PN-ABJ-136

Postharvest Grain Systems R&D

Special Report No. 33
September 1991

INTEGRATING THE TECHNICAL AND MARKETING APPROACH FOR PROFITABLE UTILIZATION OF GRAIN POSTHARVEST TECHNOLOGY

KSU
KANSAS STATE UNIVERSITY

Food and Feed Grains Institute
Manhattan, Kansas 66506-2202
USA

PN-ABJ-136
ISN 73360

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Prepared by

Cornelius Hugo
Richard Maxon
and
Ulysses Acasio

for the

AGENCY FOR INTERNATIONAL DEVELOPMENT
UNITED STATES DEPARTMENT OF STATE

DAN-4144-A-00-1020-00
Postharvest Grain Systems

at

Kansas State University
Food and Feed Grains Institute
Manhattan, Kansas

Contribution Number 92-74-D, Kansas Agricultural Experiment Station Kansas State University, Manhattan, Kansas

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SECTION I

INTRODUCTION

Very few agricultural products are consumed in the form they are produced. They must be cleaned, processed, milled, cooked, and/or combined with other items before they can be eaten by consumers or used in industry.

Agricultural production is seasonal while the use of commodities is at a steady rate. Products must be stored for varying lengths of time to have them available when needed. As urbanization has increased, foodstuffs must be transported over greater distances to find market outlets.

The Use of Technology

Technology is increasingly employed to preserve, protect, and change the form of agricultural commodities. Each new generation of technology tends to be more precise and efficient in obtaining the desired results. New technology also tends to be more capital intensive and requires higher skill levels for proper application.

Producers who fully employ new technology often fail to benefit economically. One frequently hears the lament "if I am so rich in production and technology, why am I so poor and deep in debt?" Why should this be so?

The answer lies in the differences between the form and time of consumption, and in the consumers' perceptions of their needs. What buyers are willing to pay depends upon their own value systems and the intended use for the commodity. A rice buyer who makes industrial starches and adhesives has much different requirements than the chef preparing meals in a five star hotel. Both may buy rice from the same market, but use different criteria to check if the rice available meets their needs.

For generations, producers had relatively few decisions to make. They planted and harvested when nature decreed the time was right. Marketing was simple. The landlord took a fixed share and the financier took his due. The family kept what was left for their own consumption, or exchanged small quantities for other necessities.

As technology comes into use, matters become increasingly complicated. The volume moving to markets is larger, harvest seasons are shorter, and surpluses need to be stored. Markets can be local, regional, national, and international. Products can be sold "as is" at harvest, or later in different forms. Some technologies are suitable for only small scale use. Other capital intensive technologies require very high volume applications.

We must look at both the technical and economic issues involved. The economic questions cannot be easily separated from the technical ones. Employing technology to the fullest does not guarantee that it will bring about a higher level of well-being for the producer. Yet the common perception is that once technology is available, it must be fully used. It is the contention of this

report that knowledge of postharvest technology should be fully utilized, but the actual use of technology should be conditioned by market values.

Objectives, Goals, and Structure of Presentation

This report was developed to provide a simple method to determine when and to what extent postharvest technology should be employed by producers and producer associations.

The system can also be used by the public sector in evaluating policies. The private sector can use the methodology to determine if a new technology might be profitable for the firm making it, or the producer using it.

Section II attempts to bring about understanding of the differences between a technical and marketing approach to grain postharvest management. Later in the section, the technical and marketing approaches are integrated.

Section III explains the use of the integrated approach in making practical marketing decisions. Section IV presents a case study to illustrate the integrated approach, and assist the reader in developing his or her own approaches and methodology.

The system as presented in this report oversimplifies the decision-making process in many respects. Some of the hard questions are ignored such as "how do you calculate the cost of drying or cleaning?" Fixed costs are largely ignored, although the income generated from commodity sales must eventually pay for the acquisition and eventual replacement of any technology.

Over time, producers, manufacturers, marketeers, researchers, and planners do develop answers to these questions, or use shortcut proxies instead. The main concern of this report is to systematize and simplify postharvest decision-making processes.

SECTION II

THE TECHNICAL VERSUS THE ECONOMIC APPROACH TO POSTHARVEST GRAIN MANAGEMENT

The Quality Concept

The term "quality" is often confused with "expensive" in daily usage. As consumers, we have been taught to expect that "quality costs more" through advertising and brand name promotions.

Another common usage of "quality" is to describe changes in our feelings about a product. "Its just not as good as it used to be - the quality is lower" or "the quality has improved" is used to express pleasure or dissatisfaction without specifying the exact cause.

From the users perspective, quality can be based upon physical, psychological, or economic factors. Most often, all three elements are used to define quality. Physically, quality can be based on the presence or absence of certain shapes, chemical elements, colors, product uniformity, degree of maturity, and other physical factors.

Psychologically, quality is in the context which the product is consumed. For example, broken and whole grain rice have about the same chemical composition and nutritional properties, yet one or the other is considered low quality depending on who the consumer is. Many foods are less appealing and appetizing when accompanied by rice that lacks expected color, texture, or aroma.

Economically, quality represents the link between consumers' desires and the resources needed to satisfy them. To what degree these desires can be satisfied depends on the price consumers are willing to pay verses the costs of fulfilling such desires. This then dictates our allocation of resources. How much will a miller pay for long grain rice when his market outlook is for short grain rice? Will anyone pay the cleaning, drying, and storing of grain for six months or more?

Thus "quality" should be associated with **suitability for intended purpose**. This value or suitability can be described in both technical and economic terms.

Economic and Technical Utilities

In general, something of value is created through **utilities**: that is, performing a task or service for which others are willing to pay or exchange other goods and services. There are four utilities; form, place, time, and possession. The utilities can be examined from both technical and economic perspectives.

Form Utility. The creation of a good or changing its characteristics to something more appropriate for storage, processing, or consumption. Examples: cleaning and drying of grains; milling wheat into flour, paddy into rice;

The economic approach is concerned primarily with the costs of performing these tasks in both monetary terms and the resources required. The economic approach also determines how much consumers are willing to pay for the commodities or services, and compares the value of the forms created with other commodities that may be substituted in their use.

The technical approach concentrates more upon the physical and biological changes that occur in the creation of a form, and the labor, equipment, and skills required to complete the transformation. Often the results are measured and quality assigned on basis of how the actual product compares with what is absolutely or theoretically possible. The closer the product becomes to its highest potential, the higher the quality rating.

Place Utility. Moving products from where produced to where they are needed for consumption. Example: transporting rice from surplus rural areas to deficit urban areas.

The economic approach concentrates largely on determining where the highest financial returns can be obtained from geographic dispersion. This involves study of demand and supply by market areas, and determining the most economic transport methods.

The technical approach looks primarily at the resource requirements for transporting commodities, and the protection of those commodities from deterioration or loss during transport.

Time Utility. Storing a commodity from when it is produced to when it is needed. Evening the flow of goods to market overtime. Example: storing grain.

The economic approach studies the cost/benefits of keeping commodities over time, taking into account the possible physical and financial risks during storage.

The technical approach concentrates on minimizing product deterioration during storage. This includes the changes in physical and chemical composition of a commodity during storage, as well as the storage facilities and other inputs required to prevent deterioration.

Possession Utility. Transfer of ownership from those who have a commodity in abundance to those who do not have or need more. Example: a purchase and sales transaction; a donation of grain.

The economic approach is concerned with merchandizing the commodity, advertising and sales promotion, flow of market information, data collection, and market analysis.

The technical approach deals with the technical specification of grades and standards, methods of product testing, and evaluation.

Combining Technical and Marketing Utilities

The guidelines for the technical approach to grain postharvest management are derived from a set of technical parameters and knowledge. When such knowledge and parameters are skillfully applied, quantity as well as quality losses can be kept to a minimum.

The guidelines for the marketing approach to grain postharvest management are derived from a set of marketing parameters and knowledge. When skillfully applied, customer satisfaction, and profits can be optimized.

When these two approaches are combined it is possible to maintain each utility or value within an acceptable technical and economic range. This will then tend to optimize the use of the technology and potential profits. An example might best highlight this basic proposition.

- If shelled corn is harvested at 22.0% moisture at a temperature of 70°F., 10 days at 80.0 to 85.0% relative humidity is the most such corn can be kept without quality deterioration. This is a technical parameter, which if violated will result in spoiled corn and loss of monetary value. To dry the corn to lower and safer levels of moisture, technical parameters and knowledge are used to obtain a uniform cleaning and drying process at least cost. Corn can be stored for long periods at 12.0% moisture content. To dry corn to that level is technically feasible. However, drying implies fixed and variable costs, plus a reduction in the quantity sold. Unless the price received for very dry grain is equal to or higher than the costs involved, it will not pay to reduce the moisture content.

SECTION III

COMBINED APPROACH FOR OPTIMUM USE OF POSTHARVEST TECHNOLOGY

Purpose and Objectives

As producers and marketers acquire postharvest technology, they acquire the ability to change the commodity form and time frame in which they will sell. Grain sellers face choices they had not previously made. A marketing strategy is needed such as (1) to clean and dry or sell as harvested, (2) sell now or later, or (3) perhaps sell small amounts over time rather than all at once. The producers' successful use of their newly acquired power consists of knowing when and what degree to use it.

The following is designed to determine the profitability of postharvest technology in the available markets. These factors deserve emphasis. First, basic grains are not durable and can be perishable at harvest. It is necessary to know how long grains can be kept without spoilage at harvest. Second, the same grain has a different economic and technical value for each buyer, based upon intended use. Third, costs are incurred in changing the quality characteristics (form utility), the location (place utility) and times at which grains may be offered for sale (time utility). The buyer also faces costs of acquisition (possession utility). Coping with these points require a working knowledge of markets.

Structure and Components

A grain market analysis framework is contained in Figure 1. Three basic components: input, output, and methodology make up the structure. Each component contains a series of tables and guides which allow for easy preparation and transformation of the required data.

Inputs. Inputs comprise three sub-components which provide the information needed to analyze the market situation. When the market is known, the best selection can be made for form and time utilities.

The **first sub-component** establishes the availability and quality of local supplies. The **second sub-component** determines what the market wants. **The third sub-component** provides the internal information for calculating costs for changing grain quality and storage costs over time.

What does the market want?

Assessing market demand requires comparison of alternative marketing strategies. The methodology advocated here provides answers by pencil and paper. Hand-held calculators can provide greater depth in analysis. Computer spreadsheets permit instant answers to the "what if" changes that can be made in the commodity or storage period. Figure 1 contains a flow diagram showing the linkages between inputs, methodology, and results.

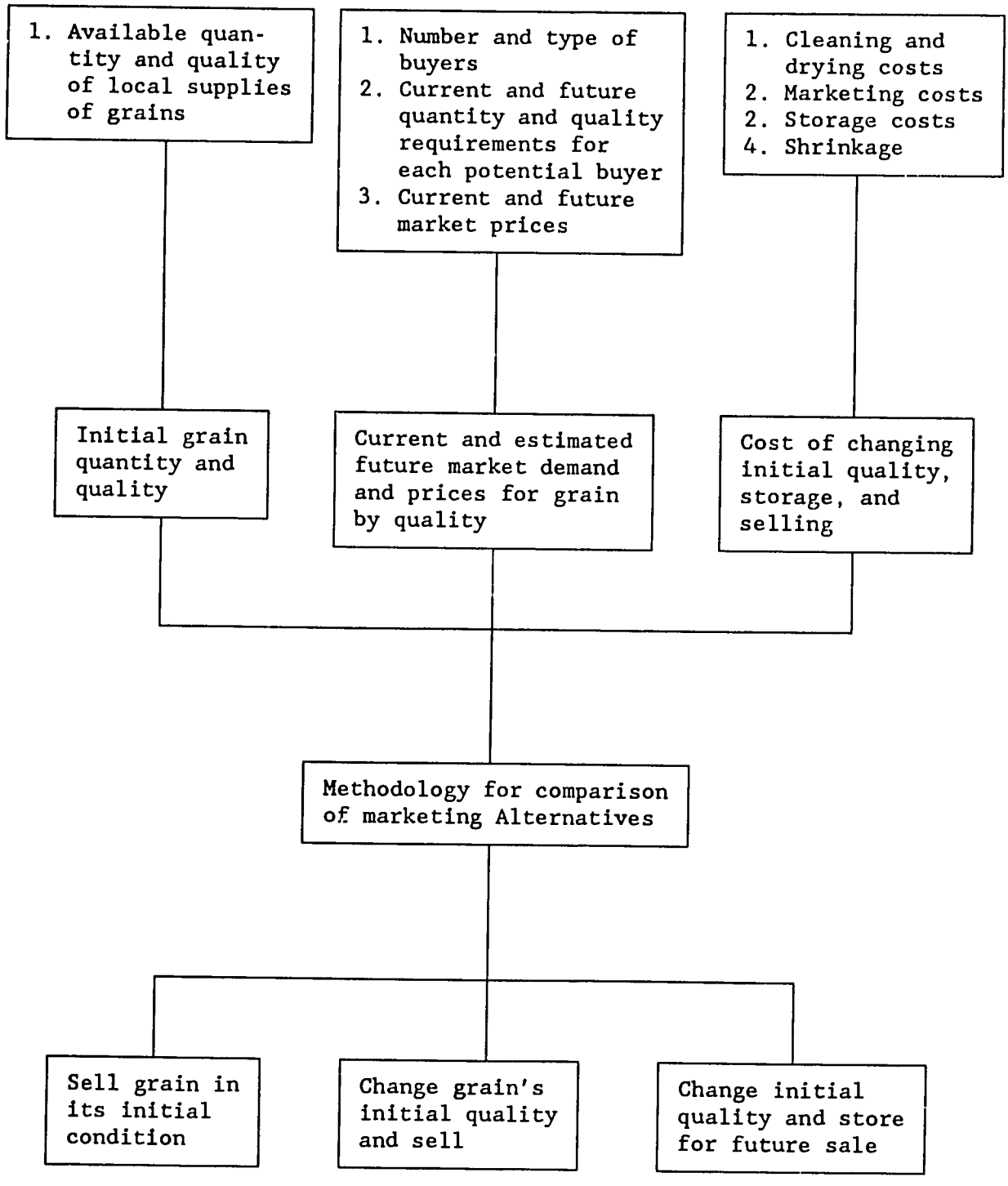

Figure 1. Structure and Components of Combined Approach.

A three step approach defines the potential value of a specific or proposed postharvest technology. First, market outlets are compared without using a given technology. What if the grain was sold as harvested, at the time of harvest (Basis in Figure 2)?

Second, current market outlets are evaluated by changing the initial quality attributes for immediate sale. The costs of using postharvest technology are compared with sale prices and margins obtained (Alternative 1 in Figure 2).

Third, storing and selling at a later time is compared with the technical and economic costs of selling grain in the future (Alternative 2 in Figure 2).

Outputs. The results are easily understood. The most profitable decision may be to sell the grain as is. There is no benefit from creating "form and time utility." On other occasions it might be better to change the "form utility" only, and then sell. The question is to what degree the product attributes are to be changed; i.e., sell high moisture corn at 20.0% or 17.0% moisture content?

In some situations, creating both "form and time utilities" can be profitable. Again, the relevant questions are the degree of change and the length of storage period (time utility). In yet another case, a combination of the three possible outcomes might be optimal, sell some now "as is", sell another portion of the harvest after cleaning or drying, and hold a portion for future sales.

Results of Application. This methodology has been profitably used in Central America and Kansas, USA. In Honduras, each application resulted in an average increase in net income of U.S. five cents per quintal (100 lbs), or $1.10 per metric ton.

In Kansas, a similar approach indicated that in nine out of the last 12 years, it did not pay producers to store wheat on the farm. Prices did not increase enough to cover storage costs. Other marketing alternatives such as hedging and forward contracting would have resulted in higher farm income from wheat production and marketing.

This positive experience in very different markets makes this type of methodology an appealing management and research tool. Individual farmers, formal and informal farm groups, and other market participants can profitably use the techniques. Policy analysts can use the methodology to evaluate policy changes. Researchers of postharvest technology can assess the economic potential prior to release.

BASIS

Initial Grain Quality

Trading Grades Desired and Bid Prices Offered by Current Market Alternatives

Marketing Expenses

Net Income from Selling Initial Grain Qualities to Different Buyers

ALTERNATIVE 1

Alternative Grain Qualities for Immediate Sale

Application of Postharvest Technology and Cost of Changing Initial Grain Quality

Marketing Expenses

Net Income (Income Change) from Selling Changed Qualities

ALTERNATIVE 2

Alternative Grain Qualities for Storage and Later Sale

Application of Postharvest Technology and Cost of Changing Initial Grain Quality and Storage

Marketing Expenses

Net Income (Income Change) from Storing and Later Selling of Changed Grain Qualities

Figure 2. Basis and Alternatives of Combined Approach to Postharvest Management.

SECTION IV

CASE STUDY

Introduction

In Central America, as in other parts of the world, small farmers sell their crop to the itinerant traders, or "coyotes". The coyotes frequently finance the farmer and family throughout the year. The farmer may be under contractual or moral obligation to sell to the trader. The buyers pick up grain in the fields or road side as it is harvested, and transport it to urban centers. Later in the year, small farmers or "campesinos" have to buy back grains for family consumption. The rural families face two problems - lack of money (own working capital) thus creating a dependency upon the middleman, and high grain prices later in the season due to smaller seasonal supplies and transport to and from the urban centers.

In a Central American country, a donor agency sought to alleviate the problem by constructing a network of small community-based storage centers. The farm community was expected to store its grain supplies, thereby avoiding high prices and indebtedness to the traders. Each center was provided with 300 to 800 MT bag storage, a diesel-fired flatbed dryer, scales, and grain protection equipment. Minimal instruction was given to farmer associations in operation and maintenance of the drying equipment, and in storage methods.

However, the situation changed between the conception of the project and its actual implementation. Some rural areas began to achieve self-sufficiency in grain production. The communities receiving the storage centers in these locations looked upon them as a means of access to the markets and for earning money, rather than as self-protection from seasonal food shortages. The Food and Feed Grains Institute was contacted to provide technical training for the centers.

It became evident that marketing skills were critical for these centers to be successful. The most readily available buyers each had a set of buying specifications that were different in regard to impurities, moisture content, and other quality factors. Selling "as harvested" was subject to large price discounts. The prices rose 50.0% or more between harvests. Conditions changed due to surpluses at harvest. The government attempted to stabilize prices through a national grain marketing board, but the company frequently was unable to buy or sell sufficient quantities to achieve this goal. The national grain board did not vary its buying prices throughout the year and adhered to a rigid set of discounts and premiums based upon moisture content and impurities.

The operators of the small centers had to obtain marketing skills quickly to make profitable use of their technology. The producers had relatively low levels of education, but were eager to learn and could follow simple step-by-step instructions. Cheap hand-held calculators were available and headquarters of cooperative organizations acquired microcomputers.

Calculating Marketing Alternatives

A local cooperative association has its dryer and storage for 1,500 bags in place. Their current production of 1,000 bags of corn is ready for harvest at an average moisture content of 18.0% humidity and 4.0% impurities. Without cleaning and drying, the maize cannot be stored more than a month. For long term storage, the moisture should be reduced to 13.0%, and impurities to 1.0%. What is their most profitable market now? Should they sell now, or store for later sale? If they store, when should they plan on selling? The cooperative and its members have an agricultural bank loan of 50,000 LC (Local Currency) at 15.0% interest due when the crop is sold.

Comparing Present Market Alternatives. The local cooperative contacted several local buyers to get their price offers and buying terms. From the information available, the three best markets at present are as indicated in Table 1.

The current trade conditions vary considerably from one alternative buyer to another. No doubt, the least complicated transaction is the one offered by the local buyer, who picks up the grains in the field, pays cash, and discounts a fixed percentage for expected shrinkage. His current price offer is LC110 per LW (Local Weight).

The marketing board has a formal trading grade which discounts or premiums to compensate for deviations from the quality factors associated with the base. Other buying conditions, however, are less favorable, including delivery to the government facilities at seller's expense, waiting up to 60 days for payment, and a fixed price during the year. The base price is LC150.0 per LW for 14.0% humidity and 1.0% impurities.

The feed manufacturer also buys to specifications, which are less stringent than the government's. The seller must deliver, and the base price of LC135.0 per LW will be discounted LC2.5 per LW for each 1.0% humidity above the base of 13.0%. There is no discount for impurities. Payment is within the week and seasonal price adjustments are made.

Net Market Returns by Alternative

To compare the price offers, the cooperative manager completes the "Market Net Return Calculator" as shown in Table 2. The results indicate that given the prices available at this time, the net value from processing for sale to the local buyer as well as the feed mill would be negative. Allowing for a reasonable margin of error in estimating costs, postharvest processing for the local market and the feed mill is not advisable unless these markets increase their prices.

Selling to the marketing board after processing can increase returns, provided that the producers are comfortable in waiting for payment. In our experience, cash in hand or very short-term is preferable to a 2.0% to 3.0% gain but uncertain wait for a government agency to pay.

TABLE 1

PRESENT MARKET ALTERNATIVES AVAILABLE TO PRODUCERS

Type of Market	Price/100 lbs. Local Currency	Basic Purchase Specifications	Other Trade Conditions
Local buyer	110.00	None; Visual inspection; Weigh in field	Cash; Will take 105 lbs. per bag to offset shrinkage;
Marketing Board	150.00	14.0% Humidity 1.0% Impurities	Must deliver; Discounts & premiums of 3.00 per 1.0% from base for humidity & impurities; Payment 30 to 60 days; Prices same all year.
Feed Processor	135.00	13.0% Humidity	Must deliver; Discount of 2.50 per 1.0% humidity above base; No discount for "reasonable" impurities; Payment in one week; Seasonal price changes;

Source: Local market research

TABLE 2

NET MARKET RETURN CALCULATOR
CURRENT MARKET ALTERNATIVES

Weight = LW; Currency = LC) *

Date _____
Prepared by _____

CROP CORN

ESTIMATED AT HARVEST: (1) IMPURITIES (F.M) 0.04% (2) HUMIDITY) 0.18% (3) HARVEST DATE December

(4) OTHER CONDITIONS AFFECTING SALABILITY: Discoloration; Molds; Odors;

	Local Buyer		Feed Mill		Marketing Board	
(5) MARKET: NAME AND LOCATION						
(6) QUANTITY AVAILABLE FOR SALE		1,000		1,000		1,000
(7) PRICE: QUALITY AS HARVESTED	110.00		122.50		129.00	
(8) GROSS INCOME (6) x (7)		110,000		122,500		129,000
(9) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation			3.00	3,000	3.50	3,500
(b) Load/Unload			0.50	500	0.50	500
(c) Interest Cost (15 %)			7 days	353	42 days	2,227
(d) Extra Weight per bag (5 %)	50	5,500				
(e) Other:						
(10) TOTAL MARKETING COSTS (9a + ...+ 9e)		5,500		3,853		6,227
(11) NET INCOME - QUALITY AS HARVESTED (8) - (10)		104,500		118,647		122,773
(12) NET PRICE/LW - AS HARVESTED (11)/(6)		104.50		118.65		122.77

(13) PRICE FOR ALTERNATIVE QUALITY	118.00		135.00		156.00	
(14) BUYER SPECIFICATIONS						
(a) Impurity %	0.02		0.04		0.01	
(b) Humidity %	0.15		0.13		0.12	
(15) WEIGHT LOSS CALCULATIONS						
(a) Impurity Reduction % (1)-(14a)	0.02		0.00		0.03	
(b) Humidity Reduction % (1)-(14b)	0.03		0.05		0.06	
(16) VOLUME FACTORS (Calculate or look-up)						
(a) Impurity (1.00-(1))/(1.00-(14a))	0.9796		0.0000		0.9697	
(b) Humidity (1.00-(2))/(1.00-(14b))	0.9647		0.9425		0.9318	
(c) Final Volume Factor (16a) x (16b)		0.9450		0.9425		0.9036
(17) NET QUANTITY FOR SALE (6) x (16c)		946		943		904
(18) GROSS INCOME FROM ALT. QUALITY (13) x (17)		111,510		127,305		141,024
(19) POST HANDLING HARVEST COSTS						
(a) Cleaning - Cost per Unit x (6)	0.50	500			0.50	500
(b) Drying - LC per 1.00% = LC1.50 Cost per ___% x (15b x 100) x (6)	4.50	4,500	7.50	7,500	9.00	9,000
(20) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation			3.00	3,829	3.50	3,164
(b) Load/Unload			0.50	472	0.50	452
(c) Interest Cost (15 %)			7 days	367	42 days	2,434
(d) Extra Weight per Bag (5 %)	47	5,576				
(e) Other:						
(21) TOTAL MARKETING COSTS (20a + ... + 20e)		5,576		3,668		6,050
(22) TOTAL ALTERNATIVE COSTS (19a+19b+21)		10,576		11,168		15,550
(23) NET INCOME ALTERNATIVE QUALITY (18) - (22)		100,934		116,137		125,474
(24) NET GAIN (LOSS) ALT. QUALITY (23) - (11)		(3,566)		(2,510)		2,710
(25) NET PRICE/LW ALT. QUALITY (23)/(6)		100.93		116.14		125.47

* LW = Local Weight Unit; LC = Local Currency

Options to Current Market Alternatives

Instead of using three different markets, the Market Net Return Calculator can be used to list alternative combinations of postharvest processing for a single buyer. By changing certain key variables, this type of analysis is useful to ascertain whether there is beneficial use of postharvest technology. Some examples are summarized in Tables 3 and 4.

Local Buyer. Three different options were analyzed for the local buyer. These are summarized in Table 3. Two options make the local cooperative indifferent to using its postharvest technology to clean and dry grain for the local buyer. Both result in the same unit price of LC104.50 per LW as obtained by selling the corn at 4.0% impurities and 18.0% humidity. The first option requires the local buyer to increase his price by an additional 3.4% from LC118.00/LW to LC122.0/LW. The second option requires an additional price increase of less than 1.0% from LC118.0/LW to LC119.0/LW, but a 50.0% cut in his extra weight deductions from 5.0% to 2.5%.

The third option consisted of raising the selling price to the local buyer by another 1.70% (from LC118.0/LW to LC120.0/LW) but changing the quality factors to those demanded by the feed mill. The costs under these conditions dropped enough to make the use of postharvest technology at least marginally profitable for the cooperative (LC1.00/LW more). This is a result of not cleaning grain and eliminating all marketing costs.

This third option opens up another indirect way for the cooperative to sell its corn to the feed mill via the local buyer, whose gross margin and net income would be as follows:

Amount delivered to feed mill x price received	= 943 x 135	= LC127,305
Amount received from coop x price paid	= 943 x 120	= LC113,160

Gross margin for local buyer		= LC 14,145
Marketing Expenses		= LC 3,668
Net Income		= LC 10,477

While this third option does pay a return to the use of postharvest technology, some nagging doubts remain as to whether or not it would be advisable to use it. First, selling the grain with its harvest qualities to the feed miller is still more profitable (Net Price of LC118.65 vs. Net Price of LC105.66 for using the postharvest technology); second, an economic rate of return analysis is needed to determine whether or not such an investment is justifiable; third, even if it is, why should the coop go through all this trouble for a lower price? fourth, the additional impurities in the grain might affect the drying operations and therefore the drying costs, altering these return enough to make this option unrealistic.

TABLE 3

NET MARKET RETURN CALCULATOR
OPTIONS TO CURRENT MARKET ALTERNATIVES

(Weight = LW; Currency = LC) *

Date _____
Prepared by _____

CROP CORN

ESTIMATED AT HARVEST: (1) IMPURITIES (F.M) 0.04% (2) HUMIDITY) 0.18% (3) HARVEST DATE December

(4) OTHER CONDITIONS AFFECTING SALABILITY: Discoloration; Molds; Odors;

(5) MARKET: NAME AND LOCATION	Local Buyer		Local Buyer		Local Buyer	
(6) QUANTITY AVAILABLE FOR SALE		1,000		1,000		1,000
(7) PRICE: QUALITY AS HARVESTED	110.00		110.50		110.00	
(8) GROSS INCOME (6) x (7)		110,000		122,500		129,000
(9) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation						
(b) Load/Unload						
(c) Interest Cost (15 %)						
(d) Extra Weight per bag (5 %)	50	5,500	50	5,500	50	5,500
(e) Other:						
(10) TOTAL MARKETING COSTS (9a + ...+ 9e)		5,500		5,500		5,500
(11) NET INCOME - QUALITY AS HARVESTED (8) - (10)		104,500		104,500		104,500
(12) NET PRICE/LW - AS HARVESTED (11)/(6)		104.50		104.50		104.50
(13) PRICE FOR ALTERNATIVE QUALITY	122.00		119.00		120.00	
(14) BUYER SPECIFICATIONS						
(a) Impurity %	0.02		0.02		0.04	
(b) Humidity %	0.15		0.15		0.13	
(15) WEIGHT LOSS CALCULATIONS						
(a) Impurity Reduction % (1)-(14a)	0.02		0.02		0.00	
(b) Humidity Reduction % (1)-(14b)	0.03		0.03		0.05	
(16) VOLUME FACTORS (Calculate or look-up)						
(a) Impurity (1.00-(1))/(1.00-(14a))	0.9796		0.9796		0.0000	
(b) Humidity (1.00-(2))/(1.00-(14b))	0.9647		0.9647		0.9425	
(c) Final Volume Factor (16a) x (16b)		0.9450		0.9450		0.9425
(17) NET QUANTITY FOR SALE (6) x (16c)		945		945		943
(18) GROSS INCOME FROM ALT. QUALITY (13) x (17)		111,290		112,455		113,160
(19) POST HANDLING HARVEST COSTS						
(a) Cleaning - Cost per Unit x (6)	0.50	500	0.50	500	0.00	
(b) Drying - LC per 1.00% = LC1.50 Cost per ____% x (15b x 100) x (6)	4.50	4,500	4.50	4,500	7.50	7,500
(20) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation						
(b) Load/Unload						
(c) Interest Cost (15 %)						
(d) Extra Weight per Bag (5 /2.5 /0%)	47	5,734	24	2,811	0	
(e) Other:						
(21) TOTAL MARKETING COSTS (20a + ... + 20e)		5,634		2,811		
(22) TOTAL ALTERNATIVE COSTS (19a+19b+21)		10,734		7,811		7,500
(23) NET INCOME ALTERNATIVE QUALITY (18) - (22)		104,556		104,644		105,660
(24) NET GAIN (LOSS) ALT. QUALITY (23) - (11)		56		144		1,160
(25) NET PRICE/LW ALT. QUALITY (23)/(6)		104.56		104.64		105.66

* LW = Local Weight Unit; LC = Local Currency

Feed Mill. The option to analyze a potential use of postharvest technology to modify the from utility of the corn for sale to the feed mill was limited to determining what price would be needed to make the cooperative indifferent to using it. As shown in Table 4, first column, the feed mill would have to offer at least a price increase of 2.22% from LC135.00/LW to LC138.00/LW in order for the coop to reach the indifference level. At this point in time, the question to be answered is whether or not the feed mill is willing to agree to a price somewhat higher than LC138.00/LW, which would give the coop the incentive to deliver a dryer grain.

Since the feed mill offers seasonal price adjustments, it would also be necessary to find out what they are in order to determine whether the coop should dry and store the grain for future sale to the feed mill. This option would depend on the storage costs vs. the seasonal price adjustments offered by the feed mill.

Marketing Board. The trade conditions of the marketing board are very clear. The trading grade is based on 14.0% moisture and 1.0% impurities for a base price of LC150.00/LW. The discount or premiums for each 1.0% difference in moisture and/or impurities is LC3.00/LW. Thus, according to the results of Table 2, third column, there is little incentive to alter the form utility of the grain for sale to the marketing board. Definitely, there is no economic incentive to store grain for later sale to the government since storage costs would not be covered.

However, a careful examination of the board's discount table reveals another market opportunity worth exploring. Because the board's pricing structure, premiums or discounts are the same amount per percent for both impurities and humidity. However, we know (or should know) that the cost of cleaning grain is less than the cost of drying, specially when the grain has to be dried to very low levels of moisture content. An analysis of this option is contained in column 3 of Table 4.

It becomes evident that cleaning alone and selling of humid corn to the government can increase the net return by nearly 4.40 LC per unit, even though the posted buying price for grain with 18.0% humidity is 18.00 LC less than the premium price for the maize with grain 12.0% humidity.

Summary of Present Market Alternatives

It is clear that given these current marketing alternatives the cooperative has a limited number of choices which would make a profitable use of postharvest technology.

- The least complicated choice without the use of postharvest technology is the sale of corn at harvest to the feed mill.

- The best choice with partial use of postharvest technology is to clean the grain alone and sell it at 18.0% moisture to the government, if we are willing to wait up to six weeks for payment.

TABLE 4

NET MARKET RETURN CALCULATOR
OPTIONS TO CURRENT MARKET ALTERNATIVES

(Weight = LW; Currency = LC) *

Date _____
Prepared by _____

CROP CORN

ESTIMATED AT HARVEST: (1) IMPURITIES (F.M) 0.04% (2) HUMIDITY) 0.18% (3) HARVEST DATE December

(4) OTHER CONDITIONS AFFECTING SALABILITY: Discoloration; Molds; Odors;

(5) MARKET: NAME AND LOCATION	Feed Mill				Marketing Board	
(6) QUANTITY AVAILABLE FOR SALE		1,000				1,000
(7) PRICE: QUALITY AS HARVESTED	122.50				129.00	
(8) GROSS INCOME (6) x (7)		122,500				129,000
(9) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation	3.00	3,000			3.50	3,500
(b) Load/Unload	0.50	500			0.50	500
(c) Interest Cost (15 %)	7 days	353			42 days	2,227
(d) Extra Weight per bag (5 %)						
(e) Other: _____						
(10) TOTAL MARKETING COSTS (9a + ...+ 9e)		3,853				6,227
(11) NET INCOME - QUALITY AS HARVESTED (8) - (10)		118,647				122,773
(12) NET PRICE/LW - AS HARVESTED (11)/(6)		118.65				122.77

(13) PRICE FOR ALTERNATIVE QUALITY	138.00				138.00	
(14) BUYER SPECIFICATIONS						
(a) Impurity %	0.04				0.01	
(b) Humidity %	0.13				0.18	
(15) WEIGHT LOSS CALCULATIONS						
(a) Impurity Reduction % (1)-(14a)	0.00				0.03	
(b) Humidity Reduction % (1)-(14b)	0.05					
(16) VOLUME FACTORS (Calculate or look-up)						
(a) Impurity (1.00-(1))/(1.00-(14a))	0.0000				0.9697	
(b) Humidity (1.00-(2))/(1.00-(14b))	0.9425					
(c) Final Volume Factor (16a) x (16b)		0.9425				0.9697
(17) NET QUANTITY FOR SALE (6) x (16c)		943				970
(18) GROSS INCOME FROM ALT. QUALITY (13) x (17)		130,134				133,860
(19) POST HANDLING HARVEST COSTS						
(a) Cleaning - Cost per Unit x (6)					0.50	500
(b) Drying - LC per 1.00% = LC1.50	7.50	7,500				
Cost per ___% x (15b x 100) x (6)						
(20) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation	3.00	2,829			3.50	3,395
(b) Load/Unload	0.50	472			0.50	485
(c) Interest Cost (15 %)	7 days	367			42 days	2,310
(d) Extra Weight per Bag (___/___/___%)					0	
(e) Other: _____						
(21) TOTAL MARKETING COSTS (20a + ... + 20e)		3,668				6,190
(22) TOTAL ALTERNATIVE COSTS (19a+19b+21)		11,168				6,690
(23) NET INCOME ALTERNATIVE QUALITY (18) - (22)		118,966				127,170
(24) NET GAIN (LOSS) ALT. QUALITY (23) - (11)		319				4,884
(25) NET PRICE/LW ALT. QUALITY (23)/(6)		118.97				127.17

* LW = Local Weight Unit; LC = Local Currency

- An intermediate choice which would make use of cleaning and drying equipment is to convince the local buyer or the feed mill to change their trading grade, that is the quality characteristics on which they base their bid price. This option would require further analysis.

Sell Now or Later?

Grain has to be stored to assure its future availability. But is storage profitable for the producer or other intermediaries who do not process grains? **The only economic reason to store is the belief that prices in the future will be higher than present prices, by at least the amount of storage costs.** How realistic is this expectation?

The typical harvest season lasts one to two months, but is usually concentrated into a month or less, particularly where second crops can be planted. Grain prices usually decline throughout the season, and start a gradual rise until the next harvest. It is very common for prices to fluctuate as a smaller second crop is harvested, a substitute crop comes in, and/or imports and exports are made. Over the-long term, however, it is possible to discern seasonal price trends. Knowledge of the trends can be useful in forecasting prices, although many other factors such as weather, international markets, shifts in demand have an impact on prices, and must be considered when making projections for specific time periods.

Figure 1 illustrates a typical seasonal price pattern for corn in Honduras. To obtain the price pattern, monthly figures were averaged over a period of time and plotted. The monthly prices can be converted into a price index, with the average becoming a base of one or 100, and the monthly prices a function of the base. This is quite simple with a microcomputer and spreadsheet program.

Since grains are harvested at a specific, not average time, converting the harvest month to a base month gives a better indication of the probabilities that prices will rise by an amount sufficient to make storage profitable. This has been done in our case study in Figure 3.

In deciding whether or not to store, much the same procedures can be applied as in determining the present market alternatives, with these essential differences:

- The risks in storage are twofold, (1) the **physical and quality** risks due to losses and deterioration caused by fire, theft, insects, rodents, and fungi; and (2) the **economic or financial** risks of market price change. To a large degree, the physical risks can be minimized by having proper facilities, storing clean dry grain, and use of appropriate pest management practices. Buying insurance transfers some physical and quality risks to others, but becomes another cost of storage.

- Economic or financial (price) risks are very difficult to transfer, especially in developing economies where markets for these types of risks do not yet exist. These, however, can be reduced by market information, analysis, and planning. In some places, hedging opportunities or futures markets may be available, but again these

5 Year Monthly Average & Annual Price

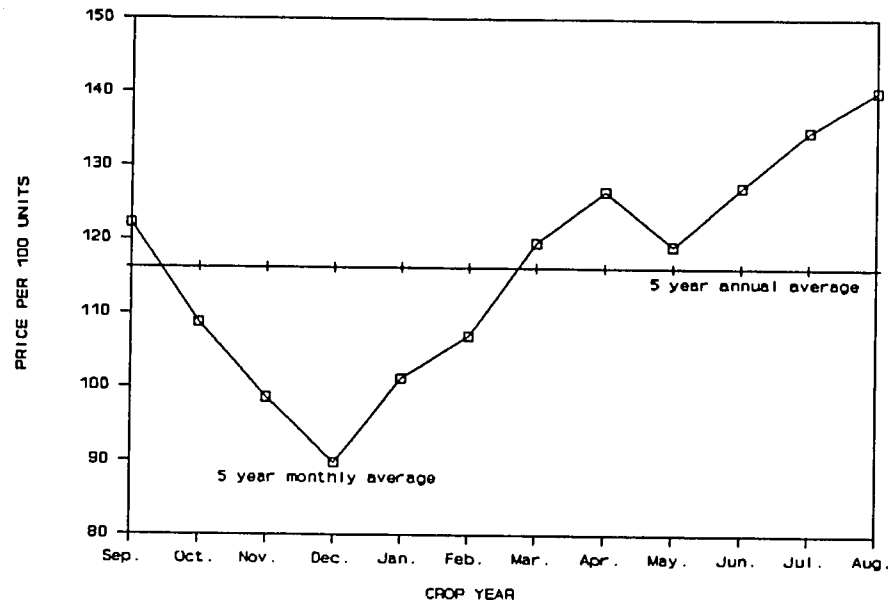

Figure 3. Typical Seasonal Price Pattern for Corn in Honduras.

5 Year Average Index of Price Changes

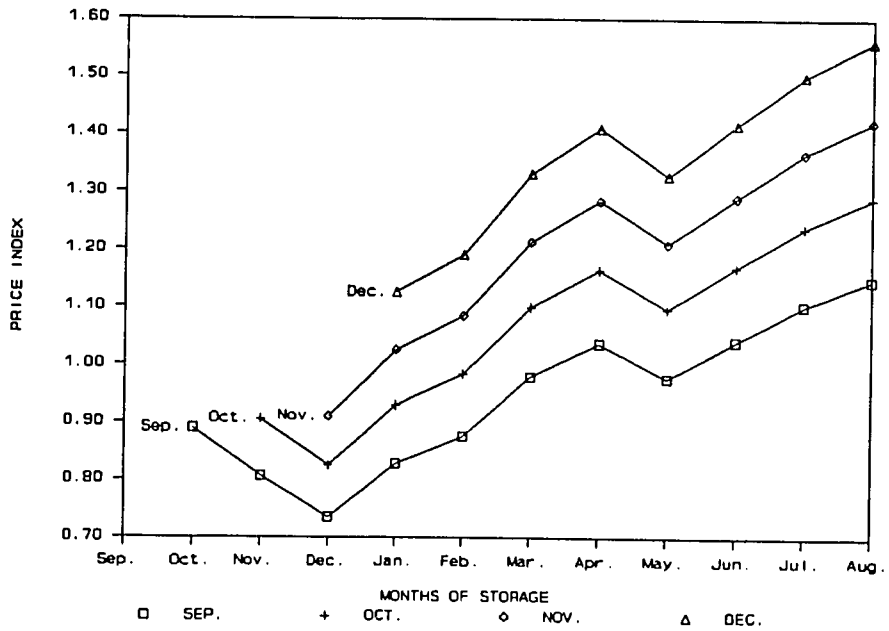

Figure 4. Corn Price Indexes by Month or Storage in Honduras.

Source: market research

are by no means complete insurance against these risks, and are generally unavailable to small scale producers in developing countries.

- The longer the storage period, the greater uncertainty in future prices. An exception is that many government agencies commonly pay the same price the year around. However, storing for later sale to the government under this circumstance would be unwise since storage costs could not be recovered (you let the government carry the storage costs and responsibilities).

- Longer term storage generally requires better cleaning and lower moisture content than crops for immediate sale or processing. Consequently, the initial shrinkage will be higher, and some shrinkage will be experienced throughout total storage period.

Table 5, the Storage Worksheet is very similar to the Market Net Return Calculator. Much of the information can be summarized and transferred directly from Market Net Return Calculator.

Results of Grain Storage Calculations

Two approaches are taken in the Grain Storage Worksheet to illustrate its use. The **average price approach** assumes that if the grain is harvested in December during the time of average long-term seasonal low prices, the market price would be about 94.00 LC/LW, or the long-term monthly average for that period. The **best price approach** assumes that the best current market price offer will be the seasonal low and that the long-term seasonal price fluctuations (average seasonal price index) will be applicable to that price base.

Average Price Approach. If the price pattern holds true, June, July, and August would be the logical months to consider selling as the index of prices for those months range from 140.0% to 156.0% of the December price levels (see Figure 3). After going through the worksheet, this indeed is the case, with the possibility of increasing the net prices received by 4.59% in June, 9.01% in July, and 11.61% in August.

However, as indicated in Table 5, these seasonal price increases are not even enough to compensate for the fixed and variable storage costs. The net price after storage would be less than the cash price from the local buyer at harvest for June and July sale. In August, the estimated net price would just match the December cash price of the local buyer.

Obviously, under these conditions and expectations it would be very risky to store grain for future sale since expected margins in August would not compensate for the risks associated with price expectations, that is, not enough margin is available to compensate for a lower than expected price level in August. If this scenario is realistic, then the cooperative would be better off avoiding price future risks and selling at harvest time.

TABLE 5

GRAIN STORAGE WORKSHEET - AVERAGE PRICE APPROACH

CROP CORN (Weight = LW, Currency = LC) Date _____

STORED AMOUNTS AND VALUE:

CONDITION AT HARVEST: (1) IMPURITY (F.M.)	0.04 %	(2) HUMIDITY	0.18 %	(7) HARVEST DATE	_____
CONDITION AT STORAGE: (3) IMPURITY (F.M.)	0.01 %	(4) HUMIDITY	0.13 %		
REDUCTION AMOUNTS: (5) IMP.(1)-(3)	0.03 %	(6) HUM.(2)-(4)	0.05 %		

(8) QUANTITY AVAILABLE FOR STORAGE				1,000
(9) FINAL VOLUME FACTOR (Calculate or look-up)				
(a) Impurity (1.00-(1))/(1.00-(4)	0.9697			
(b) Humidity (1.00-(2))/(1.00-(5)	0.9425			
(c) Final Volume Factor (9a x 9b)		0.9139		
(10) NET QUANTITY STORED (8) x (9c)				914
(11) MARKET PRICE AT STORAGE LC/LW (___/___/___)		94.00		
(12) MARKET VALUE OF QUANTITY STORED (10) x (11)				85,916

ESTIMATED STORAGE INCOME:

(13) MONTH TO BE SOLD				June	July	August
(14) NUMBER OF MONTHS STORED				6	7	8
(15) STORAGE SHRINK @ 0.003% PER MO. (14) x (15)	0.018	0.021	0.024			
(16) QUANTITY TO BE SOLD (8) x (1.00 - (15))				898	895	892
(17) ESTIMATED MARKET PRICE						
(a) Price index for sale month (Look-up Table 3-C)	1.42	1.50	1.56			
(b) estimate market price (17a)x(11)	133.48	141.00	146.69			
(c) Alt. price estimate						
(18) ESTIMATED GROSS SELLING PRICE AFTER STORAGE (16) x (17b or 17c)				119,865	126,195	130,803

GAIN (LOSS) FROM STORAGE

		(Unit)	(Unit)			
(19) PROCESSING COSTS						
(a) Cleaning Cost per unit x (8)		0.50		500	500	500
(b) Drying (LC per 1%) x ((6) x 100)) x (8)		1.50	7.50	7,500	7,500	7,500
(c) Total Processing Costs (19a + 19b)				8,000	8,000	8,000
(20) FIXED STORAGE COSTS						
(a) Storing/Withdrawing ((10)xFC/Unit)		0.60		548	548	548
(b) _____						
(c) Total Fixed Costs (20a + 20b)				548	548	548
(21) VARIABLE STORAGE COSTS						
(a) Interest (rate % for no. weeks x (12))		0.06904	0.08054 0.09205	5,932	6,920	7,909
(b) Building costs (0.25LC/Bag/Month)	299			1,371	1,603	1,832
(c) Fumigation/chemicals (Per Month)	150			900	1,050	1,200
(d) Insurance (Per Month)	800			4,800	5,600	6,400
(e) Other _____						
(f) Total Variable Costs (21a+..+21e)				13,003	15,173	17,341
(22) TOTAL STORAGE COSTS (19c + 20c + 21f)				21,551	23,721	25,889
(23) ESTIMATED NET STORAGE INCOME (18) - (22)				98,314	102,474	104,914
(24) GAIN (LOSS) OVER SELLING AT HARVEST (23) - (12)				12,398	16,558	18,998
(25) ESTIMATED NET PRICE/LW AFTER STORAGE				98.31	102.47	104.91

* LW = Local Weight Unit; LC = Local Currency

Best Price Approach. However, if in Table 5, the price at time of storage is calculated as the best current cash or near cash offer, the picture is entirely different. The best current market alternative in Table 2 was selling to the feed mill unprocessed for 118.65 LW/LC.

Using the 118.65 as the storage price, and applying the seasonal indexes to this price indicates selling prices during June, July, and August of next year would reach the following levels:

- June (LC118.65/LW x 1.42) = LC168.48/LW
- July (LC118.65/LW x 1.50) = LC177.98/LW
- August (LC118.65/LW x 1.56) = LC185.09/LW

These projected prices are, however, higher than ever recorded during those months, and therefore not realistic. It is expected that there will be some relationship between seasonal price lows and highs, but the relationships sometimes can be quite tenuous. It is therefore necessary to modify price expectations in light of other information and experience. If this is done, as shown in Table 6, storage clearly will be unprofitable, and the cooperative would be better off selling at harvest.

Summary and Conclusions

The conclusions that can be drawn from this case study depend on the position of the analyst. From the point of view of the cooperative, for which this methodology was originally developed, it must be concluded that the best choice is to sell the grain at harvest to the feed miller, using only the drying component of the available postharvest technology. It does not seem to be desirable to sell clean, but wet, corn to the marketing board at a higher price, and wait 42 days for payment. Grain storage under these marketing conditions seems out of the question. The cooperative has few options, such as not using the technology (a costly proposition), partial use (a less costly but still unsatisfactory solution), and attempt to influence the quality criteria used by the available outlets in an effort to obtain a higher price (not impossible, but time consuming and difficult).

A grain postharvest technology researcher is more likely to conclude that the technology made available to these farmers is not appropriate, given the existing policy and marketing conditions for corn. This conclusion is strengthened by the fact that several dryers were modified to use a simple device to burn corn cobs as a heat source, thus saving on costly diesel fuel oil, while helping maintain the premises cleaner. For the same reasons, the researcher would also conclude that grain storage is infeasible. Thus, a technically sound concept fails on its economic feasibility, since the market will not pay for its use.

A government analyst, say responsible for assessing the impact of public grain pricing and stabilization polices and programs, would have to conclude that "high and guaranteed" government prices are not contributing as much to the efforts to increase corn production and maintain price stability as previously thought.

TABLE 6

GRAIN STORAGE WORKSHEET - BEST OFFER APPROACH

CROP CORN (Weight = LW, Currency = LC) Date _____

STORED AMOUNTS AND VALUE:

CONDITION AT HARVEST: (1) IMPURITY (F.M.)	0.04 %	(2) HUMIDITY	0.18 %
CONDITION AT STORAGE: (3) IMPURITY (F.M.)	0.01 %	(4) HUMIDITY	0.13 %
REDUCTION AMOUNTS: (5) IMP.(1)-(3)	0.03 %	(6) HUM.(2)-(4)	0.05 %

(7) HARVEST DATE _____

(8) QUANTITY AVAILABLE FOR STORAGE				1,000
(9) FINAL VOLUME FACTOR (Calculate or look-up)				
(a) Impurity (1.00-(1))/(1.00-(4)	0.9697			
(b) Humidity (1.00-(2))/(1.00-(5)	0.9425			
(c) Final Volume Factor (9a x 9b)		0.9139		
(10) NET QUANTITY STORED (8) x (9c)				914
(11) MARKET PRICE AT STORAGE LC/LW (___/___/___)		118.65		
(12) MARKET VALUE OF QUANTITY STORED (10) x (11)				118,650

ESTIMATED STORAGE INCOME:

				June	July	August
(13) MONTH TO BE SOLD						
(14) NUMBER OF MONTHS STORED				6	7	8
(15) STORAGE SHRINK @ 0.003% PER MO. (14) x (15)	0.018	0.021	0.024			
(16) QUANTITY TO BE SOLD (8) x (1.00 - (15))				898	895	892
(17) ESTIMATED MARKET PRICE						
(a) Price index for sale month (Look-up Table 3-C)						
(b) Estimate market price (17a)x(11)						
(c) Alt. price estimate	127.00	135.00	140.00			
(18) ESTIMATED GROSS SELLING PRICE AFTER STORAGE (16) x (17b or 17c)				114,046	120,825	124,800

GAIN (LOSS) FROM STORAGE

		(Unit)	(Unit)				
(19) PROCESSING COSTS							
(a) Cleaning Cost per unit x (8)		0.50			500	500	500
(b) Drying (LC per 1%) x ((6) x 100)) x (8)		1.50	7.50		7,500	7,500	7,500
(c) Total Processing Costs (19a + 19b)					8,000	8,000	8,000
(20) FIXED STORAGE COSTS							
(a) Storing/Withdrawing ((10)xFC/Unit)		0.60			548	548	548
(b) _____							
(c) Total Fixed Costs (20a + 20b)					548	548	548
(21) VARIABLE STORAGE COSTS							
(a) Interest (rate % for no. weeks x (12))		0.06904	0.08054	0.09205	5,932	6,920	7,909
(b) Building costs (0.25LC/Bag/Month)	299				1,371	1,603	1,832
(c) Fumigation/chemicals (Per Month)	150				900	1,050	1,200
(d) Insurance (Per Month)	800				4,800	5,600	6,400
(e) Other _____							
(f) Total Variable Costs (21a+..+21e)					13,003	15,173	17,341
(22) TOTAL STORAGE COSTS (19c + 20c + 21f)					21,551	23,721	25,889
(23) ESTIMATED NET STORAGE INCOME (18) - (22)					92,495	97,104	98,911
(24) GAIN (LOSS) OVER SELLING AT HARVEST (23) - (12)					(26,155)	(21,546)	(19,739)
(25) ESTIMATED NET PRICE/LW AFTER STORAGE					92.50	97.10	98.91

* LW = Local Weight Unit; LC = Local Currency

While high on paper, the government price is less "affordable" to the farmers once all the marketing costs associated with selling grain to the government are taken into account.

The "hidden" interest cost in selling grain to the government is making the price stabilization policy less effective and more costly than necessary, for both the government and farmers. Farmers do not benefit from the price stabilization program by not selling to the government, and unfortunately so, because selling to the marketing board is a losing proposition. The answer to this problem is clearly evident - reduce the cost of doing business with the government to more acceptable levels. This may enable the government to apply even lower "minimum" prices with greater benefits to grain producers.

It seems that the stabilization impact of the current grain price policy on the normal seasonal price patterns is such that grain storage is not a money making proposition. The two different analyses of this function seem to indicate this. Again, a review of past and current government grain pricing policies would provide the answers for formulating a modified pricing policy which would provide an incentive for the private sector to get involved with grain storage.

In summary, this case study shows that postharvest technology is an integral part of modern agricultural production, and its profitable utilization depends on more than just technical factors. Like other parts of the production process, the producer must strive to get maximum returns from the inputs expended. With postharvest technology, the producer is also capable of expanding the definition of the commodities produced to include not only particular varieties of a crop, but the time, place, and form that the product can be delivered to the buyer.

To achieve this, technical, marketing and policy disciplines must come together and analyze the use of grain postharvest technology in a joint multidisciplinary effort. The ultimate objective is to remove producers from competition in anonymous grain commodities and enable them to become successful designers of products exactly matching the quality desired by consumers.

APPENDIX I

MARKET NET RETURN CALCULATOR AND INSTRUCTIONS

MARKET NET RETURN CALCULATOR

(Weight = LW; Currency = LC) *

Date _____
Prepared by _____

CROP _____

ESTIMATED AT HARVEST: (1) IMPURITIES (F.M.) _____% (2) HUMIDITY _____% (3) HARVEST DATE _____

(4) OTHER CONDITIONS AFFECTING SALABILITY: _____

(5) MARKET: NAME AND LOCATION:						
(6) QUANTITY AVAILABLE FOR SALE:						
(7) PRICE: QUALITY AS HARVESTED						
(8) GROSS INCOME (6) x (7)						
(9) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation						
(b) Load/Unload						
(c) Interest Cost (____%)						
(d) Extra Weight per Bag (____%)						
(e) Other _____						
(10) TOTAL MAREKTING COSTS (9a + ... 9e)						
(11) NET INCOME - QUALITY AS HARVESTED (8) - (10)						
(12) NET PRICE/LW - AS HARVESTED (11)/(6)						
(13) PRICE FOR ALTERNATIVE QUALITY						
(14) BUYER SPECIFICATIONS						
(a) Impurity %						
(b) Humidity %						
(15) WEIGHT LOSS CALCULATION						
(a) Impurity Reduction % (1)-(14a)						
(b) Humidity Reduction % (1)-(14b)						
(16) VOLUME FACTOR (Calculate or Lookup)						
(a) Impurity (1.00-(1))/(1.00-(14a))						
(b) Humidity (1.00-(2))/(1.00-(14b))						
(c) Final Volume Factor (16a)x(16b)						
(17) NET QUANTITY FOR SALE (6) x (16c)						
(18) GROSS INCOME FROM ALT. QUALITY (13) x (17)						
(19) POSTHARVEST COSTS						
(a) Cleaning - Cost/Unit x (6)						
(b) Drying - LC per (____%)						
Cost per (____%) x (15b x 100) x (6)						
(20) MARKETING EXPENSES:	(Unit)	(Amount)	(Unit)	(Amount)	(Unit)	(Amount)
(a) Transportation						
(b) Load/Unload						
(c) Interest Cost (____%)						
(d) Extra Weight per Bag (____%)						
(e) Other _____						
(21) TOTAL MARKETING COSTS (20a + ...20e)						
(22) TOTAL ALTERNATIVE COSTS (19a+19b+21)						
(23) NET INCOME ALTERNATIVE QUALITY (18) - (22)						
(24) NET GAIN (LOSS) ALT. QUALITY (23) - (11)						
(25) NET PRICE/LW ALT. QUALITY (23)/(6)						

* LW = Local Weight Unit; LC = Local Currency

Market Net Return Calculator, Instructions by Line and Space Numbers

1. Enter .04, estimated impurities percentage.

2. Enter .18, estimated humidity percentage.

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3. Estimated harvest date. or when grain will be ready for sale.

4. List other conditions that might affect sales price such as as uniform size, color, presence of molds, insects, that could affect selling price. Develop a list of what buyers want and match the characteristics of the grain harvested buyers needs, or avoid buyers who will discount for some quality factors that other buyers do not.

5. List markets to be compared.

6. List quantity that could be sold to each market. Some marketing boards or government agencies will take only the amount required to pay off loans for example.

7. List prices the buyers are willing to pay for the grain as harvested. Use the price lists published by marketing boards, and some large-scale buyers. Make inquires from local buyers.

8. Multiply the amount to be sold (6) times the price (7) for each market to get the gross selling price.

9. List the expenses by unit cost and total for dealing with buyer, including transportation, loading and unloading, bags, costs of travel to collect amounts due. If buyer takes more than standard amount per unit, say 105 pounds per bag, but pays on basis of 100 pound bags, count extra weight as an expense at the selling price.

   If buyer delays payment, count interest as expense at the same rate as is being charged for any loans that are due when the grain is sold, or what could be earned as savings. Follow the instructions in the interest look-up tables or calculated by other means.

10. Add total selling costs (9a+ ...9e) for each market.

11. Subtract (8) - (10) to get net income from each market for present grain quality.

12. Divide (11) / (6) to get net selling price per bag or other market unit (MT..., 100 pound, 100 kg., etc.)

13. Determine if using postharvest technology can improve income at the present time. Check the price announcements of the marketing boards, processors, and ask local buyers how much more they would pay for better quality. List prices for the qualities the available technology can provide.

14. List the buyer specifications for the price levels in (13).

15. Determine how much change is needed from quality as by subtracting (14a and 14b) from (1) and (2), respectively.

16. Calculate changes in volume remaining after postharvest processing, using formulas given or by following instructions in Volume Factor look-up tables.

17. Determine volume available after processing, multiply (6) x (16c).

18. Obtain gross income from postharvest processing, multiply (13) x (17).

19. Estimate costs of processing by using a cost per unit or cost of processing total amount available.

20. Calculate marketing expenses as in (9). Note items that change with volume changes as determined in (17).

21. Add marketing costs (20a +...20e).

22. Add postharvest and marketing costs (19a+19b+21).

23. Find net income from alternative quality (18) - (22).

24. Compare gains from postharvest treatment with no treatment, (23) - (11).

25. Convert net price from postharvest treatment to price per unit to facilitate comparision. (23) / (6)

APPENDIX II

GRAIN STORAGE WORKSHEET AND INSTRUCTIONS

STORAGE WORKSHEET

CROP_____ (Weight = LW, Currency = LC)* Date_____

STORED AMOUNTS AND VALUE:

CONDITION AT HARVEST: (1) IMPURITY (F.M.) _____% (2) HUMIDITY _____% (7) HARVEST DATE _____

CONDITION AT STORAGE: (3) IMPURITY (F.M.) _____% (4) HUMIDITY _____%

REDUCTION AMOUNTS: (5) IMP.(1)-(3) _____% (6) HUM.(2)-(4) _____%

(8) QUANTITY AVAILABLE FOR STORAGE _____

(9) FINAL VOLUME FACTOR (Calculate or lookup)

(a) Impurity (1.00-(1))/(1.00-(4) _____

(b) Humidity (1.00-(2))/(1.00-(5) _____

(c) Final Volume Factor (9a x 9b) _____

(10) NET QUANTITY STORED (8) x (9c) _____

(11) MARKET PRICE AT STORAGE LC/LW (___/___/___) _____

(12) MARKET VALUE OF QUANTITY STORED (10) x (11) _____

ESTIMATED STORAGE INCOME:

(13) MONTH TO BE SOLD				_____	_____	_____
(14) NUMBER OF MONTHS STORED				_____	_____	_____
(15) STORAGE SHRINK @ ___% PER MO. (14) x (15)	------	------	------			
(16) QUANTITY TO BE SOLD (8) x (1.00 - (15))				_____	_____	_____
(17) ESTIMATED MARKET PRICE						
(a) Price index for sale month (Lookup Table 3-C)	------	------	------			
(b) Estimate market price (17a) x (11)	------	------	------			
(c) Alt. price estimate	------	------	------			
(18) ESTIMATED GROSS SELLING PRICE AFTER STORAGE (16) x (17b or 17c)				_____	_____	_____

GAIN (LOSS) FROM STORAGE

(19) PROCESSING COSTS	(Unit)	(Unit)				
(a) Cleaning Cost per unit x (8)	_____	_____		_____	_____	_____
(b) Drying (LC per 1%) x ((6) x 100)) x (8)	_____	_____		_____	_____	_____
(c) Total Processing Costs (19a + 19b)				_____	_____	_____
(20) FIXED STORAGE COSTS						
(a) Storing/Withdrawing ((10)xFC/Unit)	_____	_____		_____	_____	_____
(b)_____	_____	_____		_____	_____	_____
(c) Total Fixed Costs (20a + 20b)				_____	_____	_____
(21) VARIABLE STORAGE COSTS						
(a) Interest (rate % for no. weeks x (12))	_____	_____	_____	_____	_____	_____
(b) Building costs	_____			_____	_____	_____
(c) Fumigation/chemicals	_____			_____	_____	_____
(d) Insurance	_____			_____	_____	_____
(e) Other _____	_____			_____	_____	_____
(f) Total Variable Costs (21a+..+21e)				_____	_____	_____
(22) TOTAL STORAGE COSTS (19c + 20c + 21f)				_____	_____	_____
(23) ESTIMATED NET STORAGE INCOME (18) - (22)				_____	_____	_____
(24) GAIN (LOSS) OVER SELLING AT HARVEST (23) - (12)				_____	_____	_____
(25) ESTIMATED NET PRICE/LW AFTER STORAGE				_____	_____	_____

* LW = Local Weight; LC = Local Currency

Instructions for Storage Worksheet by Line and Space Number

1. 1 to 10 are self explanatory and can be copied from the Market Net Return Worksheet.

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11. Enter the net price offer (10) from Market Net Return Worksheet that the seller would take for the unprocessed grain. If no immediate offers are available, use published prices or other appropriate information.

12. Present value of grain before storage is (10)x(11).

13. List most probable months grain is to be sold.

14. Convert month of sale into the number of whole months of storage required.

15. Enter a monthly shrinkage figure for grain in storage, depending upon local grain and local conditions; .03 % to .05% could be used as approximations until experience is gained. (1.00-(Mo. Shrink % x Months Storage)).

16. Find net available at end of the storage period: (8)x(15)

17. Estimate price at time of sale. If supply and demand situation seems normal, multiply appropriate price index (17a) times market price (8) at time of storage. Check other information sources, contract prices, futures markets, etc.

18. Estimate gross selling price at time of sale (16)x(17b or 17c).

19. Use or calculate processing expenses as in Net Market Return Worksheet or transfer total costs only if impurity and humidity reductions are the same.

20. Enter fixed costs of storage and total in (20c).

21. Enter variable costs separately, or enter estimated amounts per month until experience is gained; Total in (20f).

22. Total all storage costs: (19c+20c+21f).

23. Subtract storage costs from storage income: (18)-(22).

24. Compare estimated net storage income with present market income: (23)-(12).

25. Optional, convert storage income to price per unit (23)/(8) for comparison with current market prices.

APPENDIX III

LOOKUP TABLES

Volume Factor Lookup Tables

VOLUME FACTOR AFTER CLEANING

Initial Impurity %	Impurities % after Cleaning													
	13.0%	12.0%	11.0%	10.0%	9.0%	8.0%	7.0%	6.0%	5.0%	4.0%	3.0%	2.0%	1.0%	0.0%
13.0%	1.0000	0.9886	0.9775	0.9667	0.9560	0.9457	0.9355	0.9255	0.9158	0.9063	0.8969	0.8878	0.8788	0.8700
12.0%		1.0000	0.9888	0.9778	0.9670	0.9565	0.9462	0.9362	0.9263	0.9167	0.9072	0.8980	0.8889	0.8800
11.0%			1.0000	0.9889	0.9780	0.9674	0.9570	0.9468	0.9368	0.9271	0.9175	0.9082	0.8990	0.8900
10.0%				1.0000	0.9890	0.9783	0.9677	0.9574	0.9474	0.9375	0.9278	0.9184	0.9091	0.9000
9.0%					1.0000	0.9891	0.9785	0.9681	0.9579	0.9479	0.9381	0.9286	0.9192	0.9100
8.0%						1.0000	0.9892	0.9787	0.9684	0.9583	0.9485	0.9388	0.9293	0.9200
7.0%							1.0000	0.9894	0.9789	0.9688	0.9588	0.9490	0.9394	0.9300
6.0%								1.0000	0.9895	0.9792	0.9691	0.9592	0.9495	0.9400
5.0%									1.0000	0.9896	0.9794	0.9694	0.9596	0.9500
4.0%										1.0000	0.9897	0.9796	0.9697	0.9600
3.0%											1.0000	0.9898	0.9798	0.9700
2.0%												1.0000	0.9899	0.9800
1.0%													1.0000	0.9900
0.0%														1.0000

VOLUME FACTOR AFTER DRYING

Initial Moisture %	Moisture % after drying													
	25.0%	24.0%	23.0%	22.0%	21.0%	20.0%	19.0%	18.0%	17.0%	16.0%	15.0%	14.0%	13.0%	12.0%
25.0%	1.0000	0.9868	0.9740	0.9615	0.9494	0.9375	0.9259	0.9146	0.9036	0.8929	0.8824	0.8721	0.8621	0.8523
24.0%		1.0000	0.9870	0.9744	0.9620	0.9500	0.9383	0.9268	0.9157	0.9048	0.8941	0.8837	0.8736	0.8636
23.0%			1.0000	0.9872	0.9747	0.9625	0.9506	0.9390	0.9277	0.9167	0.9059	0.8953	0.8851	0.8750
22.0%				1.0000	0.9873	0.9750	0.9630	0.9512	0.9398	0.9286	0.9176	0.9070	0.8966	0.8864
21.0%					1.0000	0.9875	0.9753	0.9634	0.9518	0.9405	0.9294	0.9186	0.9080	0.8977
20.0%						1.0000	0.9877	0.9756	0.9639	0.9524	0.9412	0.9302	0.9195	0.9091
19.0%							1.0000	0.9878	0.9759	0.9643	0.9529	0.9419	0.9310	0.9205
18.0%								1.0000	0.9880	0.9762	0.9647	0.9535	0.9425	0.9318
17.0%									1.0000	0.9881	0.9765	0.9651	0.9540	0.9432
16.0%										1.0000	0.9882	0.9767	0.9655	0.9545
15.0%											1.0000	0.9884	0.9770	0.9659
14.0%												1.0000	0.9885	0.9773
13.0%													1.0000	0.9886
12.0%														1.0000

<u>How to Calculate and Use Volume Factors</u>

1. Find initial impurity percentage on left scale, read across to column headed by impurity percentage after cleaning, read number. This is the volume factor for the grain after cleaning.

2. Find initial hunidity percentage on left scale, read across to column headed by the humidity percentage after cleaning, read number. This is the volume factor for the grain after drying.

3. Multiply the impurities volume factor times the humidity volume factor to obtain the volume factor for grain remaining after cleaning and drying.

Example: 1,000 kg of grain harvested with 4.0% impurities and 19.0% humidity will be cleaned and dryed to 1%.0 impurities and 14.0% humidity.

Intersection of 4.0% initial impurity and 1.0% impurities after cleaning is .9697.

Intersection of 19.0% initial humidity and 14.0% humidity after drying is .9419.

Then, .9697x.9419 = .9133 is the adjustment factor.

Then, 1,000 kg x .9133 = 913.3 kg of grain remaining after cleaning and drying.

FINAL VOLUME FACTOR

Impurities Factor	Moisture Factor 1.0000	0.9900	0.9800	0.9700	0.9600	0.9500	0.9400	0.9300	0.9200	0.9100	0.9000
1.0000	1.0000	0.9900	0.9800	0.9700	0.9600	0.9500	0.9400	0.9300	0.9200	0.9100	0.9000
0.9900	0.9900	0.9801	0.9702	0.9603	0.9504	0.9405	0.9306	0.9207	0.9108	0.9009	0.8910
0.9800	0.9800	0.9702	0.9604	0.9506	0.9408	0.9310	0.9212	0.9114	0.9016	0.8918	0.8820
0.9700	0.9700	0.9603	0.9506	0.9409	0.9312	0.9215	0.9118	0.9021	0.8924	0.8827	0.8730
0.9600	0.9600	0.9504	0.9408	0.9312	0.9216	0.9120	0.9024	0.8928	0.8832	0.8736	0.8640
0.9500	0.9500	0.9405	0.9310	0.9215	0.9120	0.9025	0.8930	0.8835	0.8740	0.8645	0.8550
0.9400	0.9400	0.9306	0.9212	0.9118	0.9024	0.8930	0.8836	0.8742	0.8648	0.8554	0.8460
0.9300	0.9300	0.9207	0.9114	0.9021	0.8928	0.8835	0.8742	0.8649	0.8556	0.8463	0.8370
0.9200	0.9200	0.9108	0.9016	0.8924	0.8832	0.8740	0.8648	0.8556	0.8464	0.8372	0.8280
0.9100	0.9100	0.9009	0.8918	0.8827	0.8736	0.8645	0.8554	0.8463	0.8372	0.8281	0.8190
0.9000	0.9000	0.8910	0.8820	0.8730	0.8640	0.8550	0.8460	0.8370	0.8280	0.8190	0.8100

Impurities Factor	Moisture Factor 0.8900	0.8800	0.8700	0.8600	0.8500	0.8400	0.8300	0.8200	0.8100	0.8000	0.7900
1.0000	0.8900	0.8800	0.8700	0.8600	0.8500	0.8400	0.8300	0.8200	0.8100	0.8000	0.7900
0.9900	0.8811	0.8712	0.8613	0.8514	0.8415	0.8316	0.8217	0.8118	0.8019	0.7920	0.7821
0.9800	0.8722	0.8624	0.8526	0.8428	0.8330	0.8232	0.8134	0.8036	0.7938	0.7840	0.7742
0.9700	0.8633	0.8536	0.8439	0.8342	0.8245	0.8148	0.8051	0.7954	0.7857	0.7760	0.7663
0.9600	0.8544	0.8448	0.8352	0.8256	0.8160	0.8064	0.7968	0.7872	0.7776	0.7680	0.7584
0.9500	0.8455	0.8360	0.8265	0.8170	0.8075	0.7980	0.7885	0.7790	0.7695	0.7600	0.7505
0.9400	0.8366	0.8272	0.8178	0.8084	0.7990	0.7896	0.7802	0.7708	0.7614	0.7520	0.7426
0.9300	0.8277	0.8184	0.8091	0.7998	0.7905	0.7812	0.7719	0.7626	0.7533	0.7440	0.7347
0.9200	0.8188	0.8096	0.8004	0.7912	0.7820	0.7728	0.7636	0.7544	0.7452	0.7360	0.7268
0.9100	0.8099	0.8008	0.7917	0.7826	0.7735	0.7644	0.7553	0.7462	0.7371	0.7280	0.7189
0.9000	0.8010	0.7920	0.7830	0.7740	0.7650	0.7560	0.7470	0.7380	0.7290	0.7200	0.7110

How to Use This Table

As alternative to (impurity volume factor) x (humidity volume factor), look up humidity and volume factors nearest the impurity and volume factors obtained from the previous tables. Read down and across to to get the final volume factors.

Example: From previous page with 4.0% impurity and 19.0% humidity, read down impurities column to .9700 and across humidity column to .9400. The intersection is .9118. The true calculated value is .9133. For estimating purposes, the difference is only .0015, or 1.5 kg per 1000 kg.

File: VOLFACTO.WK1 and VOLFACTO.PRN

Table of Interest Rate Equivalents

Length of Loan		Annual Rate of Interest											
Weeks	Days	8.0%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%	19.0%
1	7	0.00153	0.00173	0.00192	0.00211	0.00230	0.00249	0.00268	0.00288	0.00307	0.00326	0.00345	0.00364
2	14	0.00307	0.00345	0.00384	0.00422	0.00460	0.00499	0.00537	0.00575	0.00614	0.00652	0.00690	0.00729
3	21	0.00460	0.00518	0.00575	0.00633	0.00690	0.00748	0.00805	0.00863	0.00921	0.00978	0.01036	0.01093
4	28	0.00614	0.00690	0.00767	0.00844	0.00921	0.00997	0.01074	0.01151	0.01227	0.01304	0.01381	0.01458
5	35	0.00767	0.00863	0.00959	0.01055	0.01151	0.01247	0.01342	0.01438	0.01534	0.01630	0.01726	0.01822
6	42	0.00921	0.01036	0.01151	0.01266	0.01381	0.01496	0.01611	0.01726	0.01841	0.01956	0.02071	0.02186
7	49	0.01074	0.01208	0.01342	0.01477	0.01611	0.01745	0.01879	0.02014	0.02148	0.02282	0.02416	0.02551
8	56	0.01227	0.01381	0.01534	0.01688	0.01841	0.01995	0.02148	0.02301	0.02455	0.02608	0.02762	0.02915
9	63	0.01381	0.01553	0.01726	0.01899	0.02071	0.02244	0.02416	0.02589	0.02762	0.02934	0.03107	0.03279
10	70	0.01534	0.01726	0.01918	0.02110	0.02301	0.02493	0.02685	0.02877	0.03068	0.03260	0.03452	0.03644
11	77	0.01688	0.01899	0.02110	0.02321	0.02532	0.02742	0.02953	0.03164	0.03375	0.03586	0.03797	0.04008
12	84	0.01841	0.02071	0.02301	0.02532	0.02762	0.02992	0.03222	0.03452	0.03682	0.03912	0.04142	0.04373
13	91	0.01995	0.02244	0.02493	0.02742	0.02992	0.03241	0.03490	0.03740	0.03989	0.04238	0.04488	0.04737
14	98	0.02148	0.02416	0.02685	0.02953	0.03222	0.03490	0.03759	0.04027	0.04296	0.04564	0.04833	0.05101
15	105	0.02301	0.02589	0.02877	0.03164	0.03452	0.03740	0.04027	0.04315	0.04603	0.04890	0.05178	0.05466
16	112	0.02455	0.02762	0.03068	0.03375	0.03682	0.03989	0.04296	0.04603	0.04910	0.05216	0.05523	0.05830
17	119	0.02608	0.02934	0.03260	0.03586	0.03912	0.04238	0.04564	0.04890	0.05216	0.05542	0.05868	0.06195
18	126	0.02762	0.03107	0.03452	0.03797	0.04142	0.04488	0.04833	0.05178	0.05523	0.05868	0.06214	0.06559
19	133	0.02915	0.03279	0.03644	0.04008	0.04373	0.04737	0.05101	0.05466	0.05830	0.06195	0.06559	0.06923
20	140	0.03068	0.03452	0.03836	0.04219	0.04603	0.04986	0.05370	0.05753	0.06137	0.06521	0.06904	0.07288
21	147	0.03222	0.03625	0.04027	0.04430	0.04833	0.05236	0.05638	0.06041	0.06444	0.06847	0.07249	0.07652
22	154	0.03375	0.03797	0.04219	0.04641	0.05063	0.05485	0.05907	0.06329	0.06751	0.07173	0.07595	0.08016
23	161	0.03529	0.03970	0.04411	0.04852	0.05293	0.05734	0.06175	0.06616	0.07058	0.07499	0.07940	0.08381
24	168	0.03682	0.04142	0.04603	0.05063	0.05523	0.05984	0.06444	0.06904	0.07364	0.07825	0.08285	0.08745
25	175	0.03836	0.04315	0.04795	0.05274	0.05753	0.06233	0.06712	0.07192	0.07671	0.08151	0.08630	0.09110
26	182	0.03989	0.04488	0.04986	0.05485	0.05984	0.06482	0.06981	0.07479	0.07978	0.08477	0.08975	0.09474

How to Use This Table

1. Know the annual rate of interest for your loan and the length of loan in days or weeks.

2. Find the intersection nearest to the interest rate and days or weeks in the rows and columns in the table.

3. Multiply the interest rate times the amount of the loan.

4. For interest rate equivalents longer than 26 weeks, add the rate for 26 weeks to the rate for the number of weeks over 26 weeks.

5. Counting to the right of the decimal point three places gives the interest cost per 1,000.00. Multiply the number of thousands times the interest cost to get the total amount of interest to be paid or that could be earned from the money invested for this time. Moving decimal place two places to the right gives cost per 100.

Example 1. The local farmers cooperative has borrowed 100,000 for 20 weeks from the Agricultural Bank. The annual rate of interest is 14.0%.

Read down "Length of Loan" column to 20. Go across to 14.0%.

Read 0.05370. Move decimal three places to right to make 53.70.

Multiply the number of thousands x interest. 100 x 53.70 = 5,370.

Example 2. The farmers cooperative wants to sell 50,000 local currency worth of grain to the Government Marketing Board. The Marketing Board will not pay the cooperative until six weeks after the grain is delivered. The farmers borrowed money at 16.0% to plant the crop and cannot pay their loans until the marketing board pays them. How much more interest will each farmer have to pay if he cannot get paid his grain for six weeks?

Read down "Length of Loan" column to 6. Go across to 16.0%.

Read 0.01841. Move decimal three places to right to make 18.41.

Each farmer will owe 18.41 more in interest for each 1,000 borrowed if he does not get paid for six weeks. A farmer who owes 3,000 will have to pay 3 x 18.41 = 55.21 more in interest.

File: INTRATE.WK1 and INTRATE.PRN

Example of Constructing Price Indices

MAIZE PRICES: MONTHLY AND ANNUAL AVERAGES, 1981 - 1986

Crop Year	Average Monthly Price												Annual Average
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	
1981-82	120.00	110.00	98.00	90.00	105.00	112.00	123.00	132.00	125.00	131.00	138.00	145.00	119.08
1982-83	126.00	111.00	101.00	93.00	103.00	108.00	122.00	129.00	119.00	128.00	135.00	139.00	117.83
1983-84	115.00	100.00	93.00	87.00	96.00	102.00	116.00	121.00	113.00	119.00	126.00	133.00	110.08
1984-85	128.00	115.00	107.00	98.00	109.00	114.00	129.00	138.00	132.00	140.00	146.00	153.00	125.75
1985-86	122.00	108.00	94.00	81.00	93.00	99.00	108.00	113.00	107.00	118.00	129.00	131.00	108.58
5 yr. Avg.	122.20	108.80	98.60	89.80	101.20	107.00	119.60	126.60	119.20	127.20	134.80	140.20	116.27

1. To convert annual averages to a monthly index price, divide the five-year average monthly price by the five-year average price.

2. To find the price index by month stored, use the storage month five-year average price as the base, and divide following months by the base month:

										June	July	August	
Annual Price Index	1.05	0.94	0.85	0.77	0.87	0.92	1.03	1.09	1.03	1.09	1.16	1.21	1.00
Price Index by month stored													
September		0.89	0.81	0.73	0.83	0.88	0.98	1.04	0.98	1.04	1.10	1.15	
October			0.91	0.83	0.93	0.98	1.10	1.16	1.10	1.17	1.24	1.29	
November				0.91	1.03	1.09	1.21	1.28	1.21	1.29	1.37	1.42	
December					1.13	1.19	1.33	1.41	1.33	1.42	1.50	1.56	

How to Use Price Indices to Estimate Future Prices

1. Find monthly average market price for month stored, or use market price for grain at time of harvest.

2. Determine month grain is to be sold; find monthly price index for that month.

3. Multiply the harvest month price x price index for the month of sale.

Example: In October, the current market price is 96.00. If the grain is to be sold in April, the April index is 1.16. 96,00 x 1.16 = 111.00.

CAUTION: This assumes that the current harvest and marketing year is normal, or representative of the past five years. Seldom are years "average". The price index method provides the starting point for developing price estimates. It will be necessary to use judgment in raising or lowering the computed price to estimate what the price might be at time of sale.

File: GRAINPR.WK1 and GRAINPR.PRN

Sample of Price Discount Table for Corn Used by Marketing Board

NATIONAL GRAIN COMPANY
* * * *
PRICE SCHEDULE FOR CORN
(Local Currency Units)

Base Price Per 100 LW	Quality Basis		Discount/Premium Per 1% Excess
---	Moisture	Impurities	---
150.00 LC	14.0%	1.0%	3.00 LC

Percent Humidity	Percent Impurities 1.0%	2.0%	3.0%	4.0%	5.0%	6.0%	7.0%	8.0%	9.0%
12.0%	156.00	153.00	150.00	147.00	144.00	141.00	138.00	135.00	Not Acceptable
13.0%	153.00	150.00	147.00	144.00	141.00	138.00	135.00	132.00	
14.0%	150.00	147.00	144.00	141.00	138.00	135.00	132.00	129.00	
15.0%	147.00	144.00	141.00	138.00	135.00	132.00	129.00	126.00	
16.0%	144.00	141.00	138.00	135.00	132.00	129.00	126.00	123.00	
17.0%	141.00	138.00	135.00	132.00	129.00	126.00	123.00	120.00	
18.0%	138.00	135.00	132.00	129.00	126.00	123.00	120.00	117.00	
19.0%	135.00	132.00	129.00	126.00	123.00	120.00	117.00	114.00	
20.0%	132.00	129.00	126.00	123.00	120.00	117.00	114.00	111.00	
21.0% and over	Not Acceptable								

Source: National Marketing Board

File: GRSCHED.WK1 and GRSCHED.PRN

Sample of Price Discount Table for Corn Used by Feed Mill

CONGLOMERATE FEED MILLS
* * * *
PRICE SCHEDULE FOR CORN

(Local Currency Units)

Percent Humidity	Base Price Per 100 LW 13.00 LC	Quality Basis Humidity: 13%
	This Week's Paying Price	
13.0%	135.00	
14.0%	132.50	
15.0%	130.00	
16.0%	127.50	
17.0%	125.00	
18.0%	122.50	
19.0%	120.00	
20.0%	117.50	
21.0% +	Not acceptable	

Source: Local Feed Mill