

CLOSING THE INFORMATION GAP, Part II¹

MC Information Merging via LAN

Networking/Graphical Data Manipulation

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Introduction to Information Merging

As a particle accelerator operator for many years with a well-known scientific research lab (Fermi National Accelerator Laboratory) in the Chicago area, I can attest to the fact that having flexible access to information is the most critical element in analyzing and improving production processes.

The experience I gained there showed me how to collect, analyze and display scientific information in a functional way. It also taught me that data collection is nothing if a company does not learn to use it to its fullest capacity...by merging and manipulating the data and exploring graphical representation through visually-enhanced charts, graphs, and more. It significantly cuts data-crunching time and gives you precise information upon which to base production decisions, test solutions, and compare daily, weekly or monthly results. This gives you infinite flexibility and the opportunity to react rapidly to changing situations.

In essence, it closes the gap between information and profit-oriented action.

The Nineties Will Be the Proving Ground for Companies Who Understand the Importance of Information Management

In the wood products industry, moisture detection has become the number one issue for companies faced with quality and supply issues. In the next decade, "business as usual" will come to mean extremely finetuned production in order to generate maximum profit recovery from logs, lumber or wood products. With the unlimited possibilities now being presented by computerized data storage and retrieval, this maximization will, of course, depend on an intricate understanding of how to merge information into one

¹Part I of this paper was presented at last year's meeting by Jeff Biondi of Wagner Electronics, who addressed the issue of degrade loss due to over-drying and how profits can be improved by narrowing and raising MC ranges.

source and, finally, how to merge, analyze and ultimately understand what the data is saying.

Until the development of in-line moisture detection systems in the late seventies, it was extraordinarily difficult to discover and remedy costly deficiencies in wood-drying and wood-processing operations. This was because operators could not thoroughly check and accurately record the moisture content of every board dried and processed. Today, computerized data collection systems and moisture diagnostic software are changing the way we observe, record and manage that information...to the extent that we can virtually see inside a kiln, read each board's true moisture content and pinpoint drying problems inside.

Consider these facts presented by industry experts:

At the 1973 Western Dry Kiln Association meeting, Kendall H. Basset (1) stated, "Extensive studies over the past several years within the Weyerhaeuser Company have shown that the rate of degrade for softwood dimension lumber is in the order of magnitude of 1 to 3 dollars per thousand board feet of every 1% of moisture lost in our normal drying range."

More recently, Dean Huber (2) presented a technical report on lumber drying in the May 1991 issue of Forest Industries. He stated that, "The cost of degrade due to overdrying is about \$3/MBF for each 1% reduction in moisture content below 17%; this cost in loss increases to about \$7/MBF for each reduction below 12% MC."

At the 1992 Western Dry Kiln Association meeting, Mike Milota and associates (3) presented a paper discussing advantages of post-sorting and redrying. Their conclusion stated, "Post-sorting and redrying the wet pieces might increase dryer capacity by 10 to 15%, tighten the final MC distribution, and increase the final average MC. This process should also lead to a reduction in degrade, overdried pieces, and wet pieces."

To illustrate these findings, let's run some figures. Many mills can raise the final moisture content by an average of 5 percent. Even by the more conservative estimated savings figure (\$3.00), this could represent increased income of \$15.00 per thousand from reduced degrade. For an average mill drying 50,000 MBF annually this would translate into \$750,000 of increased profits. Money can definitely be saved by preventing over dried lumber, and information management is the method through which this can be accomplished.

Current Options for Gathering Moisture Monitoring Data

Before the advent of computerized moisture monitoring equipment, moisture measurements had to be taken by hand. This consisted of selecting a lumber sample, taking a handmeter reading, and recording the reading on paper. The same process was repeated for hundreds of boards, and from this moisture information a final report was generated. Hand measurements were -- and still are -- extremely time consuming and less accurate.

In contrast, today's computerized moisture monitoring equipment measures every piece of lumber and can generate a summary report automatically, within minutes (Figure 1²).

Even more advanced systems combine digital data mega-storage with software that deposits the moisture information into a central database via a local area network (LAN). Having data in a central location allows moisture data to be correlated with other types of data, such as lumber grade information and kiln charge information. All that is required is a custom software program that merges the information. This program can be created inhouse or, more frequently, by customizing commonly available software such as Microsoft's Access or Excel. Whether the charge information is recorded via barcoding at the breakdown hoist or entered by hand, the software will merge your paper reports with computer files and arrange them in your company's preferred standard formats.

Here is the type of data you can store, merge and compare...all within minutes:

Information	
<u>From the Kiln</u>	<u>From the Production Line</u>
Shut down MC	Charge Average %MC
Hot Check	Charge Standard Deviation
Dry Schedule	Percent Redry
Species	Percent Dry
Dimension	Percent Wet
Drying Time	Lumber Grade
Energy Consumption	
Days in Yard	

Our own experience at Wagner, where we spend a lot of time listening to people in the industry, is that the payback is pretty immediate. Customers often question why anyone would want to be without state-of-the-art MC equipment and related information systems.

² Figs. 1,3,4 are courtesy of Weyerhaeuser Canada, Grande Prairie Operations, Grande Prairie, Alberta, Canada.

Daily Report for			1-Mar	
Charge Number	2247	Dimension	6	
Pull Date	2/24/94	Schedule Used	Test 41b	
Days in Yard	5	Hours To Dry	54	
Moisture Readings	Wagner	RDM-1S	Pieces	8858
MC	18.6	12.07	Lucidine %2&Btr	78.9%
Std.Dev.	3.2	2.74	Lucidine %Royals	10.8%
%Dry (<9MC)	0.3%		Lucidine %Wets	0.9%
%Wet (>19MC)	45.9%		Lucidine Trim Loss	3.8%
Notes 0				

Charge Number	3248	Dimension	6	
Pull Date	2/21/94	Schedule Used	NV2x10	
Days in Yard	8	Hours To Dry	56.5	
Moisture Readings	Wagner	RDM-1S	Pieces	6205
MC	15.7	13.2	Lucidine %2&Btr	84.7%
Std.Dev.	3.2	2.65	Lucidine %Royals	15.9%
%Dry (<9MC)	2.2%		Lucidine %Wets	1.4%
%Wet (>19MC)	11.5%		Lucidine Trim Loss	3.6%
Notes test schedule				

Charge Number	3247	Dimension	6	
Pull Date	2/17/94	Schedule Used	Test 41b	
Days in Yard	12	Hours To Dry	56	
Moisture Readings	Wagner	RDM-1S	Pieces	8877
MC	16.4	12	Lucidine %2&Btr	75.0%
Std.Dev.	3.6	2.99	Lucidine %Royals	14.2%
%Dry (<9MC)	1.9%		Lucidine %Wets	6.6%
%Wet (>19MC)	21.3%		Lucidine Trim Loss	3.6%
Notes test schedule, replace steam trap				

FIGURE 1. Typical daily report.

Arranging Data via Graphical Representation

Not everyone has the time or ability to interpret numerical data. But virtually anyone can look at a graph and see immediately what it means. Besides the "bellcurve" histogram which merges board-to-board information with lumber grading information (Figure 2), there are some other useful ways to arrange your data visually. These include trending, profiles, and scatterplots.

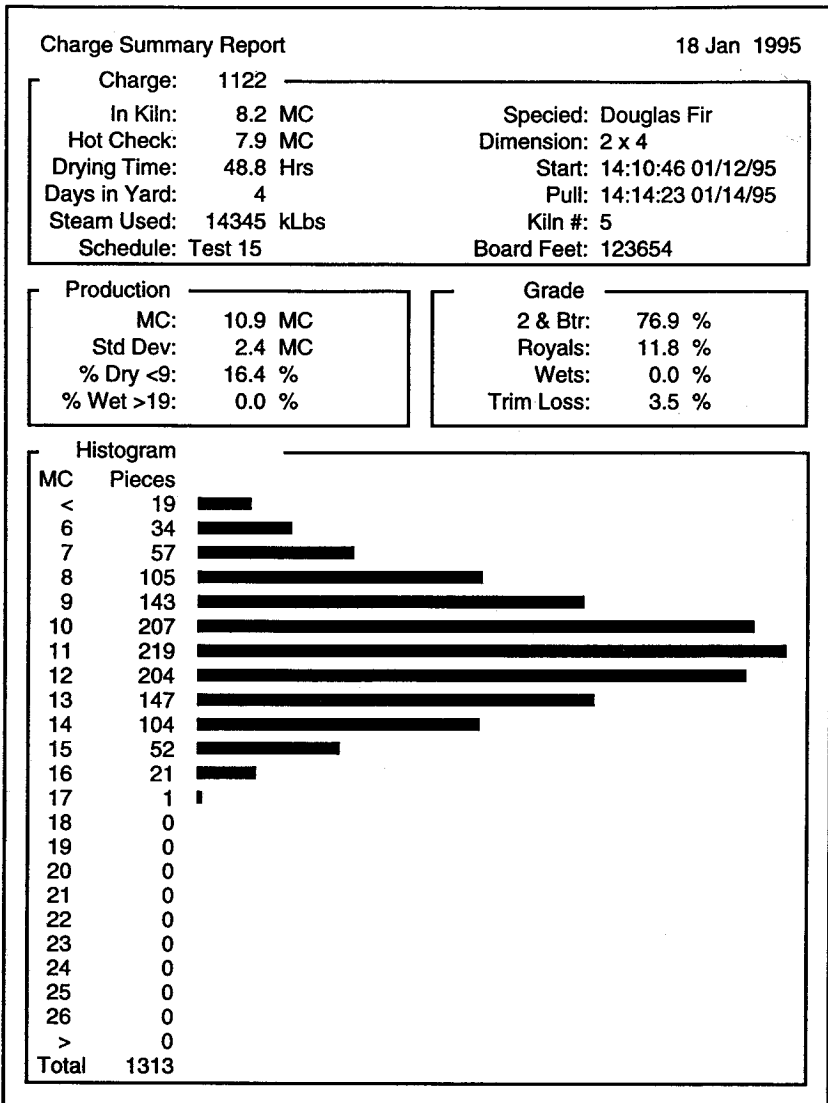


FIGURE 2. Bellcurve histogram.

Trending

Trending is a graphical method of displaying information over a period of time. Trends show how processes vary with time. A typical trend for a kiln operator would be to graph the average moisture content (Figure 3) and a standard deviation (Figure 4) over a given time period for a particular kiln, species, and dimension. Once a baseline is established any changes in kiln schedules could be analyzed. Trending could also include kiln run hours, energy consumption, in-kiln shutdown MC, handmeter hot check MC, lumber grade, etc.

To implement this level of data management in your company the following process would apply:

Step 1: Establish Baseline MC Information

You must first gather reliable information about what MC and lumber grades your kilns are currently producing. The only scientifically reliable method is to first establish baseline data specific to your drying schedules, species and lumber dimensions. For example, to collect information about "Kiln 1, Douglas-fir, 2x4's, Drying Schedule A", you would determine how many charges should be tracked in order to obtain a consistent and believable trend over a given period of time (Figure 3 and 4). Note that this set of kiln conditions should not be changed while the baseline information is being obtained.

Step 2: Pinpoint Profit-Wasting Problems & Optimize Production Goals

From this reference point (baseline trend), any changes made to drying practices (schedule changes, etc.) or drying performance (kiln equipment adjustments: vent, valve, traps, etc.) should be reflected in the average MC and standard deviation, good or bad. With each future charge, you can quickly see if it falls into an acceptable MC range, depending on your production goals. If a grading machine is used, another practical possibility is to trend the actual dollar value of each charge (not shown), then manage production with the goal of obtaining peak dollars per charge.

Kiln Profile

A kiln profile provides a vision of what's going on inside the kiln by displaying drying patterns in physical form. You can obtain side and end view profiles as shown in Figure 5 and Figure 6. Drying patterns may reveal incorrect air flow patterns, sorting practices, defective steam traps, defective steam valves, inefficient steam coils, etc.

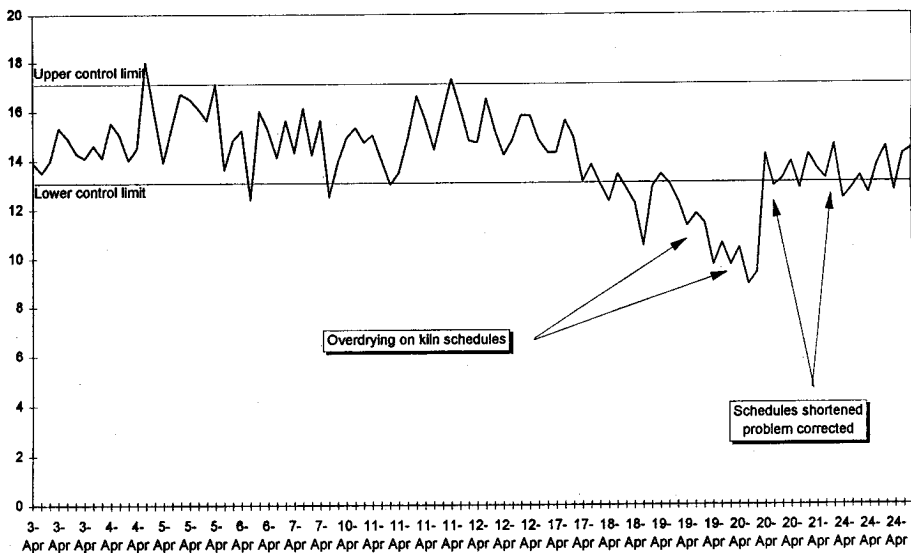


FIGURE 3. Graph of average moisture content over time.

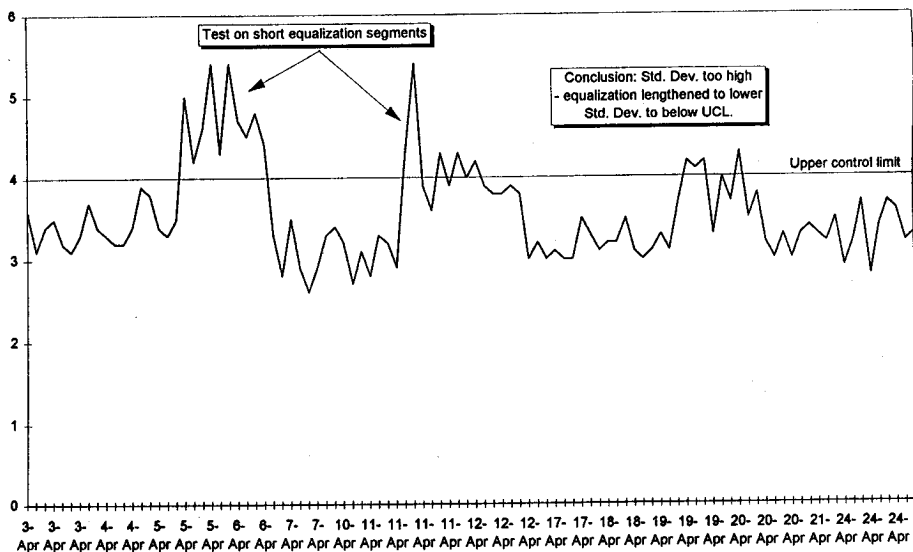


FIGURE 4. Graph of standard deviation of moisture content over time.

Kiln: 1 Species: Yellow Pine
 Dimension: 2 x 4

Pull: 04/16/95
 Start: 05:45:53 04/18/95
 Stop: 09:30:01 04/18/95

%MC Pieces STD DEV Key
 8.8 19194 2.8 Kiln 1 <- Average-per-Board

%MC Pieces %PCS Marking: Average
 8 9574 49.8 Too Dry
 8.6 18580 96.8 Passed <
 15.0 561 2.9 Wet Marker 1
 18.0 53 0.2 Wet Marker 2
 21 12 0.0 Too Wet

%MC Pieces %PCS Average-per-Board Histogram
 < 1956 10.1
 6 2112 11.0
 7 2580 13.4
 8 2926 15.2
 9 < 2544 13.2
 10 2035 10.6
 11 1596 8.3
 12 1158 6.0
 13 916 4.7
 14 594 3.0
 15 1 381 1.9
 16 210 1.0
 17 97 0.5
 18 2 53 0.2
 19 21 0.1
 20 3 0.0
 21 7 0.0
 22 1 0.0
 23 0 0.0
 24 2 0.0
 25 0 0.0
 26 0 0.0
 > 2 0.0

ZZYX Unit Labeling Convention
 Left to Right
 Bottom to Top
 Near to Far

Side View

Unit	111	211	311	411	511	611
Avg	8.6	7.8	8.5	8.7	8.9	9.2
Std Dev	2.6	2.4	2.6	2.6	2.7	2.9
Pieces	1563	1624	1629	1587	1610	1593
% Dry	51.5	66.3	54.2	51.2	48.9	44.5
% Wet	0.0	0.0	0.0	0.0	0.0	0.2

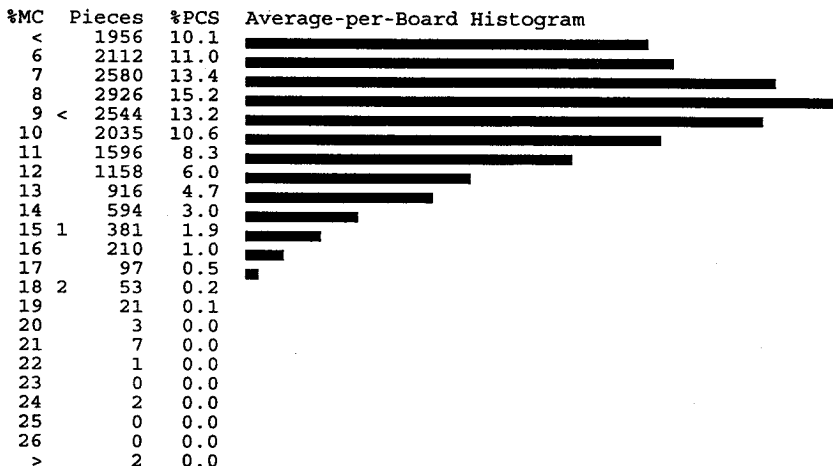
Unit	112	212	312	412	512	612
Avg	9.4	9.0	8.5	8.7	8.9	9.9
Std Dev	2.9	2.9	2.6	2.7	3.0	3.1
Pieces	1567	1613	1612	1585	1590	1621
% Dry	41.7	47.8	55.7	52.1	50.0	33.9
% Wet	0.0	0.0	0.0	0.0	0.0	0.4

FIGURE 5. Side view of kiln profile (matches end view in Figure 6).

Kiln: 1 Species: Yellow Pine Pull: 04/16/95
 Dimension: 2 x 4 Start: 05:45:53 04/18/95
 Stop: 09:30:01 04/18/95

%MC Pieces STD DEV Key
 8.8 19194 2.8 Kiln 1 <- Average-per-Board

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 8 9574 49.8 Too Dry
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 15.0 561 2.9 Wet Marker 1
 18.0 53 0.2 Wet Marker 2
 21 12 0.0 Too Wet



ZZYX Unit Labeling Convention
 Left to Right
 Bottom to Top
 Near to Far

End View

Unit	111	112	211	212	311	312	411	412
Avg	8.6	9.4	7.8	9.0	8.5	8.5	8.7	8.7
Std Dev	2.6	2.9	2.4	2.9	2.6	2.6	2.6	2.7
Pieces	1563	1567	1624	1613	1629	1612	1587	1585
% Dry	51.5	41.7	66.3	47.8	54.2	55.7	51.2	52.1
% Wet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Unit	511	512	611	612
Avg	8.9	8.9	9.2	9.9
Std Dev	2.7	3.0	2.9	3.1
Pieces	1610	1590	1593	1621
% Dry	48.9	50.0	44.5	33.9
% Wet	0.0	0.0	0.2	0.4

FIGURE 6. End view of kiln profile (matches side view in Figure 5).

Board by Board Profile

If you consider the kiln profile as a macroscopic view, then the board by board profile is a microscopic view. Boards are reassembled as they were stacked in the kiln. A moisture contour is developed by assigning a color to represent a band of MC (Figure 7). Again, drying patterns may reveal and pinpoint problems with air flow, sorting practices, or defective equipment.

Scatter Plot

A scatter plot is used to graphically show the relationship between two variables (Figure 8). They are most often used for re-calibrating moisture meters against oven-dry MC test samples. Scatter plots are also useful for showing the relationship between a particular lumber grade (i.e., 2 or better) versus the in-line meter average MC for several charges.

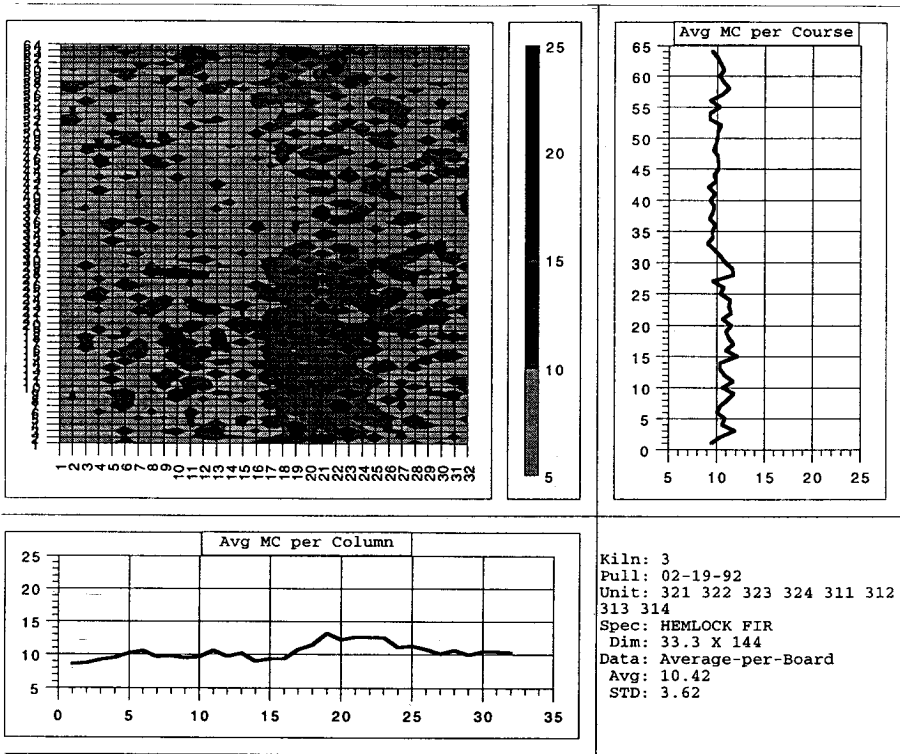


FIGURE 7. Board by board profile for a crib of lumber.

Conclusion

To stay profitable, the wood products industry must look at becoming more precise by merging MC information into one central location. Today's advanced data collection, manipulation and graphical representation capabilities allow us to do exactly that. We can now pinpoint drying problems in a way the industry never could before. As a result, mills can be in complete control of the drying process...while freeing up labor once used for laborious hand testing or kiln adjustment guesswork. The bottom line effect will be quite dramatic.

Literature Cited

1. Basset, Kendall H. 1973. A Look at Redry. Proceedings, 24th Annual Meeting of the WDKA. May 10-11. Vancouver, BC. pp 30-37.
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3. Milota, Michael R., Morrell, Jeffrey J., Lebow, Stan T. 1992. Relative Drying Rates for the Hem-Fir Species Group. Proceedings, 43rd Annual Meeting of the WDKA. May 13-15. Reno, NV. pp 93-107.

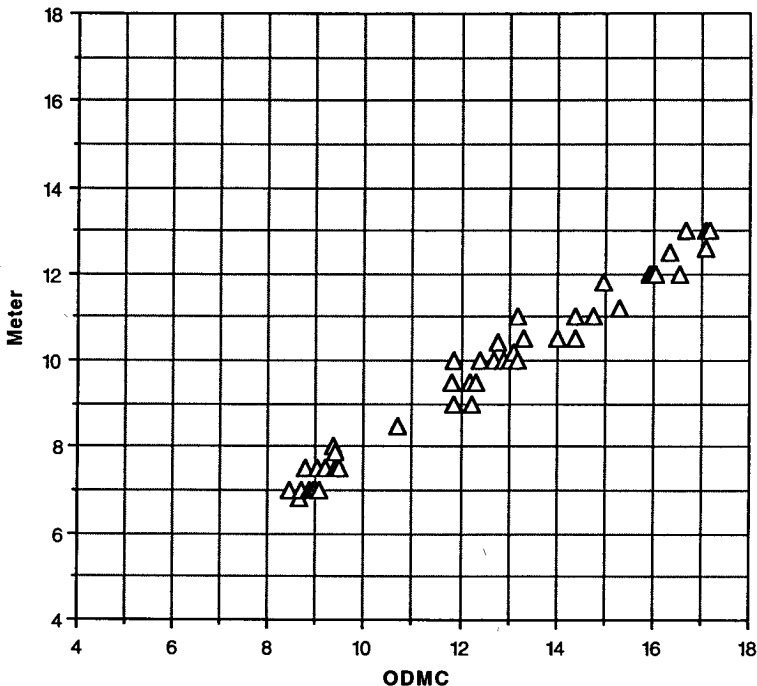


FIGURE 8. Scatter plot of relationship between meter reading and moisture content.