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Marketing of Wheat on a Constant and Nil Moisture Basis

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Abstract

This study examined moisture specification practices in the United States and for major exporters and assessed impacts of changes to a nil or constant moisture basis on prices and revenue. These were examined under scenarios where information on moisture in current prices is limited and under a scenario where current prices reflect Full Knowledge of moisture advantages. Results indicate that changing to a nil moisture basis (which requires a subsequent adjustment in volumes to reflect the subtraction of moisture) would increase reported prices from 42 to 70 c/bu for the wheat classes, while changing to a 12 percent constant moisture basis would have limited impacts on reported prices. Effects on relative prices/revenue depend on whether knowledge of moisture advantages are reflected in current prices. If current prices reflect moisture advantages (Full Knowledge), then relative effects on prices/revenues are minimal. If current prices do not reflect moisture advantages (Limited Knowledge), then prices/revenue in drier production regions would increase.

Key Words: moisture, specifications, pricing, wheat, constant moisture, nil moisture

Highlights

This study examined current moisture specification practices in the United States and for major exporters and analyzed impacts of changes to alternative pricing specifications including a nil or constant moisture price specification. These were examined under two scenarios, Limited Knowledge and Full Knowledge, which reflect that no or full information on moisture levels are contained in current prices.

Results show average moisture levels for wheat classes are lowest for Southwestern Durum Production followed by soft white wheat (SWW). Soft red winter (SRW) wheat has the highest moisture levels, while hard red winter (HRW) wheat, hard red spring (HRS) wheat, and Great Plains Durum production have similar moisture levels. Closer examination of farm production for these later three classes (HRW, HRS, and Great Plains durum) indicate moisture levels in Kansas and North Dakota are similar, while Montana has lower moisture levels and Minnesota and South Dakota have higher moisture levels.

SRW has the highest moisture levels at export, followed generally by HRS, and either hard amber durum (HAD) or HRW. HAD has had the lowest moisture since 1998. U.S. exports of higher grades of HRS and HRW had lower moisture levels than did lower grades. Moisture levels for Canadian western red spring (CWRS) wheat exports generally were similar to those for U.S. SRW and about 1 percent higher than for U.S. HRS. Australia does not allow delivery of wheat into the marketing system with more than 12.5 percent moisture and generally does not have excessive moisture problems. However, data on moisture levels of exports were not available.

Comparisons of price levels indicate conversion to a nil moisture basis would increase reported prices from 42 to 70 c/bu with a subsequent adjustment in volumes to reflect the subtraction of moisture. Meanwhile, conversion to a 12 percent constant moisture basis would have limited impacts on reported prices and volumes delivered as most grain delivered is at or near 12 percent moisture. For North Dakota, if current benefits of lower moisture levels are not reflected in prices received by farmers (Limited Knowledge), then relative price levels in western regions may increase compared to prices in eastern North Dakota. However, if current benefits are reflected in prices received by farmers (Full Knowledge), relative price levels in western regions may decline compared to prices in eastern regions.

Comparisons of moving to nil moisture or constant moisture pricing mechanisms show farmer revenue can be impacted if current benefits are not reflected in current prices (Limited Knowledge). Farmers delivering a truckload (36,000 lbs or about 600 bu) of wheat at 9 percent moisture would increase revenue by $70/truck. However, if benefits are reflected in current prices, impacts on revenue are limited. It is likely that benefits of lower moisture levels for a region are reflected to some extent in current prices. However, if moisture for a farmers' wheat varies from the average in the region, then this would be more likely to reflect the Limited Knowledge case. Thus, regional impacts of moving to either a nil or constant moisture basis may be limited, while effects for individual farmer deliveries may be more substantial, lowering revenue from current practices for higher moisture deliveries and increasing revenue for lower moisture deliveries.

There are several implications for North Dakota farmers and grain handlers. First, changes to a nil moisture price would affect levels of prices reported for all wheat classes and would result in higher reported prices for U.S. wheats. Whereas, changing to a constant moisture basis (12 percent) would leave prices relatively unchanged from current levels. Second, adjusting bushels to a constant moisture basis or changing prices to either a nil moisture or constant moisture basis would provide additional revenues to individual farmers with moisture lower than average within their region, while lowering revenue for those with higher than average moisture. This could be viewed as applying a more correct valuation for wheat delivered, similar to when protein measurements were converted to a constant moisture basis and should remove incentives to re-wet grain. Third, effects of moving to a constant or nil moisture basis on relative prices and price levels depends on whether knowledge of benefits (added value of drier lots due to more dry matter and lower transportation costs than for higher moisture lots) of lower moisture wheat is reflected in current prices. Fourth, movement to either a nil or constant moisture basis would put additional pressure on accuracy of moisture testing/grievance resolution mechanisms at least in the short term. Finally, changing to a constant or nil moisture basis may affect the competitiveness of U.S. wheat. Movement to a nil moisture basis would increase price levels for U.S. grains relative to competitors, increasing needs for buyer education, at least in the short term. However, relative effects on competitiveness would again depend on whether prices for export bids from the United States and competitors reflect benefits of dryer grain.

Marketing of Wheat on a Constant or Nil Moisture Basis

William W. Wilson and Bruce L. Dahl*

Introduction

An ongoing issue for grain growers/marketers has been the effect of low moisture grains and re-wetting. Typically, growers deliver grain which is sold based on weight. If moisture content is less than accepted maximum levels, the weight of the lot delivered is lower than if the moisture content was at the maximum acceptable level. For example, a grower delivering a lot of wheat weighing 36,000 lbs. with 13 percent moisture would be paid for 600 bushels delivered (36000/60). In this lot, there are 31,320 lbs of dry matter and 4,680 lbs of water. A grower delivering the same volume of dry matter with a moisture level of 10 percent would deliver only 34,800 lbs or 580 bu (34,800/60). This amounts to a 3.3 percent drop in bushels delivered. If farm prices are $3.00/bu, and average yields are 40 bu/A over 1,000 acres, then this amounts to a $4/A or $4,000 per farm penalty for low moisture grain. The size of this loss is a significant incentive to add water (re-wet) grain prior to or after entering the handling system. This has been an ongoing issue for wheat and corn especially in drier production regions (primarily western growing regions in Arizona, California, Oklahoma, western North Dakota, Montana, and the Pacific Northwest).

The issue of overly dry production remains a problem once grain enters the grain handling system as the practice of introducing water for purposes other than milling, malting, or similar processing operations is strictly prohibited for U.S. grain handlers (export and domestic facilities). This includes spraying of belts with water during grain handling (FGIS Directive 9070.5, 9/18/96). Several interpretations of what is legal/illegal for addition of water were advanced in the late 1970s and 1980s. Hill indicated that the U.S. Food and Drug Administration (FDA) considered adding water as adulteration of sample and was prohibited. The FDA also argued that even blending of lower and higher moisture grain to increase bulk weight and increase value would be illegal. Only blending to maintain safe moisture levels would be allowable (Hill, 1990, pp. 294-296).

Alternative methods have been suggested to reduce the effects of this problem. One method is to adjust prices to a constant moisture basis. Another is to adjust the quantity delivered to a constant moisture basis (this can be zero moisture or on some specific target level). Other methods advanced for pricing include adjustments for moisture as a component of a range of adjustments. Examples of these other methods include Net Wheat Price, Millable Wheat Index, and Value Added in milling (Drynan).

The purpose of this report is to examine effects of changing specifications for purchase of wheat to a constant moisture basis (either nil or a specific target level–12 percent). To accomplish this, current moisture levels for farm production and export shipments will be compared for various locations and also for competing exporting countries where available. Then, effects on prices are modeled assuming market participants have either Full Knowledge or

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Limited Knowledge of the probability of obtaining low moisture grains in an area which is reflected in their bids.

The report is organized as follows: First, prior studies on moisture and alternative valuation methods are summarized. Second, moisture practices of the United States and major competing exporting countries are summarized. Third, moisture levels for farm production, exports, and competing exporting countries are analyzed. Fourth, effects on prices of moving to nil or constant moisture levels are examined. Finally, results are summarized.

Effect of Moisture on Protein Measurement

The debate on moisture is similar to that for changing protein measurements to a constant moisture basis which occurred in response to the 1986 Grain Quality Act and recommendations from industry groups (i.e., North American Export Grain Association, etc.). This moved measurement of protein from an ‘as-is’ moisture basis to a fixed 12 percent moisture basis (Hill, 1990, pp. 325-333),[1] and was done to allow for comparison of protein in lots having differing moisture levels. This corrected for differences in protein measurements where drier samples tend to overstate protein values while wetter samples understated protein. Since Canada uses a higher moisture basis (MB) than the United States, a lot of wheat with 14 percent protein at a 12 percent MB would be reported as 13.8 percent on a 13.5 percent MB. Thus, effective and reported protein levels for Canada are less than those for the United States.

Prior Studies on Moisture

Prior research on effects of moisture levels have been numerous. These have focused on several areas from changing the reference methods for moisture measurement, to movement to sales on a nil or constant moisture basis, to movement toward a new wheat price.

Hill and Bender (1994) examined effects of changing the moisture reference method utilized for grains. They indicated that use of the current U.S. Department of Agriculture (USDA) measure resulted in lower moisture levels than the proposed alternative. Arguments for the change are that: 1) the current method does not specifically measure moisture and is not as correlated with other methods as was thought when it was adopted, 2) use of alternative reference would be more in line with that used by European countries and would be closer to that used in Japan, 3) it would tend to reduce complaints from buyers (specifically, Japanese buyers complaining about high moisture in corn where excess moisture over specifications was similar to the amount of observed difference in reference methods), and 4) the United States might lose market share due to moisture measurement problems and an adjustment would be viewed as being responsive to customers’ concerns. Arguments against any change are that: 1) buyers already consider differences among measurements and account for the differences in their transactions, 2) changes in methods would be costly, and 3) a preferred change would be to recalibrate meters, which has occurred repeatedly.

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[1] Canada also uses a constant moisture basis measurement for protein, but uses 13.5 percent as the base moisture rather than 12 percent in the United States.

Hill and Bender examined the change in reference methods under two scenarios: 1) Full Knowledge and 2) Limited Knowledge. Under the Full Knowledge scenario, participants were assumed to know that moisture measurements were incorrect and compensated for this discrepancy by adjusting prices and discounts to reflect the change. Under the Limited Knowledge (or naive) scenario, participants were assumed to be uninformed of the discrepancy and that prices and quantities on contracts would be maintained.

The change in reference method for moisture would increase moisture levels by .8 percent (i.e., 15 percent would actually be 15.8 percent) (Hill and Bender). Under the Full Knowledge case, the value of total production would be unchanged. Domestic users satisfied with the current moisture content would probably increase buying specifications from 15 percent moisture to 15.5 percent moisture. Export and domestic users desiring the lower moisture (15 percent) would incur additional drying changes drying grain from 15.8 percent to 15 percent, would have increased storability, reduced transportation costs, and increased kernel breakage. They calculate the cost of changing the reference method at $105 million for corn, largely due to increased drying costs and broken corn and foreign material.

Under the Limited Knowledge case, Hill and Bender found the value of production would decline by $104 million. They estimated the cost of changing the reference method under the Limited Knowledge case at $227 million for corn. Here the cost of changing the reference method is largest for the change in value, followed by additional drying costs and increased broken corn and foreign material. However, Hill and Bender indicate that changing moisture reference methods may/may not have any effect on buyer complaints. They indicate that buyers can now place restrictions on moisture specifications that would be tighter than those realized by change in reference methods (i.e., may specify max moisture levels below current levels). Changing moisture reference methods would not force buyers to buy lower moisture grains.

Alternative Adjustments for Moisture

Practices applied to adjust for differences in moisture levels have generally taken one of two forms, price adjustments or quantity adjustments. Each of these and proposed alternative methods for valuing wheat (Net Wheat Price, Millable Wheat Index, Value Added), are presented in the next subsections.

Price Adjustment

Price adjustments reflect specific price discounts (premiums) for higher (lower) moisture lots. These are typically added to a base price and require adjustments with changes in the base price to reflect the cost of drying. These have been typically applied to moisture levels higher than a base moisture and not for grain drier than the base (Hill, 1997). Adjustments below the base case for corn have typically not been applied because it has been thought that the quality of lower moisture corn is less due to the increased risk of breakage during handling.

Quantity Adjustment

Quantity adjustments reflect the value of dry matter contained within a lot regardless of the moisture content. This has typically been applied for high moisture grains by the use of a shrink factor applied to estimate quantity after adjusting for excess moisture. Shrink factors are based on a mathematical formula for estimating the amount of bushels remaining at a base moisture content and reflect expected bushels remaining after drying. It is sometimes referred to as pencil shrink. Hill indicates that quantity adjustments for corn are typically applied for high moisture, yet seldom utilized for low moisture.

Equivalent Bushel Concept

This is a quantity adjustment where prices are established for a base moisture level. The quantity of grain delivered is adjusted up or down to reflect differences in the moisture levels for the lot delivered and the base moisture level. This new quantity is then multiplied by the base price to determine value paid to the farmer.

Net Wheat Price

The Net Wheat Price is a method of determining the value of different lots of wheat independent of the moisture and screenings contained (Drynan). It has been advanced as a method to provide a more appropriate estimate of the value of wheat to the miller. In this method, the net proportion of wheat (Net Wheat) in a lot is estimated by removing screenings, dockage, and moisture.

$$\text{Net Wheat} = (100\% - (F + S + D)) \bullet (100\% - M)$$

Where
- F is foreign material (percent),
- S is shrunken and broken kernels (percent),
- D is dockage (percent), and
- M is moisture (percent).

Then, the price for the dry Millable Wheat in a sample (Net Wheat Price) is estimated as:

$$\text{Net Wheat Price} = \text{Actual Price} / \text{Net Wheat}$$

Drynan suggests this as an alternative buying concept where wheat is priced on a net wheat basis and discounted from this price based on the formula for net wheat and differences between the amount of foreign material, dockage, shrunken and broken kernels, and moisture reference values. This can also be interpreted as the net price for the clean, dry portion of a lot of wheat.

The economic impact of these formulations is estimated for various levels of foreign material, shrunken and broken kernels, dockage, and moisture for a wheat lot with a base price of $150/MT (Table 1). A lot of wheat with 3 percent of removable material (dockage + foreign material + shrunken and broken kernels) and 11 percent moisture has a Net Wheat Price of $173.75/MT. If the buyer is able to reduce the amount of dockage, foreign material, and shrunken and broken kernels by 1 percent, his net wheat cost would decline to $171.98/MT. Similarly, if the miller was able to buy a drier lot of wheat (one with 10 percent moisture), the Net Wheat Price for that lot of wheat would be $171.82/MT. This lower Net Wheat Price for the drier lot reflects that if both lots are available for the same market price, the drier lot contains more net dry wheat than the 13 percent lot. Therefore, the value of this lot is actually spread over more net dry bushels and is a better value to the miller, thus the lower Net Wheat Price.

Table 1. Estimated Net Wheat Costs (by Buyer) by Level of Foreign Material, Shrunken and Broken Kernels, Dockage, and Moisture (Base Price=$150/MT)

Foreign Material + Shrunken and Broken + Dockage	Moisture Level				
	9%	10%	11%	12%	13%
	($/MT)				
0%	164.84	166.67	168.54	170.45	172.41
1%	166.50	168.35	170.24	172.18	174.16
2%	168.20	170.07	171.98	173.93	175.93
3%	169.93	171.82	173.75	175.73	177.75
4%	171.70	173.61	175.56	177.56	179.60
5%	173.51	175.44	177.41	179.43	181.49

* Note: Lower values indicate better value to millers (more net dry bushels for same market price).

Millable Wheat Index

An extension of the above is the Millable Wheat index. This measure considers the amount of unmillable material and moisture content of wheat and derives a measure (index) which can be multiplied by the price of wheat to determine the value of a lot of wheat after it is ready for milling. This measure first computes the percent of clean tempered wheat (CTW) that would be derived from a sample of wheat as follows:

$$CTW = [(100\% - (F + S + D)) \bullet (100\% - M)] / (100\% - T)$$

Where

F is foreign material (percent),
S is shrunken and broken kernels (percent),
D is dockage (percent),
M is moisture (percent), and
T is temper moisture (percent).

The Millable Wheat index (MWI) is

$$MWI = 100\% / CTW$$

The MWI can be multiplied by the price of a lot of wheat to determine the real milling cost to the miller of that lot. For example, if two lots of wheat were priced similarly ($200/MT) while one had a MWI=.96 and the second had a MWI=.98, the first lot of wheat would have lower net cost and return more clean tempered wheat to the miller than would the second. Therefore, the first lot of wheat has the potential to cost the miller less to run through his mill than the second because it provides more millable material.

This method differs from the Net Wheat Price which values only the dry clean wheat portion of a wheat lot. In contrast, the Millable Wheat Index also considers the value that a miller captures from a lot of wheat due to the difference between wheat moisture and tempering moisture.

Value Added by Milling

A more comprehensive method for evaluating wheat value is to calculate the Value Added in milling for a specific lot of wheat. This formula utilizes the clean tempered wheat calculation to determine the quantity of wheat available to the miller and then estimates the cost of wheat and income generated from the sale of flour and by-products. These are used to calculate the Value Added (approximately a net milling margin) for wheat lots. Specifically, profit or Value Added is defined as:

$$\begin{aligned}\Pi_{VA} &= TotalRevenue - WheatCost \\ &= (P_1 \times Y_1) + (P_2 \times Y_2) + (P_3 \times Y_3) + \ldots (P_n \times Y_n) - WheatCost\end{aligned}$$

Where

P_1, P_2, P_3, ... P_n are prices for flour segments and by-products and
Y_1, Y_2, Y_3, ... Y_n are quantities of flour segments and by-products produced.

An example of the application of this method is presented in Table 2 and described as follows: An importer can purchase a lot of wheat (1 MT) for $204/MT. In this wheat lot, there is 3 percent screenings (defined as dockage + foreign material + shrunken and broken). Thus, for each ton purchased, the miller buys 970 KG of clean wheat and 30 KG of screenings. This wheat lot is 12 percent moisture and the importer tempers wheat to 16 percent moisture for milling. Therefore, the importer should obtain 1016.2 KG of Millable Wheat product from this wheat lot. Using the extraction rates specific to the importers mill and prices for saleable products, the importer would be able to generate $281.55/MT for the products made from this wheat lot. Subtracting his cost for the wheat lot of $204/MT yields profit of $77.55/MT.

As in the other alternative wheat pricing methods, moisture impacts the Value Added calculation by increasing/decreasing the total millable material. Higher moisture lots would have less millable material than lower moisture lots which translates into lower flour segregations produced and lower Value Added.

Table 2. Value Added Estimation Example.

Wheat Purchased		1000 KG
Wheat Price	$204/MT	
Mill Screenings	3.0%	30 KG
Wheat Moisture	12%	
Temper Moisture	16%	
Millable Material		1016.19 KG

Milling Products	Extraction Rate[1]	KGS Produced	Price/KG	Value
Flour	0.64	650.36	0.307	$199.66
First Clear	0.20	203.24	0.285	$57.92
By-product	0.14	142.27	0.140	$19.92
Screenings		30.00	0.135	$4.05
Total Revenue				$281.55
Less Wheat Cost				$204.00
Value Added				$77.55

[1] Extraction rates listed do not sum to 1.00 because flour extraction rates utilized assume an invisible loss of 2%.

Current U.S. Market Practices for Moisture

Moisture is not a grade determining factor for wheat in U.S. grade specifications. Moisture is treated as a contract term like protein where levels are measured and governed largely by specifications limits. Typically, no price or quantity adjustments for moisture are applied to farmers unless the wheat lots have excess moisture or are delivered for drying. Wilson and Dahl (2001) surveyed North Dakota and Montana elevator managers to determine price discounts for excess moisture in 2001. They found price discounts for 14.5 percent moisture for hard red spring (HRS) wheat ranged from no discount to 18 c/b and averaged 7 c/b. Discounts for 14.5% hard amber durum (HAD) where similar, ranging from no discount to 14 c/b and also averaged 7 c/b.

Specification limits by importers vary widely by importing country. U.S. Wheat Associates, Inc. has gathered information on contract specifications for selected importing countries. These specifications indicated most countries place maximum limits on moisture with 13-13.5 percent the most prevalent limits. For hard red winter (HRW), HRS and soft red winter (SRW) wheat, over 70 percent of the selected countries utilized maximum moisture limits of 13-13.5 percent. A few countries specified lower limits for maximum moisture, some specified additional limits on sublots, two reported a 1:1 price adjustment for moisture over the maximum up to another fixed level, and two did not specify moisture limits at all.

Moisture Practices: Canada

Moisture is not a grade determining factor in Canada. However, Canada assigns three different classifications for wheat based on moisture levels (standard 14.5 percent or less, tough 14.6-17.0 percent, and damp over 17.0 percent). Thus, wheat for a grade can be classified as No. 2 Canadian western red spring (CWRS) wheat standard (where standard is generally dropped), No. 2 CWRS tough, or No. 2 CWRS damp.

Canada has restrictions on blending of grades of wheat and requires extensive accounting of grain flows from receival to export which are audited periodically. These accounting procedures limit the potential for adding water; however, since most Canadian production is higher moisture, the moisture problem in Canada is predominantly excess moisture rather than over dry production. Canada allows blending of grades at transfer elevators as long as grains blended are not western grain or foreign grain. At terminal elevators, Canada does not allow blending of No. 1 or No. 2 CWRS. However, they do allow blending of other grades (Canadian Grain Commission, 2001, p. 18).

Moisture Practices: Australia

Australia has specific limits on moisture levels for wheat allowed for delivery. Wheat with moisture in excess of 12.5 percent is not allowed to be delivered. Farmers must dry their grain prior to delivery if it contains excess moisture. This is generally not done as few farmers have access to dryers and in most years high moisture is not a problem. Australia is currently studying the effects of handling and marketing higher moisture grains. The main focus of this investigation is the effect of changes on moisture limits on quality reputation, etc. (Australian Wheat Board).

U.S. Production Moisture Levels

Several surveys examine quality of grains produced in the United States. These include surveys done by state agencies and state wheat commissions and those done by U.S. Wheat Associates, Inc. All of these surveys gather data on wheat, flour, dough, and baking characteristics. Moisture in wheat is one of the characteristics reported (Figure 1). These are generally conducted by geographic area and for a given class of wheat.

The Kansas Department of Agriculture and Kansas Wheat Commission report annually on the quality of HRW wheat by county and crop reporting district. Moisture levels for Kansas HRW wheats were gathered for the years 1996 to 2001 by crop reporting district.

The Department of Cereal Chemistry at North Dakota State University conducts annual surveys of regional (North Dakota, South Dakota, Montana, and Minnesota) crop quality for both HRS and durum wheats. Moisture levels were available by crop reporting district until 1996. Since 1997, moisture levels are available for refined regions which in many cases are crop reporting districts, but for others, represent combinations of crop reporting districts. Depending on whether definitions for areas were consistent, different amounts of data are available.

U.S. Wheat Associates, Inc. also reports data annually on harvest and export quality of U.S. wheats by class. These reports incorporate data from other surveys as well as surveys of their own. U.S. Wheat Associates, Inc. reports data for composite harvest production quality as well as quality destined for specific marketing areas [Pacific Northwest (PNW), Gulf, etc.] for several wheat classes. These indicate lower average moisture levels for wheat grown in areas marketed extensively through PNW ports [HRS, HRW, and soft white (SWW)] and production grown in the southwest (durum and HRW in California and Arizona areas).

Average moisture levels for production in Kansas are similar to moisture levels in North Dakota. In both states, moisture levels in the western crop reporting districts are lower than the eastern portions of the state. Montana has the lowest average moisture levels, with lowest moisture in the central and southeastern crop reporting districts. Minnesota crop reporting districts and the eastern region of South Dakota have the highest moisture levels.

U.S. Wheat Associates, Inc. quality data indicate that average levels of moisture for the wheat classes vary widely and largely reflect differences in production environments (Figure 2). For example, the class with the highest moisture level is SRW which is grown in the central United States, while durum production in the southwest and SW wheat have the lowest moisture levels which reflect drier growing environments.

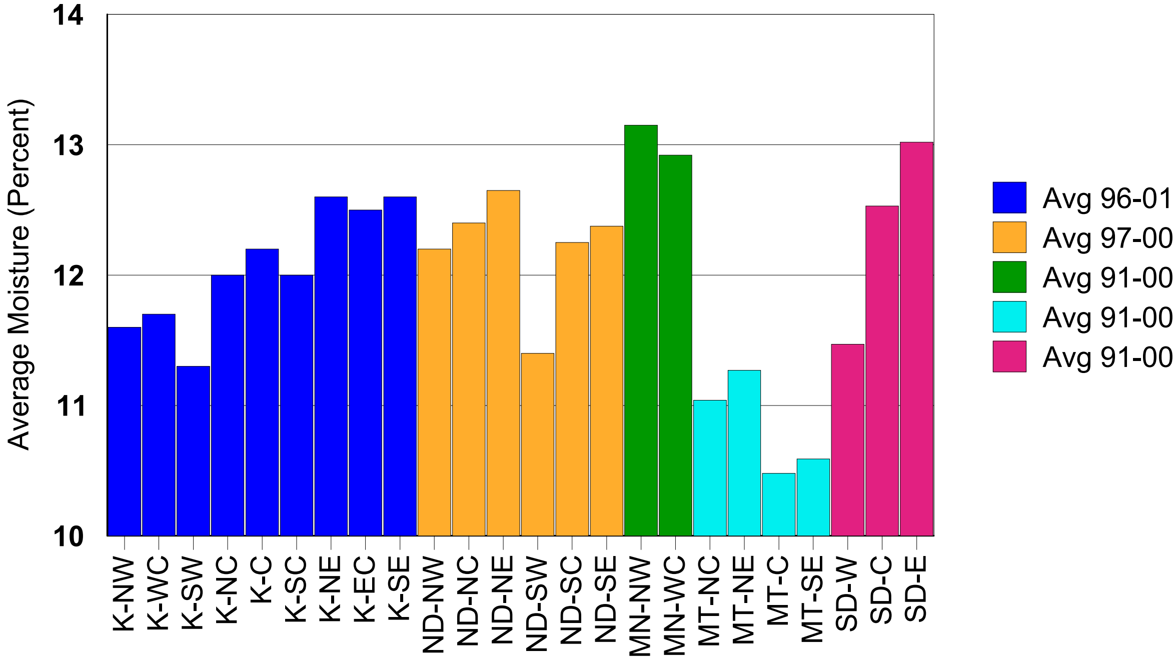

Figure 1. Average Moisture Levels for Wheat, Various Locations in Selected Wheat Producing States.

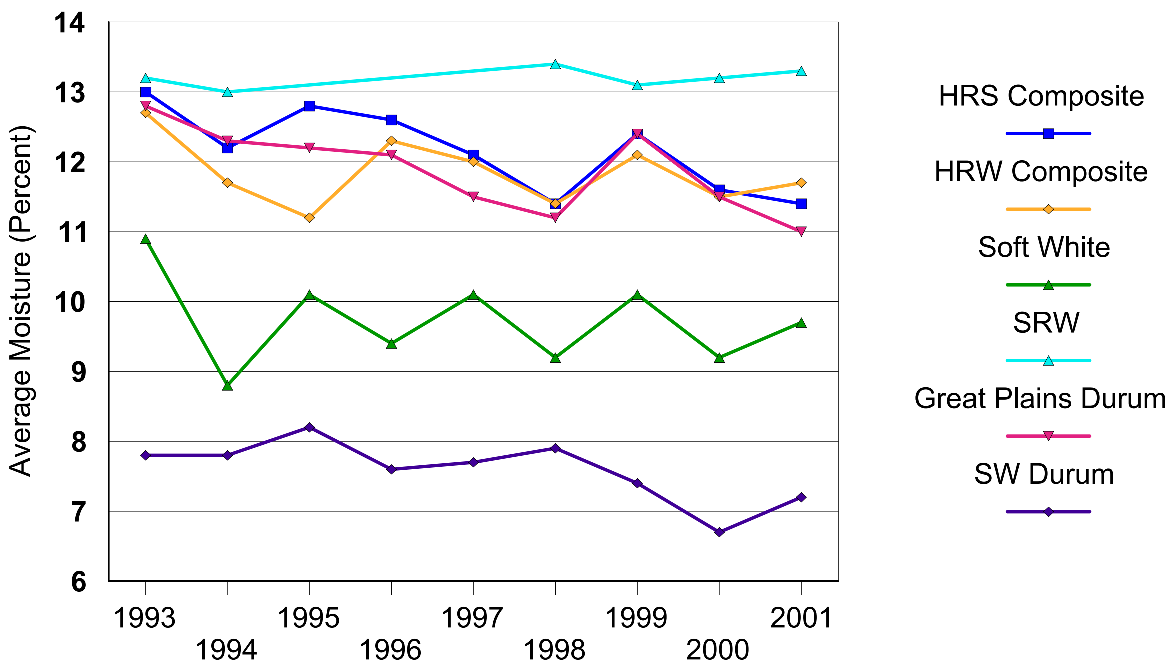

Figure 2. Average Moisture Level, by Wheat Class: U.S. Wheat Associates, 1993-2001.

Export Moisture Levels

USDA-GIPSA-FGIS reports annually on the quality of U.S. wheat export shipments. These are reported both by class and by grade and class. Average moisture levels for No. 1 HRS and HRW are up to 1 percent lower than for No. 2 (Figure 3). HRW is lower in moisture than HRS (Figure 4).

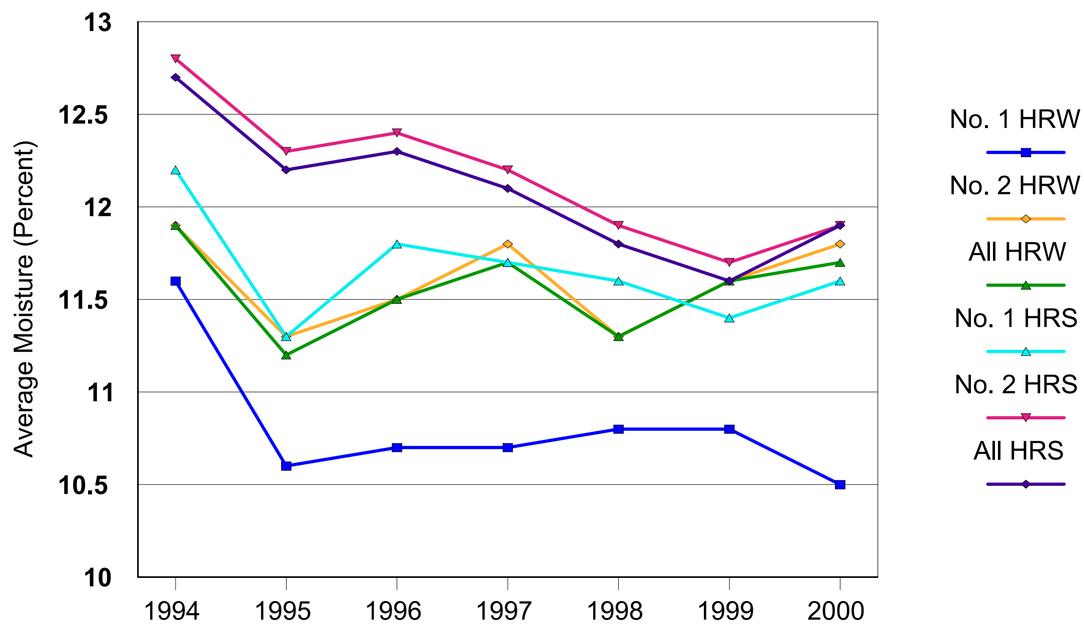

Figure 3. Average Moisture Levels for U.S. HRS and HRW Exports, 1994-2000.

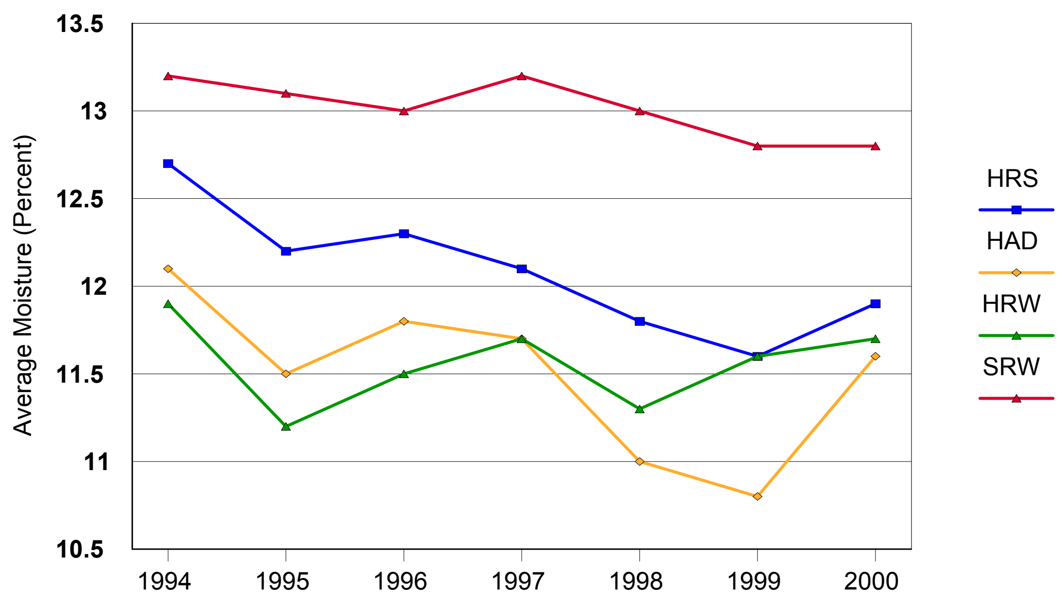

Figure 4. Average Moisture Levels for U.S. Wheat Exports, by Class.

Competitors: Canada [2]

Canada does not report moisture content in annual quality surveys of production quality for wheat. They report moisture levels for export quality; however, these are reported on a highly segregated basis (i.e., by protein level, grade, class, port area, and quarter of marketing year). These were gathered by port area for quarters 3-4 of available marketing years. Moisture for No. 1, 13.5 percent protein CWRS at Pacific ports averaged from a high of 13.6 percent in 1996/97 to a low of 12 percent in 1998/99 (Figure 5). Moisture levels at Atlantic ports were higher than those at Pacific ports and moisture levels for lower grades at both ports were typically higher than for No .1 CWRS (Figure 6).

Data for moisture and volumes exported for grade/protein segregations for quarters 3-4 of marketing years were utilized to estimate average moisture levels for CWRS exports. Estimated moisture levels for CWRS have higher moisture (greater than 1 percent higher in most years) than U.S. HRS and is more similar to moisture levels in U.S. SRW (Figure 7).

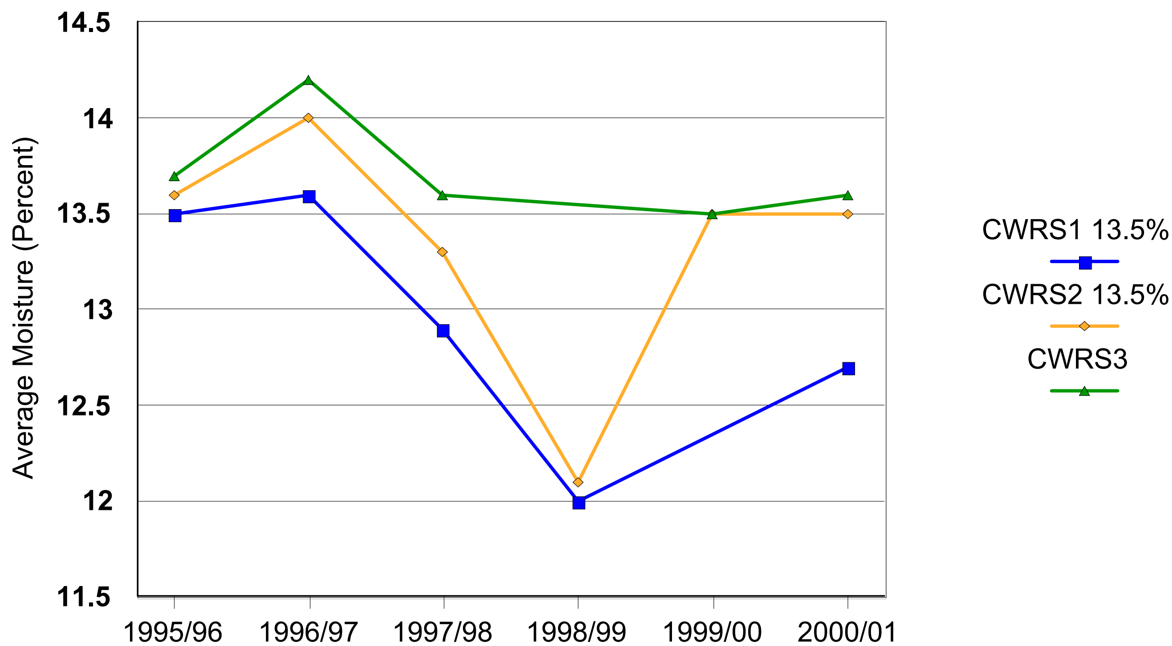

Figure 5. Average Moisture Levels for CWRS, by Grade and Protein Level, Pacific Ports, Quarters 3-4.

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[2] We were not able to obtain studies reporting moisture levels for either farm production or exports of Australian wheat. These may/may not be internal Australian Wheat Board data.

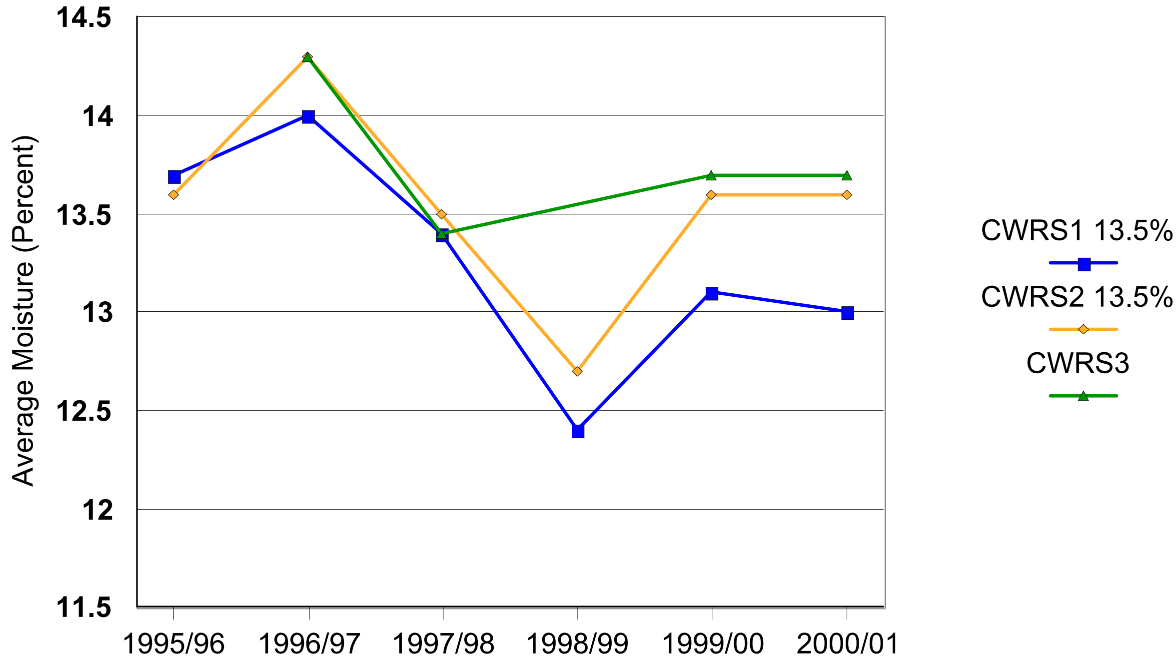

Figure 6. Average Moisture Levels for CWRS, by Grade and Protein Level, Atlantic Ports, Quarters 3-4.

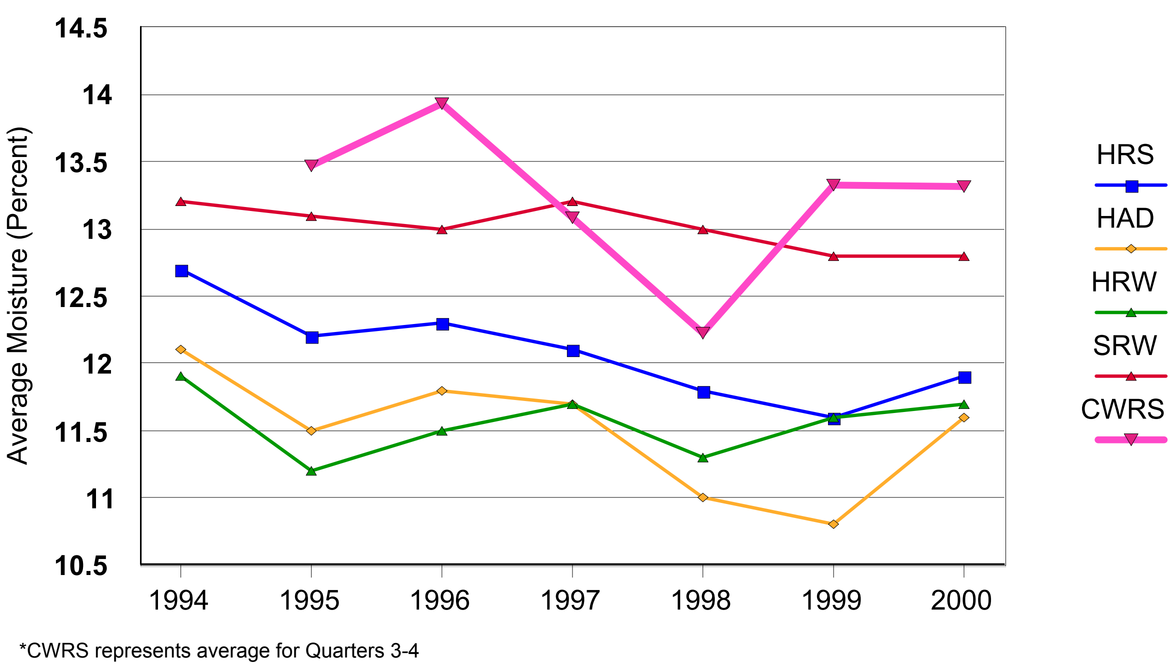

Figure 7. Average Moisture Levels for CWRS and U.S. Wheat Exports, by Class.

Effect of Change to Net Dry Wheat Pricing on Prices

Changing to a net dry wheat pricing formulation can impact prices depending on the type of change (nil moisture basis or 12 percent constant moisture basis) and assumptions on degree that benefits of lower moisture are reflected in current prices. These impacts include changing the level of prices reported, changing relative spreads between wheat classes and between the United States and other exporting countries. This section examines impacts on price levels and spreads for two scenarios reflecting the degree that benefits of lower moisture are reflected in current market prices. One scenario (Full Knowledge) is where benefits are fully reflected in current market prices. This assumes that buyers implicitly place a value on certain wheat locations/classes/ports that reflects the impact of moisture content. Those production regions/classes grown as low moisture are currently receiving a positive implicit value. The second (Limited or "naive" Knowledge) is where none of the benefits are reflected in current prices. This assumes buyers are naive and do not place value for moisture content for wheat of different location/classes/ports.

Conversion of prices to a nil moisture basis were examined for each of the major wheat classes from 1993 to 2001. Net dry wheat prices were estimated using data for average moisture levels for the various wheat classes from 1993 to 2001 (U.S. Wheat Associates, Inc.), and annual cash market prices (USDA-ERS) for the respective classes. Net dry wheat prices assume that prices reflect Full Knowledge of benefits of lower moisture and are reflected in the current wheat price. These were converted to a nil moisture basis as follows:

$$\text{Net Dry Wheat Price} = \text{Current Price} / (100\% - \text{Moisture})$$

Moving to a nil moisture basis would increase prices for all wheat classes. The average price increase [measured as a price spread (nil moisture price minus current market price)] was highest for HAD and 14 percent HRS and lowest for HRW and SRW (Figure 8). This occurs because HAD and HRS have either higher moisture levels and/or higher current prices than other classes, which result in larger nil moisture prices. This suggests that a move to a nil moisture quote for wheat would also increase prices for HAD and HRS relative to HRW and SRW. Average increases by class are as follows: HAD would increase by 73 c/bu, HRS 14 percent would increase by 61 c/bu, HRW would increase by 51 to 55 c/bu (Ord vs. 13 percent HRW), and SRW would increase by 42 c/bu. The effect of a change to nil moisture pricing would increase reported prices of HRS relative to other wheats. It should be cautioned that this increase in price would occur with an adjustment in quantity delivered (removal or adjustment to the water weight contained in the net weight of wheat delivered) and should not be confused with combined effects of both quantity and price on grower revenue which are examined in the next section.

If the change is to a 12 percent moisture basis, then the effects on prices are minimal. Average price changes by class from 1993 to 2001 were highest for SRW which increased 4 c/bu. Average prices for other classes were virtually unchanged. HRW ordinary and 13 percent protein prices averaged 1 c/bu lower, while HRS 14 percent was on average 1 c/bu higher than current prices, and HAD was unchanged.

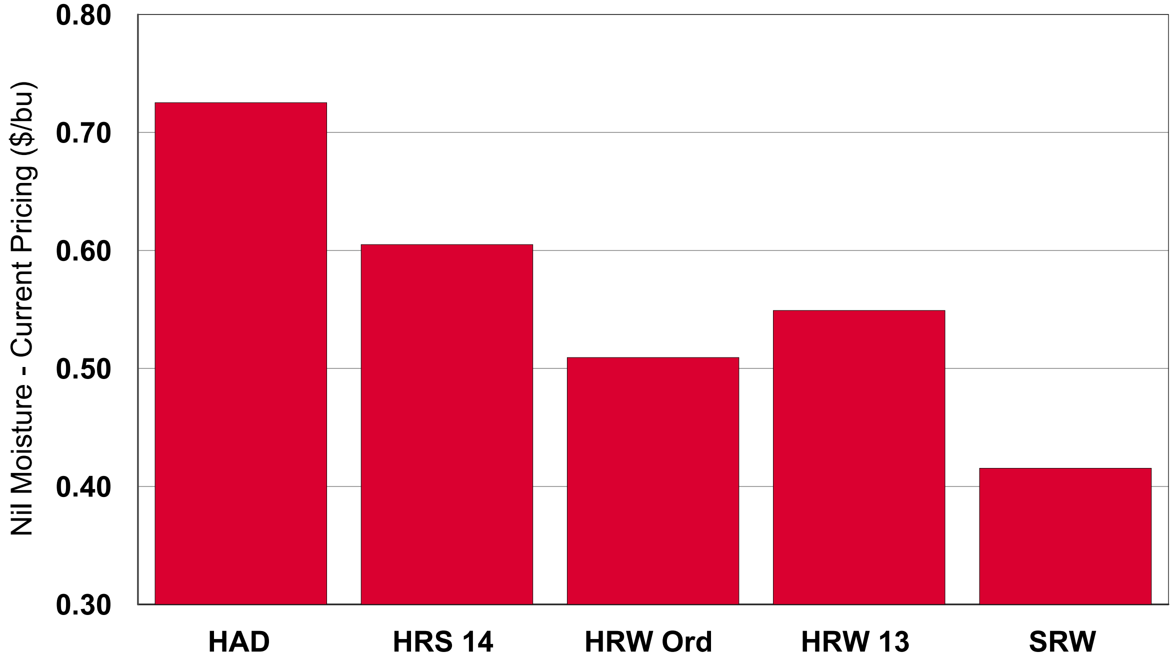

Figure 8. Average Spread Nil Moisture Price - Current Price, by Class, 1993-2001.

A similar comparison was undertaken for North Dakota price effects. This comparison utilized average moisture levels for crop quality regions and average marketing year prices received by farmers for the dominant crop reporting regions within the crop quality area (North Dakota Agricultural Statistics Service). Both a Full Knowledge and Limited Knowledge case were estimated. The Limited Knowledge price for the nil moisture content was estimated assuming prices received by farmers reflect average moisture levels across North Dakota (12 percent). These were adjusted to a nil moisture basis and then adjusted to reflect differences between crop area moisture and base 12 percent.

$$Price_{LTD} = Price_{c} * ((100\%-M)/.88)$$

Under the Full Knowledge case, where prices contained buyers' additional valuation due to drier wheat, changing to a nil moisture price increased prices by 38 to 44 c/bu with prices increasing more in eastern regions due to higher moisture levels in these regions (Table 3). This implies there is a current implicit discount (premium) for these eastern (western) regions. However, under the Limited Knowledge case, where prices do not reflect any benefits of dry wheat, changing to a nil moisture price increased price levels by 39 to 46 c/bu. Prices received by farmers in the southwestern region increased the most and southern North Dakota regions increased more than northern regions (Table 4). Moving to a 12 percent constant moisture basis under either the Limited or Full Knowledge cases resulted in minimal price changes (less than 4 c/bu) from current levels.

Table 3. Estimated Price Level Effects for North Dakota HRS of Moving to Nil/Constant Moisture Prices (Full Knowledge)

Year	NW	NC	NE	SW	SC	SE
			Average Moisture Levels by North Dakota Region			
1997	12.0	12.3	12.6	11.0	11.6	12.6
1998	11.8	11.7	11.9	10.8	11.6	11.9
1999	12.7	13.2	13.2	12.5	13.3	12.7
2000	12.3	12.4	12.9	11.3	12.5	12.3
Avg	12.2	12.4	12.7	11.4	12.3	12.4
			Average Price Received by Farmers*			
1997	3.42	3.38	3.42	3.33	3.56	3.49
1998	2.92	2.94	3.08	2.83	3.11	3.1
1999	2.65	2.76	2.89		2.96	2.93
2000	2.67		2.85		2.71	2.81
Avg	2.92	3.03	3.06	3.08	3.09	3.08
			Estimated Price - Nil Moisture Basis			
1997	3.89	3.85	3.91	3.74	4.03	3.99
1998	3.31	3.33	3.50	3.17	3.52	3.52
1999	3.04	3.18	3.33		3.41	3.36
2000	3.04		3.27		3.10	3.20
Avg	3.32	3.45	3.50	3.46	3.51	3.52
			Change in Price Levels (Nil Moisture Basis-Current)			
1997	0.47	0.47	0.49	0.41	0.47	0.50
1998	0.39	0.39	0.42	0.34	0.41	0.42
1999	0.39	0.42	0.44		0.45	0.43
2000	0.37		0.42		0.39	0.39
Avg	0.40	0.43	0.44	0.38	0.43	0.44
			Estimated Price - 12% Moisture Basis			
1997	3.42	3.37	3.40	3.37	3.58	3.47
1998	2.93	2.95	3.08	2.87	3.12	3.10
1999	2.63	2.72	2.85		2.92	2.91
2000	2.66		2.82		2.69	2.80
Avg	2.91	3.01	3.04	3.12	3.08	3.07
			Change in Price Levels (12% Moisture Basis-Current)			
1997	0.00	-0.01	-0.02	0.04	0.02	-0.02
1998	0.01	0.01	0.00	0.04	0.01	0.00
1999	-0.02	-0.04	-0.04		-0.04	-0.02
2000	-0.01		-0.03		-0.02	-0.01
Avg	-0.01	-0.01	-0.02	0.04	-0.01	-0.01

* Regions for moisture levels do not correspond directly to crop reporting districts (CRDs). Prices reflect most often reported CRD series that is part of quality region (NW, NC, NE, SW, C, and EC).

Table 4. Estimated Price Level Effects for North Dakota HRS of Moving to Nil/Constant Moisture Prices (Limited Knowledge)

Year	NW	NC	NE	SW	SC	SE
		Average Moisture Levels by North Dakota Region				
1997	12.0	12.3	12.6	11.0	11.6	12.6
1998	11.8	11.7	11.9	10.8	11.6	11.9
1999	12.7	13.2	13.2	12.5	13.3	12.7
2000	12.3	12.4	12.9	11.3	12.5	12.3
Avg	12.2	12.4	12.7	11.4	12.3	12.4
		Average Price Received by Farmers*				
1997	3.42	3.38	3.42	3.33	3.56	3.49
1998	2.92	2.94	3.08	2.83	3.11	3.1
1999	2.65	2.76	2.89		2.96	2.93
2000	2.67		2.85		2.71	2.81
Avg	2.92	3.03	3.06	3.08	3.09	3.08
		Estimated Price - Nil Moisture Basis				
1997	3.89	3.83	3.86	3.83	4.06	3.94
1998	3.33	3.35	3.50	3.26	3.55	3.53
1999	2.99	3.09	3.24		3.31	3.30
2000	3.02		3.21		3.06	3.18
Avg	3.31	3.42	3.45	3.54	3.50	3.46
		Change in Price Levels (Nil Moisture Basis-Current)				
1997	0.47	0.45	0.44	0.50	0.50	0.45
1998	0.41	0.41	0.42	0.43	0.45	0.43
1999	0.34	0.33	0.35		0.35	0.37
2000	0.35		0.36		0.35	0.37
Avg	0.39	0.40	0.39	0.46	0.41	0.41
		Estimated Price - 12% Moisture Basis				
1997	3.42	3.37	3.40	3.37	3.58	3.47
1998	2.93	2.95	3.08	2.87	3.12	3.10
1999	2.63	2.72	2.85		2.92	2.91
2000	2.66		2.82		2.69	2.80
Avg	2.91	3.01	3.04	3.12	3.08	3.07
		Change in Price Levels (12% Moisture Basis-Current)				
1997	0.00	-0.01	-0.02	0.04	0.02	-0.02
1998	0.01	0.01	0.00	0.04	0.01	0.00
1999	-0.02	-0.04	-0.04		-0.04	-0.02
2000	-0.01		-0.03		-0.02	-0.01
Avg	-0.01	-0.01	-0.02	0.04	-0.01	-0.01

* Regions for moisture levels do not correspond directly to crop reporting districts (CRDs). Prices reflect most often reported CRD series that is part of quality region (NW, NC, NE, SW, C, and EC).

Effect of Change in Moisture Basis on Relative Prices/Revenue

In this section the effects of changes to a constant (nil or 12 percent moisture basis) on relative prices or revenue are examined. Three examples representing sales at constant moisture level (12 percent), a lower moisture level (9 percent), and a higher moisture level (13 percent) are presented in Table 5. The net effect of a change to either a nil or constant moisture basis is determined by assessing both the price and quantity effects of the change and depends on whether buyers are naive or have knowledge of the advantage of purchasing lower moisture grain and that current prices reflect this advantage. If buyers are naive, (current prices do not reflect buyer preference or value for drier wheats) movement to nil or constant moisture basis would increase revenue to those farmers producing low moisture grain and would reduce revenue to producers selling higher moisture wheats. This would provide additional revenue to western North Dakota and less to eastern North Dakota and Minnesota growers. For example, if we assume a farmer in western North Dakota delivers a truckload of wheat (36,000 lbs) with 9 percent moisture (example 2 -Table 5), then he would receive an additional $70.12/truck if wheat is priced on a constant moisture basis (either nil or 12 percent) over what he would receive under the current practice where moisture is not considered. In contrast, a farmer delivering a truckload of 13 percent moisture wheat would receive $23.39/truck less for wheat on a constant moisture basis than under current practices.

If buyers have Full Knowledge of the advantage of buying lower moisture grains and these are reflected in current prices, movement to nil/constant moisture basis would have limited/no effect on revenue (Table 5). Therefore, moving to a nil moisture basis would have no/limited impact on grower revenue and would only change quoted prices. Movement to constant/nil moisture basis would remove incentives for re-wetting grain.

Summary and Conclusions

Low moisture grains have been an ongoing issue for grain growers/marketers. This study examined current moisture specification practices in the United States and for major exporters and analyzed impacts of changes to alternative pricing specifications including a nil or constant moisture price. These were examined under two scenarios, Limited Knowledge and Full Knowledge, which reflect no or full information on moisture levels and are contained in current prices.

Results show average moisture levels for wheat classes are lowest for southwestern durum production, followed by SW wheat. SRW wheat has the highest moisture levels, while HRW, HRS, and Great Plains durum production have similar moisture levels. Closer examination of farm production for these latter three classes (HRW, HRS, and Great Plains durum) indicates moisture levels in Kansas and North Dakota are similar, while Montana has the lower moisture levels, and Minnesota and South Dakota have higher moisture levels.

Table 5. Comparison of Net Bushels, Revenue, and Prices for Wheat for Current Practices, 0% MB and 12% MB under Limited and Full Knowledge.

Base Wheat Delivered Calculation				Revenue Calculation - Limited Knowledge				Revenue Calculation - Full Knowledge			
						Constant Moisture Level				Constant Moisture Level	
		Lbs	Bu		Current	0%	12%		Current	0%	12%
Example 1 Wheat Delivered at 12% Moisture											
Wheat		36,000	600	Bushels	588	516	588	Bushels	588	516	588
Moisture	12%	4,320		Price	3.50	3.99	3.50	Price	3.50	3.99	3.50
Dockage	2%	720									
				Revenue	2,058	2,058	2,058	Revenue	2,058	2,058	2,058
Net Wheat (less dockage)		35,280	588	Rev Diff		0.00	0.00	Rev Diff		0.00	0.00
Wheat 0% MB		30,960	516	Price Diff		0.49	0.00	Price Diff		0.49	0.00
Wheat 12% MB		35,280	588	% Rev Diff		0.0%	0.0%	% Rev Diff		0.0%	0.0%
Example 2 Wheat Delivered at 9% Moisture											
Wheat		36,000	600	Bushels	588	534	608	Bushels	588	534	608
Moisture	9%	3,240		Price	3.50	3.99	3.50	Price	3.62	3.99	3.50
Dockage	2%	720									
				Revenue	2,058	2,128	2,128	Revenue	2,128	2,128	2,128
Net Wheat (less dockage)		35,280	588	Rev Diff		70.16	70.16	Rev Diff		0.00	0.00
Wheat 0% MB		32,040	534	Price Diff		0.49	0.00	Price Diff		0.37	-0.12
Wheat 12% MB		36,483	608	% Rev Diff		3.4%	3.4%	% Rev Diff		0.0%	0.0%

Table 5. Comparison of Net Bushels, Revenue, and Prices for Wheat for Current Practices, 0% MB and 12% MB under Limited and Full Knowledge (Continued).

Base Wheat Delivered Calculation				Revenue Calculation - Limited Knowledge				Revenue Calculation - Full Knowledge			
						Constant Moisture Level				Constant Moisture Level	
		Lbs	Bu		Current	0%	12%		Current	0%	12%
Example 3 Wheat Delivered at 13% Moisture											
Wheat		36,000	600	Bushels	588	510	581	Bushels	588	516	588
Moisture	13%	4,680		Price	3.50	3.99	3.50	Price	3.46	3.99	3.50
Dockage	2%	720									
				Revenue	2,058	2,035	2,035	Revenue	2,035	2,035	2,035
Net Wheat (less dockage)		35,280	588	Rev Diff		-23.39	-23.39	Rev Diff		0.00	0.00
Wheat 0% MB		30,600	510	Price Diff		0.49	0.00	Price Diff		0.53	0.04
Wheat 12% MB		34,879	581	% Rev Diff		-1.1%	-1.1%	% Rev Diff		0.0%	0.0%

Export moisture levels indicate SRW has the highest moisture levels, followed generally by HRS, and either HAD or HRW, where HAD has had the lowest moisture since 1998. U.S. exports of higher grades of HRS and HRW had lower moisture levels than did lower grades. Moisture levels for Canadian CWRS exports generally were similar to those for U.S. SRW and about 1 percent higher than for U.S. HRS. Australia does not allow delivery of wheat into the marketing system with more than 12.5 percent moisture and generally does not have excessive moisture problems. However, data on moisture levels of exports were not available.

Comparisons of price levels for either a nil moisture or constant moisture (12 percent) basis indicate conversion to a nil moisture basis (with a subsequent adjustment to volumes to reflect the subtraction of moisture) would increase reported prices from 42 to 70 c/bu for the wheat classes, while a 12 percent constant moisture basis would have limited impacts on reported prices. For North Dakota, if current benefits of lower moisture levels are not reflected in prices received by farmers (Limited Knowledge), then relative price levels in western regions may increase compared to prices in western North Dakota. However, if current benefits are reflected in prices received by farmers (Full Knowledge), relative price levels in western regions may decline compared to prices in eastern regions.

Comparisons of effects of moving to nil moisture or constant moisture pricing mechanisms show farmer revenue would be impacted if current benefits are not reflected in current prices (Limited Knowledge). Farmers delivering a truckload (36,000 lbs or 600 bu) of wheat at 9 percent moisture would increase revenue by $70/truck. However, if benefits are reflected in current prices, impacts on revenue are limited. It is likely that benefits of lower moisture levels for a region are reflected to some extent in prices. However, if moisture for a farmers' wheat varies from the average in the region, then this would be more likely to reflect the Limited Knowledge case. Thus, regional impacts of moving to either a nil or constant moisture basis may be limited, while effects for individual farmer deliveries may be more substantial, lowering revenue from current practices for higher moisture deliveries and increasing revenue for lower moisture deliveries.

There are several implications for North Dakota farmers and grain handlers. First, changes to a nil moisture price would affect levels of prices reported for all wheat classes and would result in higher reported prices for U.S. wheats. Whereas, changing to a constant moisture basis (12 percent) would leave prices relatively unchanged from current levels. Second, adjusting bushels to a constant moisture basis or changing prices to either a nil moisture or constant moisture basis would provide additional revenues to individual farmers with moisture lower than average within their region, while lowering revenue for those with higher than average moisture. This could be viewed as applying a more correct valuation for wheat delivered, similar to when protein measurements were converted to a constant moisture basis and should remove any incentive to re-wet grain. Third, effects of moving to a constant or nil moisture basis on relative prices and price levels depends on whether knowledge of benefits (added value of drier lots due to more dry matter and lower transportation costs than for higher moisture lots) of lower moisture wheat is reflected in current prices. Fourth, movement to either a nil or constant moisture basis would put additional pressure on accuracy of moisture testing / grievance resolution mechanisms at least in the short term. Finally, changing to a constant or nil moisture basis may affect the competitiveness of U.S. wheat. Movement to a nil moisture basis would increase price levels for U.S. grains relative to competitors, increasing needs for buyer education, at least in the short term. However, relative effects on competitiveness would again depend on whether prices for export bids from the United States and competitors reflect benefits of dryer grain.

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