Approved March 4, 1983
Date

MINUTES OF THE HOUSE COMMITTEE ON AGRICULTURE AND LIVESTOCK.

The meeting was called to order by Rep. Bill Fuller at
Chairperson

9:00 a.m./~~p.m.~~ on February 23, 1983 in room 423-S of the Capitol.

All members were present except:

Committee staff present:

Bruce Hurd, Revisor of Statutes' Office
Raney Gilliland, Legislative Research Department
Kathleen Moss, Committee secretary

Conferees appearing before the committee:

Rep. Richard Harper, sponsor of HB 2299
Don Jacka, Assistant Secretary of Agriculture
George Grossenbacher, Bern, Kansas
Keith C. Behnke, Ph.D., Kansas State University

Chairman Fuller instructed the committee that today is the last day for the committee to introduce bills.

Rep. Campbell reported on a meeting he attended in Des Moines, Iowa in May of 1982 where he received information on a plant that could be grown here that produces natural rubber. He stated that rubber is now imported and perhaps a new industry could be established.

Rep. Johnson said he believed the committee should consider legislation to allow wine-making in Kansas but does not feel there is enough time to have a draft approved. He would like to do a little more research on it and run it through the Federal and State Affairs Committee to be referred back to this committee. He read part of a Mississippi statute and said he would like to have the bill drafted out of the Mississippi procedures.

Rep. Solbach told the committee he has been talking to the organic people and they feel they would not be ready for hearings until next year. He would like the committee to keep this in mind for next year.

HB 2299 providing for registration and certification of moisture measuring devices.

Rep. Richard Harper, sponsor of HB 2299 distributed a prepared statement, Attachment No. 1, supporting HB 2299.

John Blythe of the Kansas Farm Bureau was called for testimony. He previously had passed out a Resolution book that shows their position on Page 5. The Farm Bureau supports state certification and testing of moisture devices by the State Board of Agriculture. He then introduced George Grossenbacher of Bern, Kansas, to give additional testimony. Mr. Grossenbacher distributed a prepared statement, Attachment No. 2, supporting a state inspection program for moisture testers.

Don Jacka, Assistant Secretary of Agriculture, appeared for the State Board of Agriculture. His presentation reported on what other states are doing, the types of methods used and problems that have been encountered in this type of program. His statement is Attachment No. 3.

Dr. Keith Behnke, Kansas State University appeared providing technical aspects of moisture testing. He looked at research and visited about 50 elevators across the state and collected

500 samples of wheat that he took back to K-State and tested for variability. His sampling showed that the calibration of the testers was in favor of the farmer. Meters can be set to be close, then can get out of calibration. Time was limited on questions.

Chairman Fuller asked those who did not have the opportunity to appear if they would be able to come back tomorrow and all said they could. He informed the committee that the committee will meet tomorrow and continue the hearing.

The meeting was adjourned at 9:59 a.m.

The next meeting will be at 9:00 a.m. on February 24, 1983 in Room 423-S.

GUEST REGISTER

DATE Feb. 23, 1983

HOUSE OF REPRESENTATIVES
COMMITTEE ON AGRICULTURE AND LIVESTOCK

NAME	ORGANIZATION	ADDRESS
John Craft	KGFO	Marion
Nancy Pantola	Kansas Co-op Council	Topeka
Keith C. Behnke	Kansas State University	Manhattan.
Kim B. Koch	Kansas State University	Manhattan
[illegible]	Ks Seed Dlrs, Inc	Topeka
John Blythe	KFB	Manhattan
George [illegible]		Bern Kans
Della Wray Blythe		Manhattan
Jack Milligan	Ks. Assn. Conservation Districts	Topeka
Jon Jacka	Ks. State Board of Agriculture	Topeka
John L. O'Neill	Ks State Board of Agriculture	Topeka
Dale Goter	HNS	Topeka
B Crenshaw	CKFO	"
Dee Likes	KLA	Topeka
Gary M. Bothwell	Kans State Grain Insp	Topeka

Attachment No. 1 - 2-23-83

House Agriculture Committee

RICHARD L. HARPER
REPRESENTATIVE, ELEVENTH DISTRICT
BOURBON, CRAWFORD, AND LINN COUNTIES
R.F.D. NO. 3
FORT SCOTT, KANSAS 66701

STATE OF KANSAS

TOPEKA

HOUSE OF REPRESENTATIVES

COMMITTEE ASSIGNMENTS
CHAIRMAN: ELECTIONS
MEMBER: JUDICIARY
TRANSPORTATION

February 23, 1983

Mr. Chairman and Members of the Committee

I appreciate the opportunity to appear this morning in favor of HB 2299 which would require the testing of Moisture Measuring Devices for Grain.

The issue of implementing legislation requiring moisture measuring devices to be tested in Kansas has been addressed previously. The most recent formal consideration came in 1977. At that time, the House Agriculture and Livestock Committee considered HB 2136. Obviously, the legislation did not receive favorable consideration.

However, several other states have enacted legislation which requires the testing of moisture measuring devices used for grains. Those states are:

Arkansas	Indiana	Nebraska
California	Iowa	Pennsylvania
Colorado	Kentucky	South Carolina
Delaware	Maryland	Tennesee
Florida	Michigan	Virginia
Georgia	Mississippi	Wisconsin
Illinois	Missouri	

This information was obtained from sources at the National Bureau of Standards. These sources also indicated that the trend for implementing such legislation is somewhat recent. The oldest legislation appears to be that of Nebraska's which was implemented in the late 1950's. Most of the other states passed their legislation in the

Atch. 1

1970's. These sources also indicated that there are several different brands of moisture measuring devices, which may measure moisture in grain differently, among the 2,000 to 2,500 devices used for commercial purposes in the state.

cereal foods world
american association of cereal chemists
FEBRUARY 1980

Improvement of Commercial Grain Moisture Measurement: A Cooperative Program Between the U.S. National Bureau of Standards and Individual State Regulatory Agencies[1]

C. S. Brickenkamp, National Bureau of Standards, Washington, DC 20234

Knowledge and control of the moisture content of grain are two important elements in maintaining grain quality. On-farm and industrial handling and processing of grain, and especially commercial exchange of grain, depend on the use of devices which measure grain moisture content almost instantaneously.

The majority of "moisture meters" in commercial service in the United States are capacitance devices. These moisture meters are calibrated by the manufacturers (except for one meter calibrated by the U.S. Department of Agriculture [USDA] for its own use in inspection) by relating the moisture value shown on the meter to the moisture value obtained by USDA oven drying methods (1) for a number of individual grain samples from various geographical regions of the United States. The resulting calibration may be built into the meter's circuitry to provide a direct readout of moisture content; alternatively, charts and peripheral equipment such as thermometers and weighing devices (called grain moisture-test scales) may be needed to supply data to convert the meter reading to moisture content.

Within the United States, authority to require a specified accuracy and precision from such measurement devices used in commercial trade rests with the weights and measures jurisdictions of the individual states. To date, 28 states have asked the National Bureau of Standards (NBS) for guidance on appropriate test procedures, traceable reference methodology for moisture determination, and technical requirements and tolerances to be applied. In response to the immediate needs of state regulatory agencies, NBS has developed a grain moisture meter testing program as a cooperative venture with individual states. Sixteen states (Alabama, Arkansas, California, Florida, Georgia, Illinois, Kentucky, Maryland, Mississippi, Missouri, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Wisconsin) are currently involved or have agreed to become involved in data collection and field test evaluation programs with NBS. These programs have been devised according to the needs, constraints, and resources of each state. The programs are modified or expanded as new information or data becomes available from the states, industry, or other sources.

TESTING PROGRAM

Field Testing

Field testing and laboratory procedures supply information on necessary equipment, laboratory and field techniques, and data collection. The states have surveyed their market environments and systematized their regulatory schedule of testing and reporting to maximize the effectiveness of their testing results in promoting fair marketing and to provide feedback to meter manufacturers and government agencies.

The field testing program is conceptually composed of three phases. The first phase is an interim period in which the state inspects and regulates peripheral equipment such as grain moisture-test scales and thermometers. Data are collected and used to set performance criteria for grain moisture meters in that state. An educational campaign is also waged by the state inspection force during this period to acquaint meter owners, operators, and users with the best available techniques for grain sampling and for sample handling and measurement. This interim period usually requires a minimum of one year.

The second phase of the testing program is purely regulatory. Responsibility for performance of the entire measurement system (meters, grain moisture-test scales, thermometers, charts, other computing or sampling devices, and their use) is placed entirely in the hands of the grain buyer. Penalties for not meeting this responsibility are within the purview of an individual state legislature or regulatory agency.

The third phase, the setting of national performance and design criteria and standards suitable for enforcement by all state agencies, is yet to be carried out at the national level in concert with state and federal agencies. This is usually the function of the National Conference on Weights and Measures (NCWM), a voluntary organization of state and local weights and measures officials, which convenes annually to add or amend model regulations and other legal codes voluntarily adopted by their individual member jurisdictions. NBS acts as technical advisor to the NCWM and publishes the code book developed and adopted by all 50 states, Handbook 44, *Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices* (2). Presently

[1]Presented at the International Association of Cereal Chemistry seminar on Moisture Determination in Cereals, held in conjunction with the Sixth International Cereal and Bread Congress, Winnipeg, Canada, September 1978.

Att. 1a

no code or model regulation covers grain moisture meters (although a code for grain moisture-test scales exists).

Standards

The reference moisture content standard provided to the states consists of the USDA official oven drying techniques[2], and the results of official oven tests made by the USDA on grain samples supplied by individual states. Other work in this area is reported elsewhere (3).

To eliminate the demonstrated differences between individual meter readings and the official oven results on a particular grain sample, grain is used as the transfer standard between the official oven reference and the meter being tested. This method replaces the formerly used one of checking a meter of each make and model with a like "master" meter owned and operated by the state. Zeleny and Hunt of the USDA noted in 1964 that "Checking moisture meters by means of grain samples of known moisture content should provide the most reliable meter inspection system if the agency performing this inspection is prepared to use a sufficiently large and diversified group of grain samples for this purpose" (4). (Because state regulations require commercial meters to function within prescribed tolerances on any grain sample, a "large and diversified group of grain samples" is not strictly necessary to test individual meters.)

A number of states have demonstrated the feasibility of using grain samples when care is exercised in the selection, collection, preparation, and preservation of such samples. The International Organization for Legal Metrology, in its first working paper for an international recommendation for legal requirements for grain moisture meters, requires the use of grain samples to test the meters (5).

EXAMPLE OF COOPERATIVE TESTING

Arkansas, with a program well into the purely regulatory phase, provides an excellent example of the cooperative work. In the winter of 1974, the state weights and measures authority found that 90% (292) of the grain moisture-test scales in use (not all meters require scales) did not meet Handbook 44 requirements. They were all repaired or replaced that year.

In 1975, 67 fresh grain samples of wheat, rice, and soybeans (Arkansas's major crops) were prepared as sets of transfer standards, each set composed of a relatively high, a medium, and a low moisture content sample (for rice, above 19%, between 16 and 19%, and between 12 and 16%, respectively). These samples were taken into the field to test commercial meters. Other essential peripheral equipment was tested and required to be repaired or replaced if not adequate for its intended use.

In 1976, the state took 96 fresh samples of wheat, soybeans, and rice prepared as high, medium, and low moisture sets to the field to test commercial meters. No legal requirements on the meters were enforced at that time. The resulting meter readings for each sample for each meter model tested were plotted against the USDA oven test results. (Ten models of meters are used commercially in Arkansas: Burrows Moisture Recorder, Burrows 700, Motomco 919, Steinlite 400G, Steinlite DM, Steinlite SS250, Steinlite RC, Steinlite RCT, Steinlite Automatic, and Steinlite DL.) Figures 1 and 2 show results from two meter models. For each model, the difference between the meter moisture value and the oven moisture value for soft red winter wheat is plotted against the oven data. The best straight line relating the meter reading and the oven value was computed by least squares. The equations for these lines for meters T and O are shown in Table I.

These data were then used to determine the magnitude of error in moisture content determinations that Arkansas should initially allow. The state decided that a rejection rate of about 10% would not disrupt grain commerce. For simplicity of initial estimate, a tentative tolerance was chosen by the state corresponding to a band parallel to the fitted line that enclosed 90% of the meter readings. This band varied from meter model to model (eg, about ±0.5% for meter O, ±0.6% for meter T, and even larger values for other meters); consequently, an average tolerance band of ±0.7% was chosen. All data collected in 1976 were transmitted to meter manufacturers so that they could modify their calibration charts or internal calibrations before the next year's harvest.

In 1977, the state again used fresh grain samples to test commercial moisture meters and applied the ± 0.7% performance tolerance. Because meters had not been adjusted by the manufacturers to take into account the information supplied by Arkansas in 1976, a rejection rate of 30% resulted. Meters that failed to give moisture content values with ±0.7% in

TABLE I
Fitted Lines ($y = a + bx$)[a] for Two Moisture Meters

Meter	Year	a	b	Range in x (%)	x^b (%)	y^c (%)	y−x (%)
T	1976	1.05	0.91	12.30–18.04[d]	15.58	15.25	−0.33
	1977	1.06	0.91	13.88–19.21	16.12	15.66	−0.46
	1978	0.15	1.00	11.94–16.20	13.92	14.12	+0.20
O	1976	0.65	0.94	12.30–18.04	15.20	14.87	−0.33
	1977	0.64	0.93	13.88–19.21	16.17	15.69	−0.48
	1978	−0.081	0.98	11.94–16.20	13.94	13.54	−0.40

[a] y = moisture content from meter, a = intercept, b = slope, x = moisture content from USDA oven drying procedures.
[b] Mean of x.
[c] Mean of y.
[d] Expressed as percent wet basis:

$$\%\ \text{Moisture content} = \frac{\text{weight of water}}{\text{weight of water and grain}} \times 100.$$

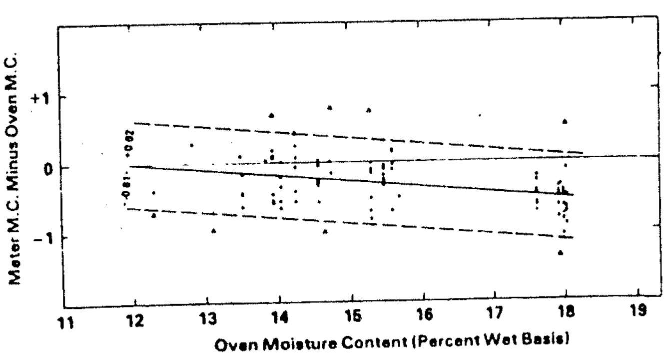

Fig. 1. Fitted line for 1976 Meter T moisture measurement of fresh soft red winter wheat. ——— = tentative tolerance boundaries, ——— = fitted line, Δ = readings beyond tolerance boundaries.

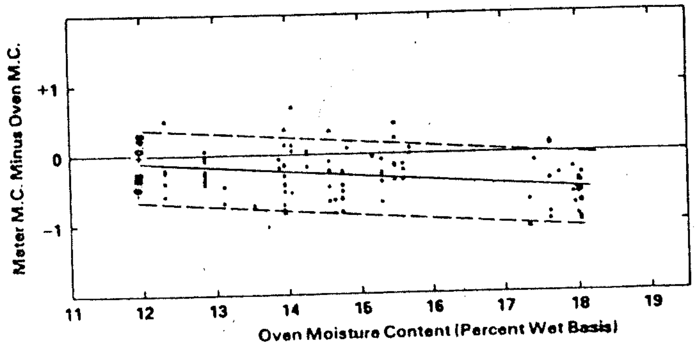

Fig. 2. Fitted line for 1976 meter O moisture measurement of fresh soft red winter wheat. ——— = tentative tolerance boundaries, ——— = fitted line, Δ = readings beyond tolerance boundaries.

[2] See also Method 44-15 of The American Association of Cereal Chemists.

moisture [illegible] tent of the oven values on any sample were required to be repaired by the manufacturer. As a result of this high rejection rate, the manufacturer of meter T issued a new calibration chart for Arkansas soft red winter wheat, which was used by meter operators in the 1978 harvest. The manufacturer of meter O did not change the meter calibration.

Figures 3 and 4 show the difference between meter and oven moisture contents plotted against oven moisture content for meters T and O for soft red winter wheat for 1977. These figures and Table I show that the fitted line is very similar to that from 1976 grain samples, even though the range of the moisture content of the grain samples is slightly different.

During 1977, the state collected grain samples and stored them under refrigeration so that results obtained with stored and fresh grain could be compared during the 1978 season. If stored grain proved acceptable, it could be used to test meters before harvest begain in subsequent years. Because grain elevator operators in Arkansas did not buy soft red winter wheat with moisture content higher than 17% and discounted for moisture content beginning at 13%, weights and measures officials decided to use grain samples with moisture content between 12 and 17% in 1978.

The results of 1978 tests using fresh and stored grain are shown in Figs. 5 and 6 for soft red winter wheat. Student's *t*-test (6) was used to compare the intercept and slope of the stored grain with those of the fresh grain for meters O and T. In both cases, the computed value for t was much larger than the critical 1% value for t, indicating that the present data do not show a difference between the stored and fresh grain. Therefore, the data for fresh and stored grain samples were combined.

Figure 5 indicates that the calibration furnished by the manufacturer of meter T was improved over 1976 and 1977, but was approximately 0.2% higher in moisture content than the oven results.

Figure 6 shows that a large displacement of meter O readings from the oven moisture content values still existed. In the range of moisture contents used in 1978, meter O read about 0.4% lower than oven values.

The fitted line for meter O differs slightly from those computed from 1976 and 1977 data. However, the range of moisture content of the grain samples was quite different from the previous two years, and the 1978 data were the first to be collected after legal requirements on the meters had been strictly enforced.

If Arkansas applies a proposed tighter tolerance of ± 0.5% in moisture content in 1979, approximately 20% of the meter readings of meter T can be expected to fall outside the tolerance. If the calibration were shifted downward by 0.2% in moisture content, 11% of the readings would fall outside this tolerance.

The rejection rate in 1978 was 8% for meter O. However, if the State applies a ± 0.5% tolerance in 1979 and if the calibration for meter O is not changed from that presently available, meter O readings will have approximately a 30% failure rate. If the calibration were shifted so that the meter read 0.4% higher than it presently does, the failure rate would be approximately 5%.

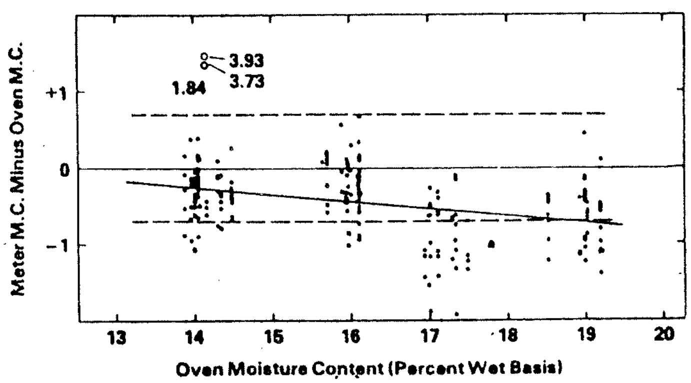

Fig. 3. Fitted line for 1977 meter T moisture measurement of fresh soft red winter wheat. ———— = applied tolerance boundaries (± 0.7% moisture content), ——— = fitted line, o = readings not used in least squares calculation.

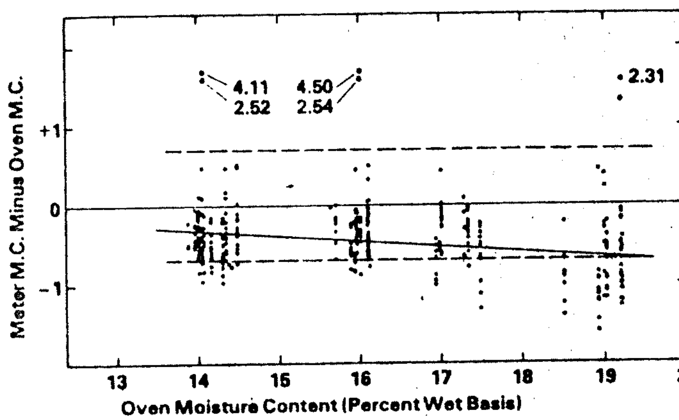

Fig. 4. Fitted line for 1977 meter O moisture measurement of fresh soft red winter wheat. ———— = applied tolerance boundaries (± 0.7% moisture content), ——— = fitted line, o = readings not used in least squares calculation.

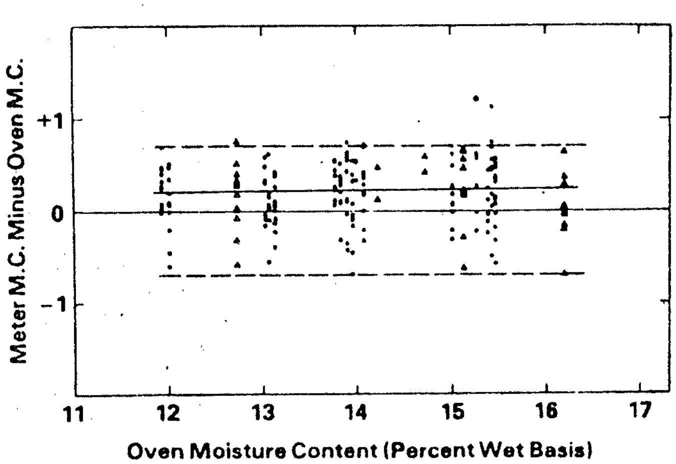

Fig. 5. Fitted line for 1978 meter T moisture measurement of fresh and stored soft red winter wheat. ———— = applied tolerance boundaries (± 0.7% moisture content), ——— = fitted line, o = readings not used in least squares calculation, ▲ = fresh grain, • = stored grain.

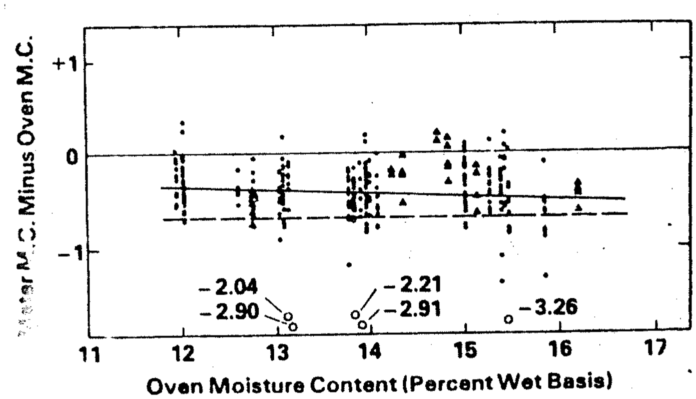

Fig. 6. Fitted line for 1978 meter O moisture measurement of fresh and stored soft red winter wheat. ———— = applied tolerance boundaries (± 0.7% moisture content), ——— = fitted line, o = readings not used in least squares calculation, ▲ = fresh grain, • = stored grain.

DISCUSSION

Traditionally, "master" moisture meters have been used to test moisture meters in the field because officials assumed that grain samples could not be maintained long enough for field use. State agencies in the United States have reported the successful use of grain samples of up to 20% in moisture content for wheat and soybeans and 25% for rice and corn for testing moisture meters in the field. Successful refrigerated storage of grain of this high moisture content for periods of up to one year has also been reported.

Until field testing programs using grain samples were begun, evaluating the intrinsic capabilities of existing meters in the field was not possible. No one had investigated the responses of large numbers of meters in a way that tested the validity of their calibrations.

The much discussed poor agreement among commercial moisture meters appears to result, in part, from the calibrations furnished with them. Improvement of the meter calibrations with respect to the reference standard should reduce the observed variations between different models of meters. Although most meters use linear calibrations to relate meter readings to oven moisture content values, a nonlinear calibration curve (7) may be superior.

The most common pricing structure in the United States is that in which the seller loses 1% of the selling price for every 0.5% of moisture content over a certain value. The moisture measurement system should be capable of discriminating moisture content within a range of 0.5%, resulting in a corresponding range in the purchase price of not more than 1% when based on a single sample of grain (for the purpose of discussion we are ignoring the large errors which could enter if various 1-kg samples were taken from a 50,000-kg load). This is the required precision of the meters.

Moisture contents determined by moisture meters must also be accurate enough to control elevator grain drying so that the grain is dried to and maintained at a moisture content permitting safe storage and so that heating fuel is not wasted by over drying grain.

A 0.5% range in moisture content determinations from meter to meter would require a tolerance of ± 0.25% variation from the reference standard for each meter. This tolerance probably cannot be met, however, with current equipment and reference procedures. The USDA oven drying method requires precision of only ± 0.1% in moisture content. A difference of ± 1°F (one division on most thermometers used in grain moisture determinations corresponds to 2°F) can affect the meter's moisture content results by ± 0.05%.[3] The calibration curve fitting based on finite data will introduce an error, perhaps ± 0.05%. The errors from packing and grain orientation in the sample holder of the moisture meter from one measurement to another will correspond to several hundreths of a percent in moisture content, especially for samples of high moisture content (>25% for corn) and for grains with large kernel sizes.[4] A 1-g error in weighing can produce an error of approximately ± 0.15% in moisture content (8). Because of these errors, a tolerance of ± 0.25 in moisture content is probably not realizable.

The grain trading public should therefore be informed of the limitations of the meter measurement systems and the impact those limitations have upon safe grain storage and the price quotations a farmer will receive from a buyer.

State agencies are a valuable resource to the farmer, elevator operator, processor, and meter manufacturer as they attempt to improve the accuracy of grain moisture meters. Grain moisture determinations have shown immediate improvement since the advent of weights and measures agencies into commercial grain handling. Education of meter owners and farmers has upgraded commercial practices in those states operating enforcement programs. As more states carry out similar investigations and enforcement programs in cooperation with NBS, meter manufacturers, and the USDA, the magnitude of the tolerances allowable in other states nationwide in succeeding years will be interesting to see.

[3]See temperature corrections furnished with moisture meters that require temperature to be measured separately and applied to the meter readings (eg several models of the Steinlite, Motomco, etc).

[4]R. N. Jones, NBS at Boulder, CO. Personal communication.

ACKNOWLEDGMENTS

Appreciation is extended to F. E. Jones of NBS for his assistance in devising and discussing many aspects of this program, and to S. Hindsman and his staff of the Arkansas Department of Commerce, Weights and Measures Division for their data and continuing cooperation.

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GOVERNMENT AND GRAIN

Volume XXXIV, No. 9, April 22, 1982

Summer Meeting to Determine Moisture Meters' Future

By James E. Maness
Director of Engineering Services, National Grain and Feed Association

Drastic changes may be in the offing for one of the grain industry's most important pieces of equipment -- a piece of equipment that is an integral part of grain marketing.

At its upcoming meeting this July, the National Conference on Weights and Measures is scheduled to consider a tentative code that would establish new and radically different requirements for grain moisture meters used in commercial trade. A revised version of the tentative moisture meter code was released recently by the National Bureau of Standards.

At issue are two fundamental questions: Will changes in moisture meters evolve following prudent, scientifically sound research and development and be sold because the grain industry wants a new type of meter? Or will such a change result from a consensus decision based largely on opinion by the National Conference on Weights and Measures? Fortunately, the grain industry has an opportunity to influence the decision. As the buyers and users of moisture meters, the industry has a great stake in the outcome. There are three major issues that arise in the tentative code for moisture meters that should be examined by the industry:

--The tentative code establishes mandatory provisions that would require that all new moisture meters manufactured after Jan. 1, 1985 be fully automatic, digital-indicating and self-compensating for all variables. Under this requirement, grain moisture meters would be required to automatically compensate for grain temperatures, perform sample weights and automatically correct for test weight -- without the use of charts to correct for these factors.

--The tentative code could be amended easily to apply to meters manufactured prior to 1985. For now, the code would permit continued use of manually operated meters.

--The tentative code fails to adequately establish tolerances for moisture meter performance.

Industry Response

In the following pages, each of these issues is explored. The industry has several courses of action available. It can object to the setting of a premature requirement that all moisture meters be fully automatic until adequate research and development is completed. It can urge that such requirements not be made applicable to existing equipment. And it can urge the National Conference on Weights and Measures to establish performance requirements for all meters. It is important for the industry to make its views known prior to the July meeting of the weights and measures conference. Requests for copies of the tentative code on grain moisture meters, as well as comments on the code, should be submitted to: Mr. Otto Warnloff, National Bureau of Standards, Office of Weights and Measures, Washington, D.C., 20234. The National Grain and Feed Association would appreciate receiving a copy of your views.

The ultimate decision by the National Conference on Weights and Measures is important since any code would be incorporated into the National Bureau of Standards' *Handbook 44* as tentative for a period of perhaps two years. The code then would be adopted as final and be included permanently within *Handbook 44*. *Handbook 44* requirements are adopted automatically by most states as law.

Automatic Meter Requirements

The tentative code has three provisions containing specific requirements for all moisture meters manufactured after Jan. 1, 1985. The first would require meters to be fully automatic, digital-indicating and self-compensating for all variables affecting the measurements, including test weight. Under the second requirement, the meter would have to correct automatically for grain sample temperature. Neither the range nor response times for temperature corrections is specified. The third requirement would be the toughest to meet. It would stipulate that the meter automatically weigh the grain sample to the accuracy currently required for grain test scales. When automatically determining test weight, a given volume of grain must be weighed accurately. The three requirements follow:

--"*S.1.6.* *DIRECT INDICATION. -- A device shall be equipped with a means for adjusting the indication and recorded representations (if equipped to record) of the measured value to the percent moisture content, wet basis without the use of conversion or correction charts. (Nonretroactive and enforceable as of Jan. 1, 1985.)*

--*S.1.6.1* *TEMPERATURE CORRECTION. -- If the temperature is a variable of the measurement, automatic temperature compensation means shall be provided. (Nonretroactive and enforceable as of Jan. 1, 1985.)*

--*S.2.2.* *INTEGRAL QUANTITY DETERMINATION. -- A device shall be equipped with means for adjusting the quantity of grain or seed as an integral part of the device so that separate accessories such as scales, etc., are not required for determination of the final percent moisture content, wet basis. (Nonretroactive and enforceable as of Jan. 1, 1985.)*"

While the above requirements may be desirable, it is not clear that there are any meters currently available that could comply with them. Thus, these provisions would dictate the development of new equipment by 1985. Several questions emerge: Should a code or standard dictate equipment design and performance when there is no assurance they can be achieved in the time frame mandated? Further, do such requirements truly represent an improvement in measurement technology? Can the increased cost necessary to fully automate a meter -- costs that could be five to eight times the cost of current manual meters -- be justified on the basis of moisture measurement improvement? If current meters and technology are not sufficiently improved to significantly decrease measurement variability, what is gained? And, is the prime purpose of the automatic requirements to improve measurement accuracy or to make it easier for regulators to test or approve the meter?

Easily Amended

The code would permit continued use, through a grandfather provision, of existing manually operated moisture meters, provided the meter can pass performance tests. However, once a standard or code is adopted for all new moisture meters, the grain industry should be concerned that the code can be amended easily requiring at a specified future date only fully automatic meters be approved as suitable for commercial trade. This action is not unrealistic, since the Conference on Weights and Measures traditionally has eliminated new retroactive provisions at future dates for grain weighing equipment. Further, while the tentative code does not require recorded representations (printed hard copy of results) as currently written, simple modifications to the tentative code could mandate this. Some weights and measures officials have endorsed the concept of a printer or recorder requirement.

Moisture Meter Tolerances

The tentative code fails to address adequately the problem of establishing tolerances for moisture meter performance. The code would establish tolerances for the performance accuracy of meters, but only so long as they are field tested using clean grain samples whose moisture has been measured by the air oven. Several states during the past few years, with support provided by the staff of the National Bureau of Standards, have tried to use calibrated grain samples in the field to test commercial moisture meter accuracy. Although this technique can be made to work for moisture levels below 25 percent, many problems have been encountered. Some states have found it difficult to implement the grain test sample program because it is difficult to ensure that weights and measures personnel maintain the integrity of field samples since they must be properly refrigerated, adequately warmed up at the elevator prior to testing, and correctly handled.

Another difficulty is that the tentative code would establish tolerances for meter performance for all grains. This is despite the fact that the National Conference on Weights and Measures and the National Bureau of Standards have data only for corn and wheat. Virtually unknown is the testing of moisture meter accuracy and performance for such commodities as soybeans, sunflower, flax, barley, sorghum and oats. The establishment of tolerances for commodities with little or no data is improper. Further, the code fails to define when or how to apply the tolerances. However, in most cases <u>acceptance tolerances</u> apply to new equipment initially placed into service, or when a device has been repaired and is placed back into use. <u>Maintenance tolerances</u> apply to meters being tested in the field.

A third major problem with the tentative code's section on tolerances is that it would not set tolerances for moisture meters that are checked by comparable machines. In several states, a master moisture meter calibrated against the air oven is used in the field to check moisture meters of a like kind. In such cases, both the master meter and the meter being tested measure grain samples. The differences between the master meter's determination and the reading on the meter being tested is used to determine whether the meter being tested is approved or rejected for use in commercial trade. Tolerances used by states for meter comparisons in some cases were established based on what they consider a "reasonable rate" of rejection of meters tested (often ten percent).

Under the tentative code, an asterisk and footnote would be used stating that the tolerances being set do not apply to meters tested by means other than grain samples. Thus, in states that check meter tolerances by comparing the tested meter to a master meter of a like kind, there would be no tolerances. These states would have the responsibility for establishing their own individual tolerances. This policy of using a footnote to designate exceptions is suspect and indicates that a number of states do not find this part of the code acceptable. This method of tolerance-setting does not result in nationally uniform standards, since states can use or maintain their own individual tolerances.

The use of grain samples or master moisture meters as "transfer standards" for testing moisture meters has been a point of continued disagreement among s es. Surprisingly, little research has been conducted to determine appropriate or proper performances for either method of field testing of grain moisture meters. Many state officials believe that problems they experience indicate these tolerances often are not achievable. Meter variability and measurement often exceeds the tolerance values, especially at higher moisture levels.

Even laboratory testing of moisture meters under ideal conditions against the air oven has indicated that wide variability in meter measurements occurs throughout all levels of moisture measurement. The use of a single sample of corn in comparing moisture meters to air ovens under laboratory conditions shows that variability can be as much as ± 3 percent at 35 percent moisture content, ± 1.5 percent at 25 percent, ± 0.8 percent at 15 percent and ± 1.2 percent at 10 percent. Utilizing and arranging a number of samples can significantly reduce the moisture measurement variability. If moisture variability of this magnitude can occur under laboratory conditions when using clean and controlled samples, larger variability can be expected under field conditions.

If the code cannot address the primary performance criteria of moisture meters, then perhaps it is premature to adopt these even as a tentative code. Serious consideration should be given to the issues of what represents appropriate transfer standards and tolerances before the code is adopted. I believe it is not wise to adopt an unsuitable code in hopes that it can be changed to meet basic needs in the future. A code that is not workable will not improve national uniformity or measurements.

The following table was prepared to indicate the tolerance levels established in the code for meters tested with clean grain samples:

<u>Proposed Tolerances for Grain Moisture Meters</u>[1]
(Tolerances only apply to moisture meters when grain samples are used to check the accuracy.)

Moisture meters would be required to read plus or minus the following moisture percentages at the following moisture contents:

Grain moisture content	Tolerance Factors			
	Acceptance tolerance for corn, rice, sorghum and sunflower .04	Maintenance tolerance for corn, rice, sorghum and sunflower .05	Acceptance tolerance for other cereal grains and oil seeds .03	Maintenance tolerance for other cereal grains and oil seeds .04
12%	.60%[2]	.80%[2]	.50%[2]	.70%[2]
15%	.60%[2]	.80%[2]	.50%[2]	.70%[2]
18%	.72%	.90%	.54%	.72%
21%	.84%	1.05%	.63%	.84%
24%	.96%	1.20%	.72%	.96%
27%	1.08%	1.35%	.81%	1.08%
30%	1.20%	1.50%	.90%	1.20%
33%	1.32%	1.65%	.99%	1.32%
36%	1.44%	1.80%	1.08%	1.44%

[1]The proposed tolerances at each moisture level are obtained by multiplying the tolerance factor times the moisture content, except where a minimum tolerance is established.

[2]This is the minimum tolerance applicable to the meter regardless of the moisture level.

Grain Moisture Testers

Grain moisture testers at the elevators throughout the state have become a necessary part of grain handling equipment. These testers if not accurately calibrated can be very costly to the grain farmer. As a grain farmer, I feel the moisture testers should be state inspected, just as elevator scales are.

An incorrectly calibrated tester can generate a great deal of extra income for the elevators. At certain moisture levels a dockage of as much as 2¢ to 4¢ per hundred weight, per ¼ point of moisture is assessed against the farmer's grain. Figuring this on hundreds of bushels, this can amount to quite a sizable sum. With the 4¢ per ¼ point moisture discount, you are receiving 16¢ dockage per hundred weight of milo.

In my own farming operation we have taken the same sample of milo to three different elevators and received three different moisture reports, varying 1½ points.

Last year was a very high moisture year for our area. Grain had to be dried to be stored. With cost of fuel for drying and a varience in moisture testing, this just adds to the loss of income to the already declining profit for the farmer.

I'd like to stress, I am not making accusations of dishonesty among the dealers, I just feel there is a need for testing and calibrating the moisture tester, so that uniformity in testing exists.

A periodical state inspection and test of the moisture testers may not totally solve the problems, but it would be a step in the right direction.

Thank you,

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Atch. 2

Attachment No. 3 - 2-23-83

House Agriculture Committee

HOUSE COMMITTEE ON AGRICULTURE AND LIVESTOCK

TESTIMONY BY

THE

KANSAS STATE BOARD OF AGRICULTURE

RE: HOUSE BILL 2299 - MOISTURE MEASURING DEVICES

February 23, 1983

Atch. 3

I. Moisture Measuring Devices in Kansas Grain Transactions

A. When grain is purchased and sold in Kansas, such transactions are based upon weight and quality of the product.

1) Moisture measuring devices are used in all grain transactions to determine the relative moisture content of the grain.

2) This moisture content is then used as a factor in the pricing of the grain, similar to the use of grades.

3) Just as it is critical that scales be calibrated and maintained in accurate working order, moisture measuring devices must also be calibrated and their accuracy maintained.

B. Presently Kansas has no statutes or regulations which address the accuracy of moisture measuring devices.

1) Last year the dollar value of grain sold in the state amounted to approximately $2.7 billion. If there was a one percent error rate in such transactions as a result of inaccurate moisture measuring devices, the lack of regulating these devices could have cost Kansas farmers and elevators $27.2 million.

II. Moisture Measuring Device Regulation in Other States

A. Eighteen other states presently maintain moisture measuring device regulation programs.

B. These states implement one of two different methods of moisture measuring device regulation:

1) Three states implement a system of inspection and certification based on comparing one device with a certified device calibrated in the metrology laboratory (Iowa, Nebraska & Illinois).

2) The other fifteen states (Wisconsin, Indiana, Virginia, South Carolina, North Carolina, Missouri, Colorado, Kentucky, California, Delaware, Florida, Maryland, Mississippi, Texas and Pennsylvania) utilize the oven method of regulation.

a) This method would use samples of grain prepared by the metrology lab, given a specific level of moisture content. Those samples are then kept at a constant temperature until they are used in testing the moisture measuring devices in the field.

b) The oven method is presently outlined by the National Bureau of Standards in a tentative code to Handbook 44.

c) This method is considered the most advanced, practical, state of the art, and is the only method recognized and approved by USDA.

3) In one state (Wisconsin) moisture measuring devices are inspected and regulated only on a complaint basis.

C. The other states have encountered the following problems in moisture measuring device enforcement:

1) Charts for moisture measuring need to be kept up-to-date by region.

2) Environmental condition of elevators.

3) Scales used in the process are incorrect.

4) Temperature of the grain at the time of the test is not taken correctly.

5) Moisture measuring device servicing is not being performed regularly.

D. However, the states which employ such a moisture measuring device inspection and certification program have good user confidence in the program.