 V. W. Davis, "Costs of Storing Shelled Corn on Farms," Proceedings of the Sixth Agricultural Industries Forum, Feed and Grain Industries, January 23, 1964.

season is about the same regardless of the length of the storage period. The significance of the first is that once a farmer has made an investment in drying and storage equipment, he can operate fairly cheaply. He is a much easier competitor before he gets equipped than he is after. The point that costs are about the same regardless of the length of the storage period relates to the kind of charge structure that elevators might reasonably use.

Costs at elevators for performing the same services are somewhat lower. Gillfillan has estimated a total cost of 2.43 cents for the removal of 5 points of moisture from 500,000 bushels of corn with a 1,000-bushel-per-hour dryer.[2] As the dryer is used less, the cost goes up.

Cost of storage varies with the kind of storage space. Space equivalent to the kind of farm storage used above is minimal and can be provided cheaply, certainly as cheaply as on farms. The extra in-and-out costs are certainly as low as those encountered on farms.

There are intangible costs in the farm drying and storage operation that do not get into the tabulation. One is labor balance. The job must be done at one of the busiest times of the year and requires a relatively high degree of skill. Second, there is risk of quality loss that is not encountered when elevator services are hired. Third, unless the drying capacity is very large, the harvesting period must be extended to such an extent that a part of the gains from smaller field losses of combines are lost. Fourth, we have assumed that farmers dry corn just down to a keepable level. In actual practice, much of the corn is dried to lower levels with an accompanying greater weight loss than indicated. Finally, we should mention the heavy capital investment that farmers must make in the whole line of new equipment. There is a factor of capital rationing that may imbalance the farm business.

I have only a limited tolerance for the detailed arguments about where the job can be done more cheaply. There is no serious doubt in my mind that conditioning and storage of shelled corn can be done for substantially less at country elevators than on farms. There are several inherent advantages that elevators have.

First, there are economies of scale in drying. The total capacity required for drying a million bushels is less if concentrated in one unit than if scattered in many. It is less if the drying period can be extended than if it must be done all at once, as is the case on farms. The operating costs (fuel, labor, maintenance) are less in large units.

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[2] R. A. Gillfillan, "Drying and Storing Corn at Country Elevators," Proceedings of the Sixth Agricultural Industries Forum, Feed and Grain Industries, January 23, 1964.

The quality of the drying job is greater if the time is extended and specialized personnel are used.

Second, there are economies of scale in storage. The history of grain storage is one of a few large units rather than many tiny units. I do not think anyone who had the job of storing one million bushels of corn would build 500 individual bins of 2,000 bushels each rather than a single large unit.

Third, a more minimal job of conditioning and storing can be done at elevators than on farms. The key problem is to do the least possible amount of conditioning and storage necessary to cope with the speed of harvest. On farms it is necessary to prepare the corn at the time of harvest to keep indefinitely without further supervision. In elevators it can be conditioned the minimum amount necessary to maintain quality for the immediate future. The full conditioning job need be done only for the corn that will be kept indefinitely. The use of temperature devices and specialized personnel and the flexibility of elevator operations enabling the quick removal of grain that is in trouble makes it possible for the elevator to walk a much more dangerous line of keepability than a farmer can.

Fourth, elevators can get a better space utilization than farmers can. A bin on a farm is used to store the corn produced on that farm when the farmer wants to store it. Otherwise, it sits empty and the equipment is unused. The elevator has access to several kinds of grain, and some corn is going to be held back on farms until after harvest. Thus the average occupancy can be higher.

In addition, the corn is finally going to move through an elevator. This requires a substantial facility even if the off-farm movement is spread exactly evenly through the year. To a considerable extent, this loading part of the facility can have a storage use as well, further reducing the total storage required at central locations in contrast to that required on farms. In connection with better space utilization, it should be kept in mind that a high proportion of the cost of storage is in the fixed costs of investment and depreciation. Empty space is expensive.

Fifth, elevators can come much closer to meeting the quality for which the market is willing to pay than can farmers. Corn stored on farms has to be put in the highest possible quality and kept there. The market simply does not pay for this quality at all times. Because the elevator can hold higher moisture corn and can blend various moistures and quality, it can furnish each of the outlets for corn with the quality for which it is willing to pay. There is an inherent advantage in integrating conditioning, storage, and merchandising.

Sixth, elevators can do an excellent job of maintaining the quality of corn. It is more difficult for farmers to do so. Much has been written and said about the effect of high temperatures and rapid drying on the quality of corn. Some market

outlets do not want country dried corn because much of it is damaged. Country elevators can maintain market outlets better if they condition corn than if it is dried on farms.

In summary, conditioning, storing, and merchandising of corn constitute a major economic activity in which substantial benefits can be obtained from the economies of scale, application of advanced technology, and specialization.

The Opportunity and the Hazard

The conditioning and storage of corn is a major economic activity. The change from one system—slat crib storage of ear corn—to another is a major change requiring new technology and major capital investment. If a high proportion of this activity is transferred off farms, a large growth in the total activity of country elevators will occur. The country elevator industry has a great opportunity for growth. Add to the growth opportunity of taking on new functions the rapid increase in the total production and marketing of grain in Illinois, and we necessarily foresee a bright future for the industry.

To capitalize on the opportunity, the industry must move rapidly. The key consideration is to get the facility investment made in the right place, which, I think, is off farms rather than on farms. To the extent that the investment is made on farms, elevators are going to have to wait until that sunk capital is exhausted before getting that particular lot of business. I do not think that farmers are going to wait to get corn combines until elevators are ready to take corn from the fields. They are changing and will continue to change.

As is true of every major change, there is not only opportunity for growth of individual firms, but there is also a hazard to survival. The business is going to go to the elevators that can receive corn as fast as farmers want to bring it in. The experience of the past two years has made this quite clear.

The hazard in the country elevator field is doubly great because of the large number of elevators. Originally the distance between elevators was established by the distance that grain could reasonably be hauled from farms with horses and wagons. Obviously this has changed, and I think it is clear that if we were starting from scratch today the spacing would be quite different.

The density of elevators in Illinois is quite great. For example, there are approximately 47 elevators in Champaign County. The total sales of grain off farms per elevator in 1962 averaged 352 thousand bushels of corn, 132 thousand bushels of soybeans, 16 thousand bushels of oats, and 33 thousand bushels of wheat, for a total of 532 thousand bushels of grain. In Logan County, 33 elevators handled an average of 300 thousand bushels of corn and 100 thousand bushels of other grain.

Obviously, these volumes were not evenly distributed, and there are a lot of units that operate on a quite small volume.

I do not know what the minimum volume for survival in the new technology is, but I suspect that it is larger than the average now being handled. If so, there are many elevators marked for extinction in the future. By way of illustration, suppose that two million bushels of all grain handled per year is a viable number. Some thirteen elevators would be required in Champaign County. If this many elevators were spaced equidistantly, no farmer would be more than 5 to 6 miles from an elevator. Such spacing is not possible, but 5 to 6 miles is not very far either. I was tempted to work the exercise out on the basis of a 10-mile maximum haul, but it was too bloody.

The essential conclusion is that now is the time for each firm to look to the future, to make plans to get in a fully modern way or to get out, either now or by gradually dwindling. And in more cases the decision should be to get out than to get in. The blunt truth is that the economics of the situation indicate that territories need to be consolidated. Merging of territories is a more graceful and mutually profitable system than competitive extermination.

What Are the Adjustments?

Elevators need to make adjustments so that they can follow four basic rules. The first of these is to put themselves in a condition so that they can take farmers' corn at the time that they want to bring it in and give the farmers a choice between selling on delivery and storing at the elevator. Farmers are not going to tolerate waiting for long periods in line or stopping harvest for very long before they either take corn elsewhere or provide on-farm facilities for conditioning and storing.

Further, farmers generally want to be in a position to speculate in the price of corn. They do not want to be in a position where they have no choice about whether to hold or sell at harvest. The long-run average price change is just equal to the cost of storage. However, the difference between the harvest price and the subsequent season's high is usually greater than the cost of storage. There is money to be made from successful speculation, and farmers want the chance to try. In 1963 20 percent of the corn was marketed directly from the field, and only 3 percent was stored off farms. The percentage marketed was greater than traditional harvest sales have been. It was greatest where the harvesting of shelled corn was greatest. For example, in the east-southeast crop reporting district, 44.5 percent was harvested shelled and 30 percent sold from the field, while in the central crop reporting district 36.5 percent was harvested shelled and 20.5 percent sold from the field. For the past two years farmers have been quite tolerant of being forced to sell at harvest, but I do not think that this tolerance will be a thing of long life.

The second rule is to charge an amount for drying and storing that will price a maximum of the job off farms. It goes without saying that charges must be high enough to cover costs and return a profit. But the economics are sufficiently in favor of off-farm conditioning and storage that a price above elevator cost but below farm cost can be established.

It is possible to charge a higher price for services in the short run than will stand up in the long run. The pressure of harvest the past two years has made some rather large elevator charges possible. Yet the wisdom of charging all that the traffic will bear in a particular year is questionable. A study of farmer attitudes made by Richard Gillfillan and reported at the Agricultural Industries Forum this year indicates different attitudes of farmers toward on-farm drying and storage and elevator storage in different areas. They tend to favor elevator storage in an area where charges are rather low, and farm operations in an area where charges are higher. Elevators are going into this business for the long run and should maximize long-run rather than short-run profits.

In this connection, elevators have a major teaching job to do. Farmers frequently fail to add up all of the costs involved in on-farm operations and are rather quick to suspect elevators of charging too much. The real on-farm cost structure needs to be explained to farmers, and I am afraid that a lot of this explaining is going to be left up to elevator operators.

Third, elevators must walk a fine line of danger on the brink of corn going out of condition. The worst bottleneck in dumping corn as fast as farmers want to bring it is in the conditioning processes. A large share of the cost of drying is investment in the dryer itself. The objective is to minimize the drying capacity and yet get the job done.

The largest advantage that elevators hold over farmers is their ability to hold corn at fairly high moisture. On the one hand, this enables them to avoid the weight loss taken by farmers from drying below 15.5 percent, and, on the other hand, it enables elevators to extend the conditioning process out over a much longer period of time than the harvest. This extension reduces the amount of dryer capacity required and the dryer operation costs.

Fourth, the average percent of occupancy of space must be maximized. The space required is determined by the harvest receipts of corn and soybeans minus the amount that can be shipped out during the harvest. The aggregate need for space in the state declines as the season progresses and supplies are used up. The total amount that is in storage in all space farm, country elevator, processors, and terminals is determined by forces other than the actions of the storage industry. The aggregate percentage of occupancy is determined by immutable external forces. The

objective of the individual firm is to get more than an equal share while, of course, getting paid for the use of space.

Individual firms can influence the percentage of occupancy above an equal share or let it fall below. In general, country elevators are in a better position than either terminals or processors; they get first chance at the grain and have a lower cost structure. There is a lot of skill involved in space management. The good managers are going to have a higher occupancy rate and obtain a higher return per bushel of grain in storage than are poor managers.

There are three main sources of income from the use of space: warehouse rental, hedging of owned inventory, and merchandising. The first claims on space are by farmer customers. This reverts to my first rule: the need to satisfactorily serve farmers.

On occasion, space can be rented to processors, but these opportunities have not been great in recent years. In addition, this business can be declined if more profitable opportunities appear, particularly through hedging.

Much has been said about the demise of CCC as a factor in the storage market. However, much as I might like to write them off, to do so would seem premature. It appears to me that there will be a substantial increase in the carryover of corn on October 1 of this year. The increase will be carried by CCC and stored, primarily, in warehouses. CCC is also going to acquire some soybeans. The prospective 1964 crop of soybeans now looks larger than use and implies a further buildup. If farmers continue to get corn yields as high as in recent years, the current loan of $1.10 is above market equilibrium, and inventories will accumulate.

The use of hedging-owned inventories as a means of selling space is a subject in itself. It seems sufficient at this point to suggest two things: (a) there is substantial variation in the results of hedging obtained by different operators, and (b) so long as prospective gross returns are greater than out-of-pocket costs, space should be filled with hedged inventories.

During the past two years the basic gain available from hedging has been less than in the several preceding years. This was caused by the rapid decrease in CCC inventories of corn. But I am optimistic about hedging opportunities at country points in the future. There are two principal reasons for my optimism. First, there is a tendency for the cash price in the country to gain in relation to the cash price at terminals. At harvest the country tends to be tributary to the terminal while later in the season it is not. Thus, the country has a better basis gain built in than the terminal. Second, there is a tendency for the basis to be set by terminal elevators. They are the people who deliver or move hedges forward during the delivery

month. They try to operate at cost or higher. So long as the terminals can make cost, the country can make a profit because of lower costs.

Storage space is essential to a good merchandising program and, conversely, a good merchandising program can make the ownership of space profitable. One aspect of merchandising is the blending of various qualities and moistures of grain. If there is opportunity to have a variety of qualities and moistures of grain on hand and this opportunity is used, profits can be obtained from blending operations. The country grain trade in Illinois has learned to do this out of CCC corn sales.

In the future, there will be a wide range of moistures of corn available most of the time. There will be just as high moisture from combined corn as elevators will let farmers bring in, lower moisture from combined corn as harvest progresses, picked corn at about 20 percent moisture, and moisture content of dried corn ranging down to an over-dried 9 or 10 percent. Elevators will hold corn at various moistures until summer so that blending opportunities will always be present.

A second aspect of merchandising is picking a time to sell when the local market is high in relation to other locations. The market directs the flow of grain by increasing the price at the points from which it wants to draw grain and decreasing the price at others. Thus, at any given point the price of a grain is like a cork on a lake, continually rising and falling in relation to the general level of the lake. Only out of an existing inventory can the opportunity to make premium sales be used.

How Much and What Kind of Storage?

In view of the major adjustments that confront elevators, the pertinent question is not how much space can be effectively used, but what is the minimum amount of space that will accomplish the job of taking corn as it is harvested.

The minimum, in addition to the necessary soybean space, is equal to the harvest receipts minus the amount that can be shipped during harvest. During the harvest last fall, we tabulated the receipts of five central-Illinois elevators. During the nine weeks ending October 5 through November 30, they received three million bushels of corn. Receipts the week ending October 5 were 100 thousand bushels, and receipts the week ending November 30 were 27 thousand bushels. The peak was the week ending October 26 at 750 thousand bushels. Inasmuch as the year is not yet completed, we do not know how large the total receipts from 1963 will be, but it appears that on the order of 40 percent of the year's receipts were in the nine-week period.

An ordinary kind of boxcar allocation for shippers of the size in the study might well be 10 per week per elevator, or a total of 450 cars for the nine weeks. This number of cars would move about one-third of the harvest receipts and leave an accumulation of two-thirds.

I do not think that this rudimentary data can be applied to other elevators. I use it only as an illustration of method. Each elevator should now look back on last fall's receipts and shipments, adjust these for the losses from its usual trade territory because of closed time, and for amounts shipped by abnormal transportation procedures.

The experience of last fall is not a reliable guide to next fall. The harvest receipts last fall were a higher percentage of the receipts for the year than the year before, and it appears likely that there will be a further peaking of receipts next fall as the use of combines continues to expand.

Some estimate of the long-run requirements can be made for individual territories by making assumptions about the ultimate percent of the crop that will be combined and the share that will be stored on farms. The balance should be delivered to the elevator. From this, the potential shipments can be subtracted. The balance is the corn storage space requirement.

While at the university we are attempting to work out some norms for the state as a whole; the adjustments in capacity of elevators should be based on studies of individual trade territories.

The kind of space that should be erected is a much-discussed question. Arguments develop between upright concrete and flat space, and each has advantages and disadvantages. The answer may well lie in some balance between the two.

Upright space has the advantage that grain can be moved quickly and cheaply. As the number of times that space is filled and emptied each year increases, the value of this advantage increases.

A second advantage of upright space is that as problem spots in corn develop, they can be eliminated more quickly and cheaply. This could prevent a major financial loss. Corn of much more questionable keeping quality can be put in upright rather than flat space.

One can envision the problem encountered if a heating spot is detected in the center of a flat bin of 120 thousand bushels of corn in the middle of a busy harvest!

A third advantage of upright space is the flexibility in binning various moisture and qualities of corn and in blending operations. In this connection a substantial amount of upright space appears essential.

The primary advantage of flat space is the cheaper construction cost. This reduces capital cost and, presumably, depreciation. Capital and depreciation cost on flat space is calculated at 3 to 3 $^1/_2$ cents per bushel per year compared to 6 to 6 $^1/_2$ cents for upright concrete storage space. Offsetting the lower cost of flat space is the high cost of putting grain in and out. The in-and-out costs vary substantially from elevator to elevator, depending on the physical situation.

A second advantage that flat space may have is in the ease with which grain can be held under aeration. It is suggested that the smaller distance that air must be pulled through corn in flat space increases the ability to hold high-moisture corn. Offsetting this is the difficulty of moving hot spots. I think the fact is that we do not fully know what can be done with aeration, either in flat or upright space. A lot of people are gaining experience this year.

The debate between flat and upright space must also relate to the question of drying capacity. It seems fairly clear that the flat space must relate to once in and once out each year because of the cost of moving corn. Thus, it follows that corn that is to be put into flat space must be put in adequate condition to hold at least until spring under aeration.

On the other hand, it seems to be possible to do a limited amount of drying of corn that is to go into upright space on the first pass through the dryer. This may well extend to simply blowing cold night air through the corn and holding it under aeration until the flush of harvest is passed. To the extent that drying capacity can be reduced, the higher capital cost of upright space is offset.

There is a system of holding and conditioning corn from corn combines that I should like to see experimented with further. It is to accept corn at harvest only as the moisture content is under 25 percent, take the moisture down to 18 percent on its first trip through the dryer, hold it in upright tanks under aeration until the press of harvest is past, and then gradually bring the moisture of the whole house down. By this process, the drying capacity and operation is minimized, and the elevator is in the position of always selling maximum-moisture corn. There is always moisture corn available to mix with corn of less than 15.5 percent moisture that comes in from farms. It should be kept in mind that a key advantage that elevators have over farmers is that they can avoid the weight loss associated with drying corn below 15.5 percent.

The Charges to Make

There is a great range in the charges that elevators make for drying and storage of corn. This is to be expected in a fast-changing situation; however, it is to be both hoped and expected that the charge structure will stabilize into a fairly uniform pattern.

The key consideration in the charge structure is to charge enough to make a profit but to keep charges low enough to prevent farmer investment in on-farm facilities. The charge structure should relate to the cost of performing the various services; that is, some services should not be priced below cost and others above. In the country elevator business we have seen handling margins falling well below cost so that elevators could obtain corn to store for CCC. Once these distortions get institutionalized, they are difficult to correct.

The charge for drying can be related to the implied charge in the market discount schedule. At one-cent discount for each half percent above 15.5, the market charge is the equivalent of .6313 cents per bushel per point of moisture at a price of $1.10 per bushel, or .7557 cent per bushel per point of moisture at $1.00 per bushel. This assumes that the elevator takes 1/2 percent invisible shrinkage.

A charge of .75 cent per bushel per point seems to be common around the state. It is high enough to be moderately profitable and definitely low enough to price the job off farms. At a cent per bushel per point of moisture, a substantial number of farmers will be encouraged to own dryers.

Storage charges are more variable, covering a wide range of prices from lump sums for the season to daily charges. One guide to storage charges is the cost of storage. Gillfillan arrived at a storage cost of 6.13 cents per bushel for the period of October-March and 8.54 cents for October through August for storage in upright concrete space storing one million bushels and fully occupied.[3] These costs include allocating expenses among drying, storing, and merchandising, and require assumptions about other grains handled. They do not include property taxes on corn or interest on the value of corn.

A very high proportion of the cost is fixed, that is, is incurred regardless of the length of time that corn is left in storage. Most of the 6.13 October to March cost is attributed to the first month. The cost structure suggests a season's charge or certainly a charge that has a high minimum payment.

Another guide to the appropriate storage charge is the market price of storage as it is indicated by basis patterns. I calculated the basis change, east-central Illinois points, nearby contract, from the first day of each month to the last day for the period October 1958 through April 1964. The results follow on the next page.

The basis pattern is much as we should expect; there is a rapid basis gain (high price for storage) at and immediately following harvest, and a quite slow basis gain (low

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[3] R. A. Gillfillan, The Effects of Field Shelled Corn on Country Elevators, M.S. thesis, University of Illinois, 1964.

price for storage) later in the year. The price of storage is high when the quantity of corn is large in relation to the available space, and the price is low when part of the crop has been used up and some space stands empty.

I adjusted the basis gain downward by 1/2 cent per bushel per month because of the interest cost that the elevator avoids if it stores for farmers rather than stores hedged corn. I have thus arrived at an opportunity cost of storing corn for farmers. The cumulative total for the first three months averaged 7.4 cents, and the average per month thereafter through July was approximately .4 cents per bushel per month. The cumulative total through July was 10 cents.

	1958–59	1959–60	1960–61	1961–62	1962–63	1963–64	5-YR AVG	MINUS 1/2 CENT INTEREST	CUMULATIVE TOTAL
Oct.	2.125	2.750	-3.375	1.750	1.500	-3.750	.950	.450	.450
Nov.	6.625	2.625	.750	5.875	1.250	4.750	3.425	2.925	3.375
Dec.	1.750	3.375	11.125	2.125	4.250	6.125	4.525	4.025	7.400
Jan.	- .375	1.375	.375	2.250	.875	-1.125	.900	.400	7.800
Feb.	- .875	.250	.562	1.500	-1.125	1.500	.075	-.425	7.375
March	2.250	2.875	.125	- .625	.625	.625	.850	.350	7.725
April	2.125	- .250	3.875	.625	-1.250	1.375	.825	.325	8.050
May	.375	.500	- .500	3.625	1.750		.950	.450	8.500
June	.250	3.375	.250	1.250	2.000		1.425	.925	9.425
July	.250	.500	3.625	-1.125	2.000		1.050	.550	9.975
Aug.	.250	.625	-750	.125	-1.875		0	-.500	9.475
Sept.	-8.250	-4.500	3.875	2.250	-8.875		-5.125	-5.625	3.850
Total through July	14.500	17.375	16.875	17.250	12.000				
Total through August	14.750	18.000	17.625	17.375	10.375				
Total through September	6.500	13.375	21.500	19.625	1.500				

The data shows a rather small basis gain during October and the largest basis gain in December. As the use of corn combines increases, we should expect the harvest pressure to occur earlier.

This data suggests that a rate of, say, 2.5 cents for October, 2.5 for November, 1.5 for December, and $^1/_2$ cent per month thereafter would be a reasonable charge system. Such a rate system should price the storage job off farms. The rate is high when farmers least want to store corn, the charge for the first three months is a low total so that there is no clear gain to farmers for erecting storage, and the ten-cent total for the year seems to be an acceptable figure.

These numbers that I use here are tentative suggestions rather than firm recommendations. There is one aspect of the problem about which I wish to be quite emphatic: because of the high proportion of the costs that are fixed and are thus incurred when the space is made available and because of the structure of opportunity costs, the rate charged for the harvest and immediately following period should be much larger than that for the balance of the year and should be large enough to cover all of the fixed costs for the season.

Some Warehouse Receipt Problems

The development of corn storage operations along lines that I have been discussing may necessitate some changes in warehouse rules and law. One problem is the permissibility of a charge schedule such as I have just been discussing. Frankly, I do not know nor have I looked into the question of its legality or permissibility. It makes economic sense. If it contradicts the law or regulations, then it will be necessary to change the law or regulation.

A more difficult problem is the quantity and moisture content for which warehouse receipts should be written. Suppose that a general practice develops of taking in 23-percent-moisture corn and gradually reducing the moisture content of the whole houseful to 14 percent by summer. How shall warehouse receipts be written? If the delivered quantity is receipted at 23 percent, the house will not have enough corn to cover the receipts. If the receipt is issued for a lesser amount of 14 percent moisture, the house will not have the right quality. It rather appears to be a question of which crime the warehouseman would prefer to be convicted. Yet he will be performing as a prudent and efficient warehouseman.

One solution that occurs to me is to issue receipts at three different times. One might be issued for 18 percent corn at harvest, the first one called in in January and a new one issued for a smaller quantity at 15.5 percent. Finally, the second might be called in May 1 and a third one issued for a still smaller quantity at 14 percent.

A simpler solution would be to write a receipt that would specify different quantities at different moistures for each month, and the quantity and moisture that the farmer would receive would depend upon the time that the receipt was presented. These automatically declining balances would, of course, be based on a constant quantity of dry matter.