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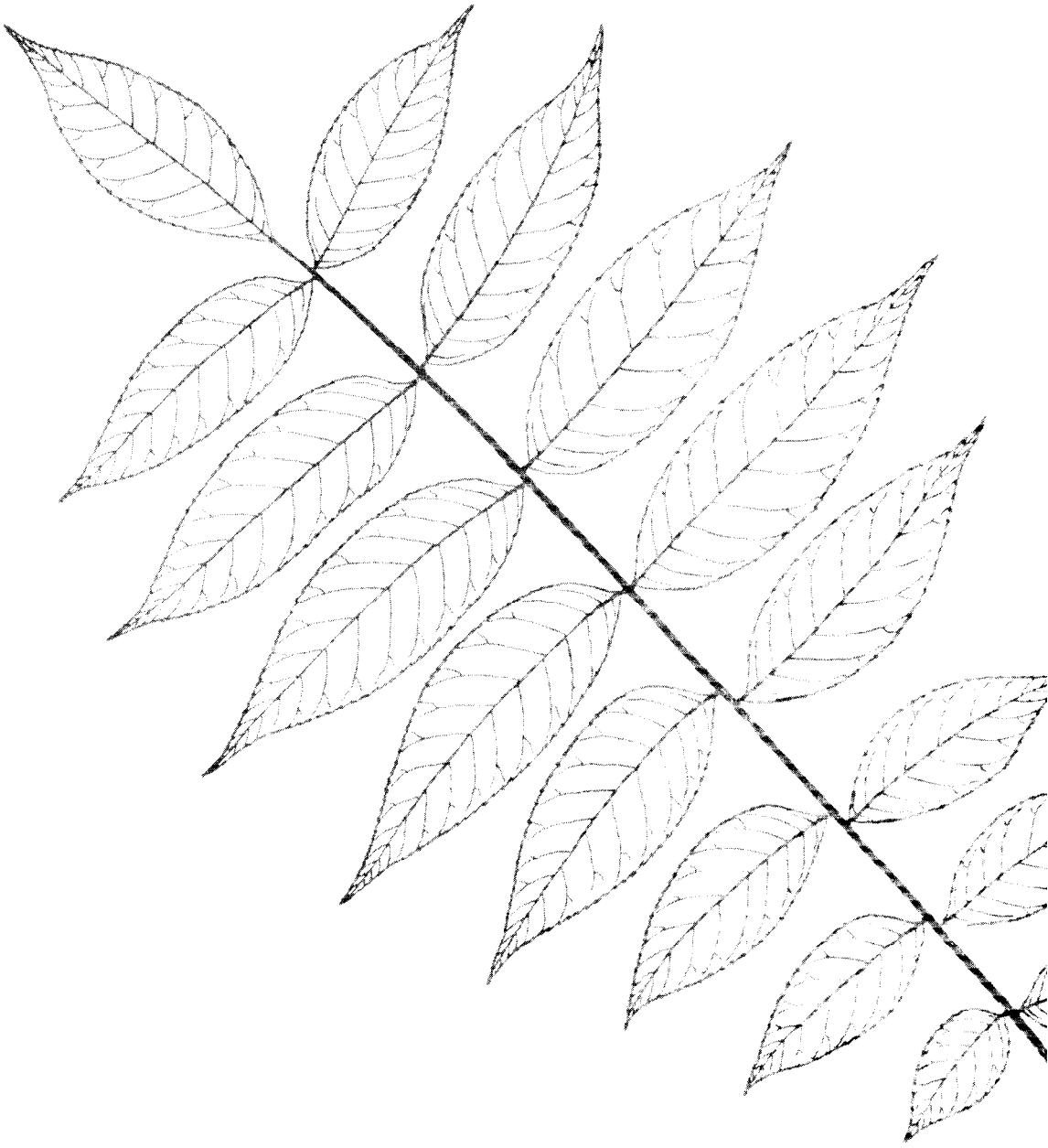

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ABSTRACT

Charts are presented for determining yields of dimension from the top four grades of walnut lumber. The basic chart for each grade is for random-width material, with an adjustment for determining yields in other widths. Yield and cost comparisons can be made of the various grades and grade mixes to obtain the most economical choice for a specific cutting order,

Acknowledgment

In providing an adequate sample for a yield study of this magnitude, a sizable amount of lumber from several sources was required, so cooperators from the walnut manufacturing industry made material available. This assistance from the American Walnut Manufacturers' Association and its members is hereby gratefully acknowledged.

DIMENSION YIELDS FROM BLACK WALNUT LUMBER

By

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INTRODUCTION

American black walnut (Juglans nigra L.) has consistently been one of the most popular species used in the manufacture of furniture, pianos, and organs. In a 1969 industrial show where 23 exhibiting companies displayed 274 pianos and organs, more walnut instruments were displayed than from all other woods combined. A survey conducted in 1970 by the American Walnut Manufacturers' Association (AWMA) demonstrated that walnut was one of the best selling woods in contemporary and modern case goods and tables. This rating was based on profitability when considering markup and sales volume.

Surveys by the AWMA in 1970 and 1971 showed that walnut was either No. 1 or 2 in the number of bedroom and dining room suites exhibited at furniture shows. These surveys were conducted at several different locations.

Black walnut has traditionally been the standard in high-quality office furniture, It is also a preferred species for use in gunstocks, paneling, and architectural woodwork.

The domestic consumption of walnut sawtimber in 1970 was 7.6 million board feet, while the volume of logs exported over the same period was 17.2 million board feet. On the other hand, between 1963 and 1968 the inventory of black walnut decreased 10.6 percent, The average price of walnut logs has increased 3-1/2 times in the decade 1959-68 as compared to 1949-58. The average price of high-grade walnut lumber from 1969-71 increased approximately 20 percent.[2]

The high demand for walnut products and the short supply of logs and lumber suggested the need for more research into the management and utilization of this species, Current research and extension work includes an aggressive seed collection program with distribution of low-cost seedlings and stratified seed. Genetics research involves establishing seed orchards and breeding for genetically superior trees, Investigations are being conducted in stand improvement including weed control, thinning, releasing, and pruning, The effect of fertilization on growth and the quality of the wood is being explored. Research into the variability of cell structure, extractive content, and heartwood development in relation to site and soil is being conducted. A study has shown that it is feasible to salvage dimension stock with a bolter saw from small-diameter short bolts and logging residue. These and other studies lead to greater knowledge about utilizing a most desirable and valuable species.

An area of research highly applicable to users of graded walnut lumber is the maximum utilization of that resource, Until the advent of the high-speed computer, potential yields of various-size dimension cuttings had never been thoroughly investigated and presented in a format easy to understand and use. Since 1950, though, the industry has had an excellent report, "Walnut Yields," published by the AWMA.[3] This report will be discussed in a later section of this paper,

[1] Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

[2] Statistics from the AWMA and the Hardwood Market Report.

[3] White, C. H. Walnut yields. A report on Walnut Dimension. Amer. Walnut Manuf. Assoc. AWMP 190-50. Chicago, Ill. 1950.

The walnut yield data herein are presented in a manner similar to that given in an earlier U.S. Forest Service research paper,[4] in which dimension yields of 4/4 hard maple lumber are listed from each of the top five grades. Subsequent tests proved that data to be applicable to other species graded by the standard rules.[5] Because of different grading specifications, however, yield data for black walnut must be treated individually,

Furniture and dimension plant operators need to know what yields can be expected for a specific cutting order from the various lumber grades, This information will provide a tool in selecting the most economical grade or mix of grades for a particular cutting order. A sequence in applying the yield data is as follows:

(1) Determine the yield for a particular cutting order from each of the lumber grades and grade mixes.

(2) Determine the purchasing requirements for each of the various grades.

(3) Knowing plant capacity and lumber requirements, determine the processing time,

(4) Determine total manufacturing costs, including handling costs, freight charges, kiln drying, and processing.

(5) Determine the most economical grade or grade mix by comparing the price differential between the various grades and the manufacturing costs.

Other applications of the yield information include scheduling production time, developing a base for pricing, and checking on operator proficiency and the capability of the machinery,

ANALYSIS

The number and footage of the boards by grade and sample lot that were used in this study are shown in table 1. A frequency distribution by board length for each of the grades is shown in figure 1. A CDC 3600 computer was used to determine the yields for each of the grades, The program that was used is a revision of an earlier program written for the CDC 1604 computer.[6] The following primary cutting lengths were used for the four grades:

Lumber grade	Cutting Length (In.)
FAS	20 30 40 50 60 70 80 90 100
FAS1F	20 30 40 50 60 70 80 90
No, 1 Common	10 20 30 40 50 60 70 80
No. 2 Common	10 20 30 40 50 60 70

Cutting widths in all grades ranged from a minimum of 1 inch to a maximum of 5-1/2 inches.

It should be noted that the yields are based on 4/4 kiln dry walnut lumber with sap no defect for each of the four top grades. The yields apply to clear, one-face rough dimension, In using kiln-dry lumber, drying defects are accounted for in the yield figures. Loss in yield due to kerf for each of the grades is as follows:

Lumber grade	Kerf (Pct.)
FAS	5.8
FAS1F	6.6
No. 1 Common	6.7
No. 2 Common	7.0

These figures are averages of the values obtained when cutting each of the various cutting orders. It can be said of the variation that unless a 1-in-20 chance has occurred in the sampling, the true mean is within ±0.5 percent of the tabular value. Individual lots, of course, could exceed these limits. These kerf losses are very similar but slightly higher than those reported for the hard maple data. This is to be expected, since walnut grades are less restrictive than the standard grades,

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[4] Englerth, George H., and Schumann, David R. Charts for Calculating Dimension Yields from Hard Maple Lumber. U.S. Forest Serv. Res. Pap. FPL 118. Forest Prod. Lab., Madison, Wis. October 1969.

[5] National Hardwood Lumber Association. Rules for the Measurement and Inspection of Hardwood and Cypress Lumber. Chicago, Ill. 1967.

[6] Wodzinski, Claudia, and Hahm, Eldona. A Computer Program to Determine Yields of Lumber. Forest Prod. Lab. unnumbered rep. March 1966.

Table 1.--Number and board measure of 4/4 walnut boards used to obtain yields by lumber grade and lot

Lots	Number of boards				Board measure (kiln-dried material)			
	FAS	FAS1F	No. 1 Common	No. 2 Common	FAS	FAS1F	No. 1 Common	No. 2 Common
					Bd. ft.	Bd. ft.	Bd. ft.	Bd. ft.
1	95	102	121	111	475	459	475	475
2	106	108	82	152	475	486	478	470
3	108	93	123	161	448	495	485	495
4	100	120	120	167	496	492	448	380
5	109	93	143	124	507	443	496	480
Totals	518	516	589	715	2,401	2,375	2,382	2,300

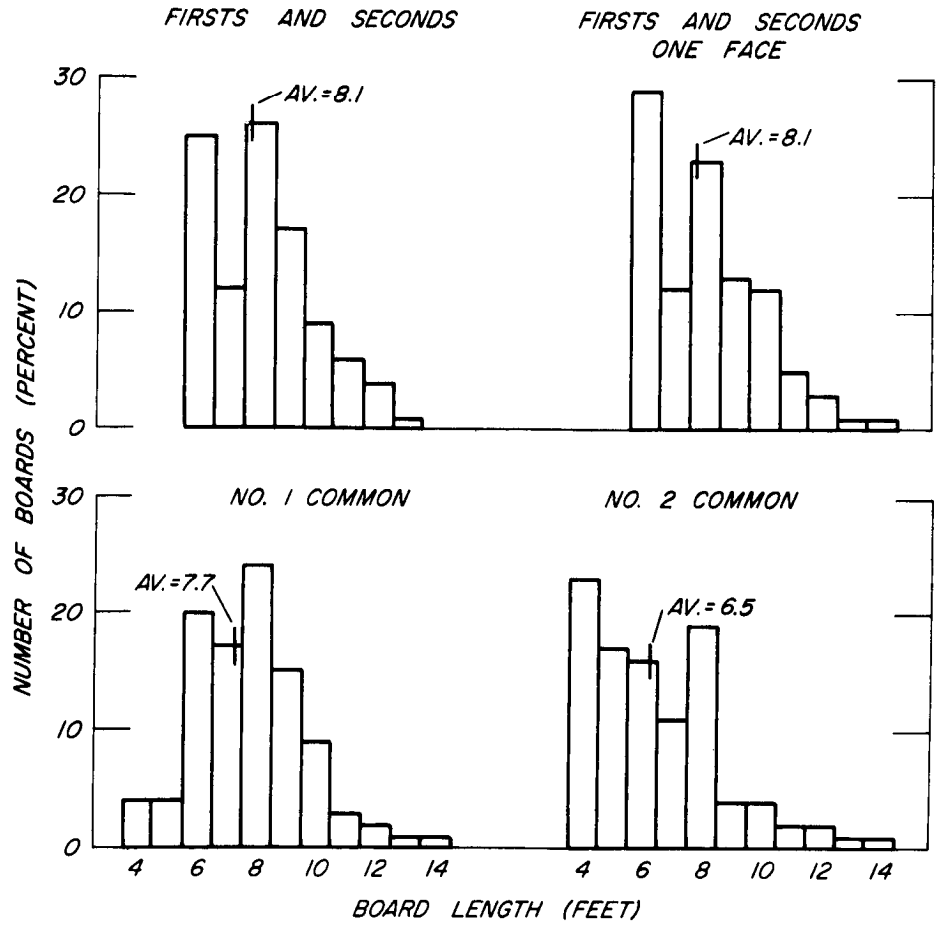

Figure 1.--Frequency distributions, by lumber grade, of board lengths used in this study. M 138 307

PRIMARY AND TOTAL YIELDS

Primary cutting length (the longest length considered in a cutting order) drastically affects primary yield, but has little effect on overall yield. Primary yields decrease as primary cutting length increases, figure 2. Yields given are based on random-width cuttings down to a l-inch minimum. A comparison in yield can also be made between the four lumber grades (fig, 2).

We can state that unless a 1-in-20 chance has occurred in the sampling, the true mean yield for any primary cutting length in each of the four grades is within the confidence limits of ± 4.0 percent. For example, the yield of a 40-inch random width No. 1 Common cutting is 34.5 percent and its confidence limit is from 30.5 to 38.5 percent.

On the other hand, the length of the primary cuttings had an insignificant effect on total yield. The reason is that increased yields of the shorter secondary cuttings compensated for the lower yields of the longer primary cuttings. The total yields as given in table 2 are the mean values from the five sample lots, The total yield includes all cuttings available down to a 1- by 10-inch minimum cutting size. The three sets of limits in table 2 provide some indication of the variation and the reasonable values that we might expect based on the sample data.

Consequently, unless a 1-in-20 chance has occurred in sampling:

(1) The true mean will fall within the confidence limits.

(2) At least 75 percent of the yield will fall within the two-sided tolerance limits.

(3) At least 75 percent of the yields will exceed the one-sided tolerance limit.

COMPARISON TO EARLIER STUDIES

Because of the differences in grading specifications of walnut and maple, we would expect lower yields in walnut. In comparing total yields of the four grades, this difference increases in the lower grades. Maple yields are from 1 to 2 percent higher in FAS and FAS1F and 6 to 7 percent higher in No, 1 and No. 2 Common. This same pattern exists when considering just the primary lengths. However, there is a larger spread in differences as the primary cutting length increases. Maple yields average 4 percent higher than walnut in the shorter 10- to 20-inch lengths. This difference increases to 22 percent when we consider the longer 80- to 90-inch cuttings.

The objectives of this yield study were much the same as those in the AWMA study.[3] The major differences were in design, procedure used

Table Z.--Total yield and limits of variation of clear one-face cuttings from 4/4 walnut lumber

Lumber grade	Total yield	95 percent confidence limits	95 percent two-sided tolerance limits for 75 percent of the observations	95 percent one-sided tolerance limits for 75 percent of the observations
	Pct.	Pct.	Pct.	Pct.
FAS	75.6	73.7 -- 77.4	71.0 -- 80.1	72.3
FAS1F	70.7	68.8 -- 72.6	66.1 -- 75.2	67.4
No. 1 Common	64.9	63.0 -- 66.7	60.4 -- 69.4	61.7
No. 2 Common	54.8	51.9 -- 57.8	47.6 -- 62.0	49.7

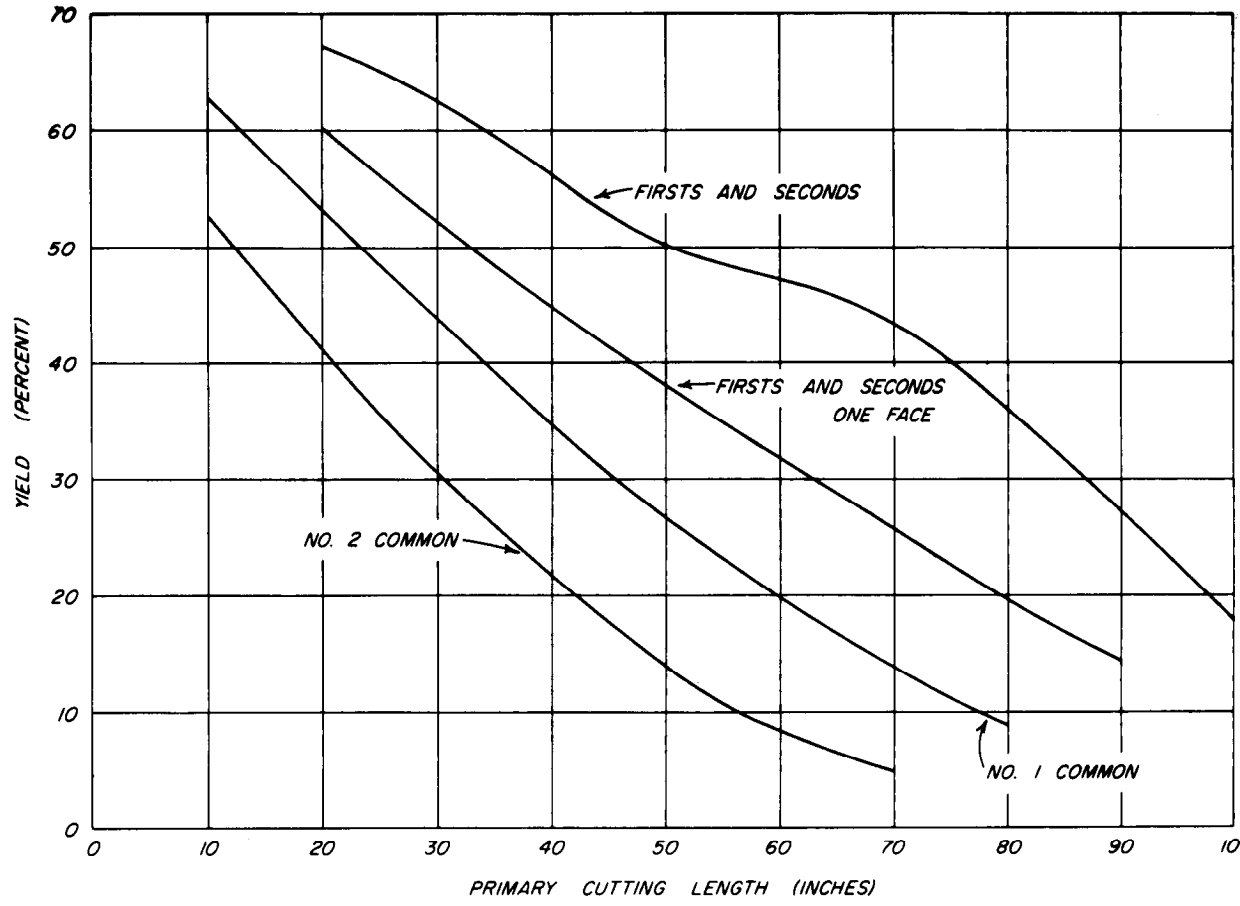

Figure 2.--Primary yield of clear one-face cuttings, random width with 1-inch minimum yield, from 4/4 walnut lumber.

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in determining the yields, and presentation of results. The use of a computer now has made possible the analysis of a monumental amount of data and consideration of possible alternatives. The results are presented so yields of any cutting order can be readily obtained by referring to pertinent charts and making a few simple calculations. Similar experiences with the charts for hard maple have shown the results to be highly acceptable.

A comparison of the two studies does indicate that the yields of this current study are generally lower than for AWMA.[3] Total yields are from 1 to 4 percent lower in FAS1F and FAS and 7 percent lower in No. 1 and 2 Common. Differences in the yields of primary lengths are less in the shorter cuttings and lower grades. These differences range from 28 percent in the FAS long cuttings to 3 percent in the No. 2 Common short cuttings. A comparison of the reduction in yield of wider cuttings shows this study approximately 7 percent lower in FAS and FAS1F narrow cuttings and approximately 2 percent lower in the No. 1 and 2 Common wide cuttings. These differences in yield may be attributed to a liberalization in the grading rules, the current lumber supply being of lower quality, procedural differences used in obtaining data, and sampling design.

USING THE CHARTS

One chart for random-width cuttings is presented for each lumber grade (figs. follow). These values are based on a minimum width of 1 inch, which approximates minimum widths cut in commercial practice. Adjustments for widths greater than 1 inch can be made from the lower chart on the same page. In all cases, the adjustment figures are subtracted from the l-inch yields.

Length

In the random-width chart the numbers along the diagonal line refer to the longest length in a cutting bill. The numbers at the left refer to the lengths of the subsequent cuttings. The predicted yield, in percent, is shown at the extreme left.

Assume, for example, that a cutting bill calls for 60-, 48-, 24-, and 12-inch lengths, all random width, l-inch minimum. On the FAS chart locate the longest length, 60 inches in this case, at the right of the chart. Then follow horizontally to the yield line to where 47.5 percent is predicted as yield.

Turn then to find the yield of next longest length, here 48 inches, Starting again at the 60-inch line, move vertically up to where the curved 48-inch line crosses, then follow laterally left to where the predicted yield is 56.5 percent, This 56.5 percent value, minus 47.5 percent for the 60-inch length, leaves 9.0 percent as the yield for the 48-inch cutting.

For the third longest cutting of 24 inches, continue up the line of the longest length cutting (60 in.) to where 24 intersects and read across to the yield line, The figure is 71.0 percent, Subtracting the value of 56.5 percent for the 48-inch length from this gives a 14.5 percent yield for the 24-inch length.

Likewise, for the fourth length of 12 inches, continue up the 60-inch line to where 12 intersects and read across to 75.5 percent. Subtracting the value of 71.0 percent for the 24-inch length from this leaves a yield of 4.5 percent for the 12-inch length.

The total yield for the four lengths in the FAS grade, of course, is the summation of the individual yields, or 75.5 percent.

The same procedure is used for any combination of cutting lengths in any of the grades by using the appropriate chart. This same cutting bill of 60-, 48-, 24-, and 12-inch random-width lengths from No. 1 Common lumber would yield 20.0, 13.5, 23.5, and 7.0 percent, respectively, The total yield is 64.0 percent.

Width Adjustments

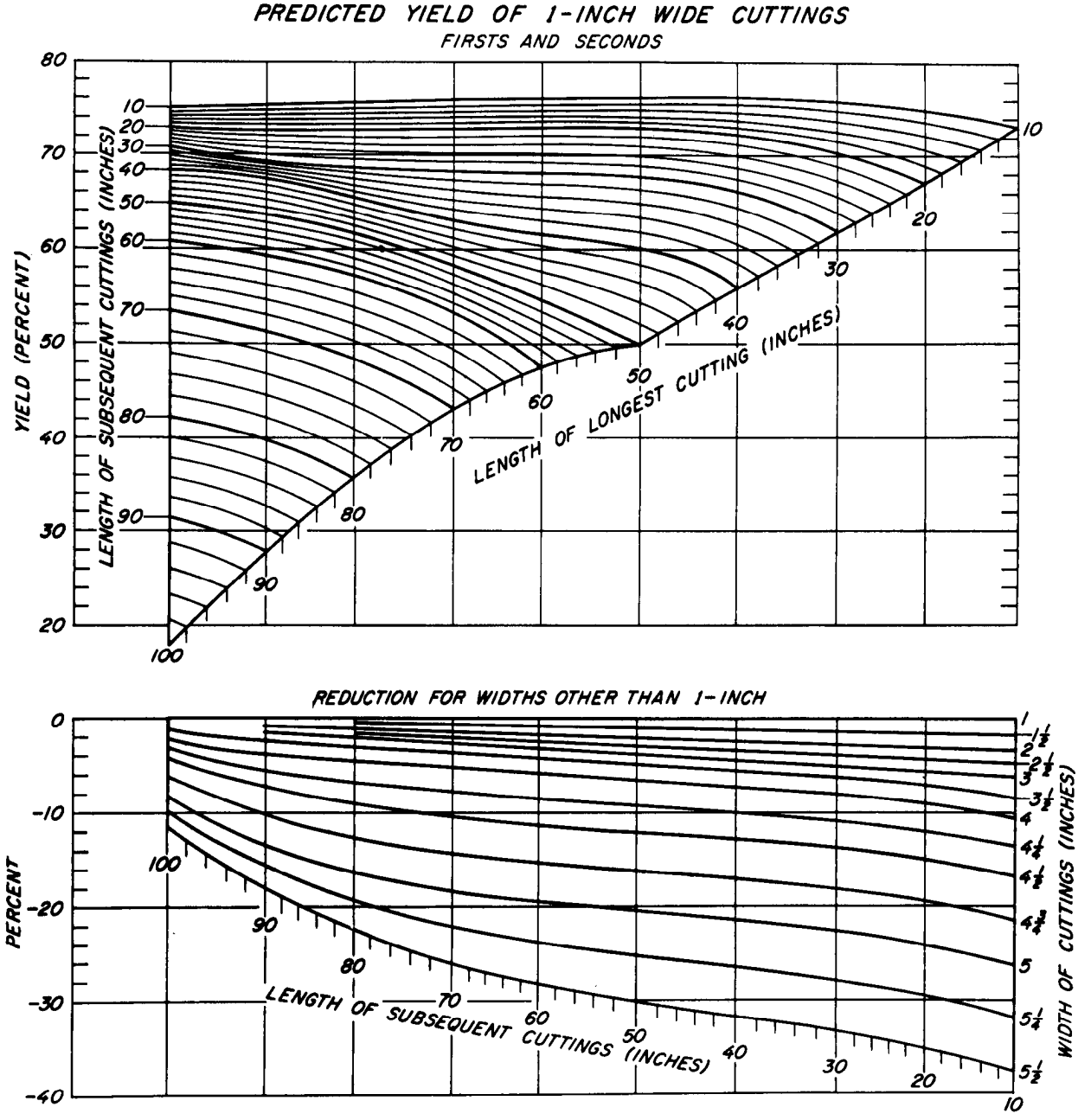
Adjustments in yield for specific widths greater than 1 inch can be obtained by the use of the lower chart on the same page. The difference between the desired width and the random width is subtracted from the percent yield of the 1-inch width for any of the lengths,

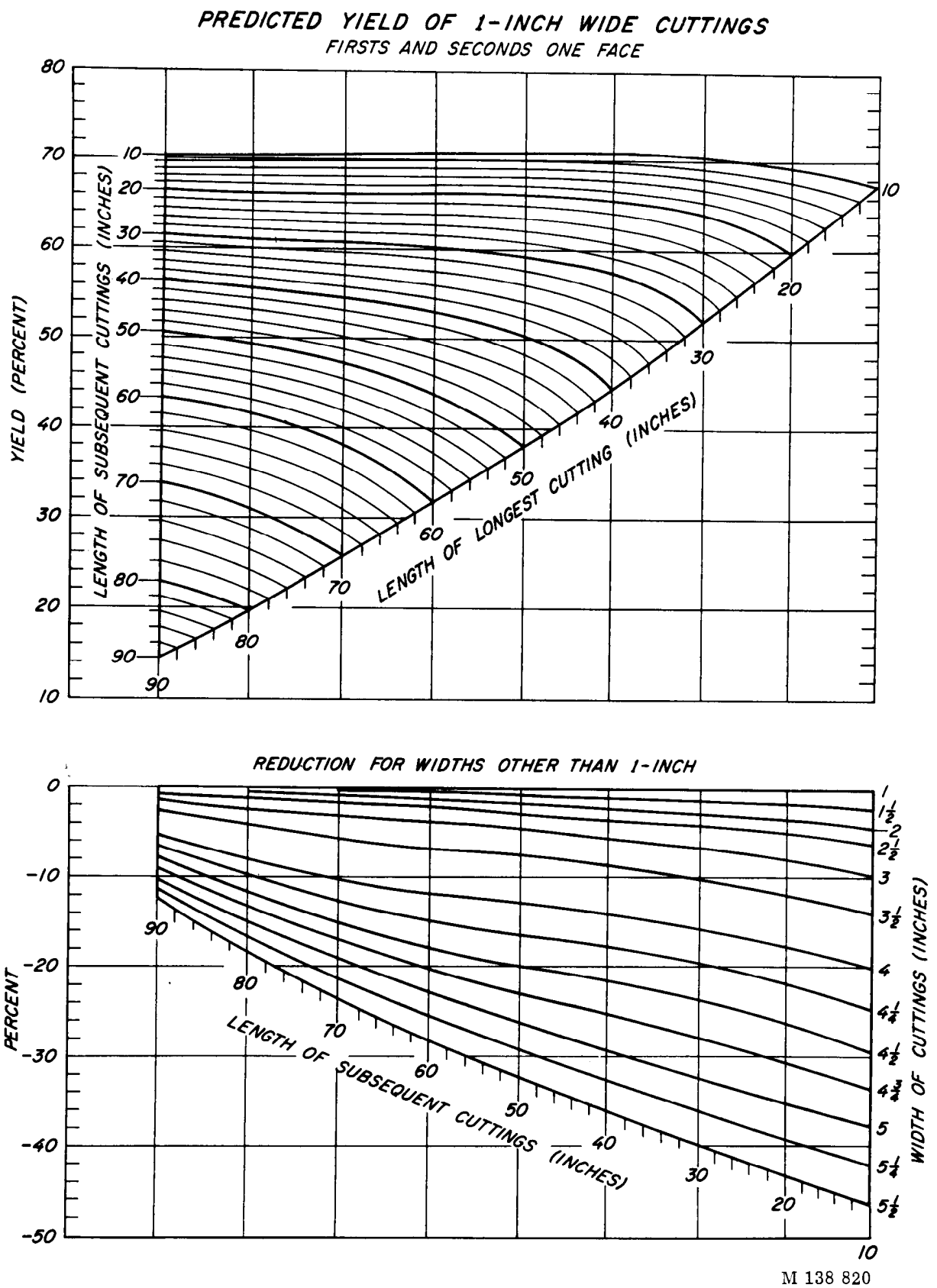
To obtain yields of specific widths from the FAS grade and using the cutting lengths of the above example, start with the 60-inch cutting length at the bottom. From the 60-inch line, follow up to the 2-1/2-inch line, then horizontally to a reduction of 2.5 percent. Repeat the procedure for other lengths, The values for the cutting bill are shown in table 3.

Table 3.--Example of how to obtain yields of four cutting sizes from 4/4 FAS walnut lumber

Cutting size		Random-width reading	Adjustment	Adjusted reading	Yield
Length	Width				
In.	In.	Pct.	Pct.	Pct.	Pct.
60	2-1/2	47.5	Subtract 2.5	45.0	45.0
48	3	56.5	Subtract 4.0	52.5	7.5
24	2	71.0	Subtract 3.5	67.5	15.0
12	Random width	75.5	--	75.5	8.0
Total yield					75.5

The following charts provide a means of predicting yields of black walnut for four grades and widths from random width to 5-1/2 inches.




PREDICTED YIELD OF 1-INCH WIDE CUTTINGS
FIRSTS AND SECONDS ONE FACE
YIELD (PERCENT)
LENGTH OF SUBSEQUENT CUTTINGS (INCHES)
LENGTH OF LONGEST CUTTING (INCHES)
REDUCTION FOR WIDTHS OTHER THAN 1-INCH
PERCENT
LENGTH OF SUBSEQUENT CUTTINGS (INCHES)
WIDTH OF CUTTINGS (INCHES)
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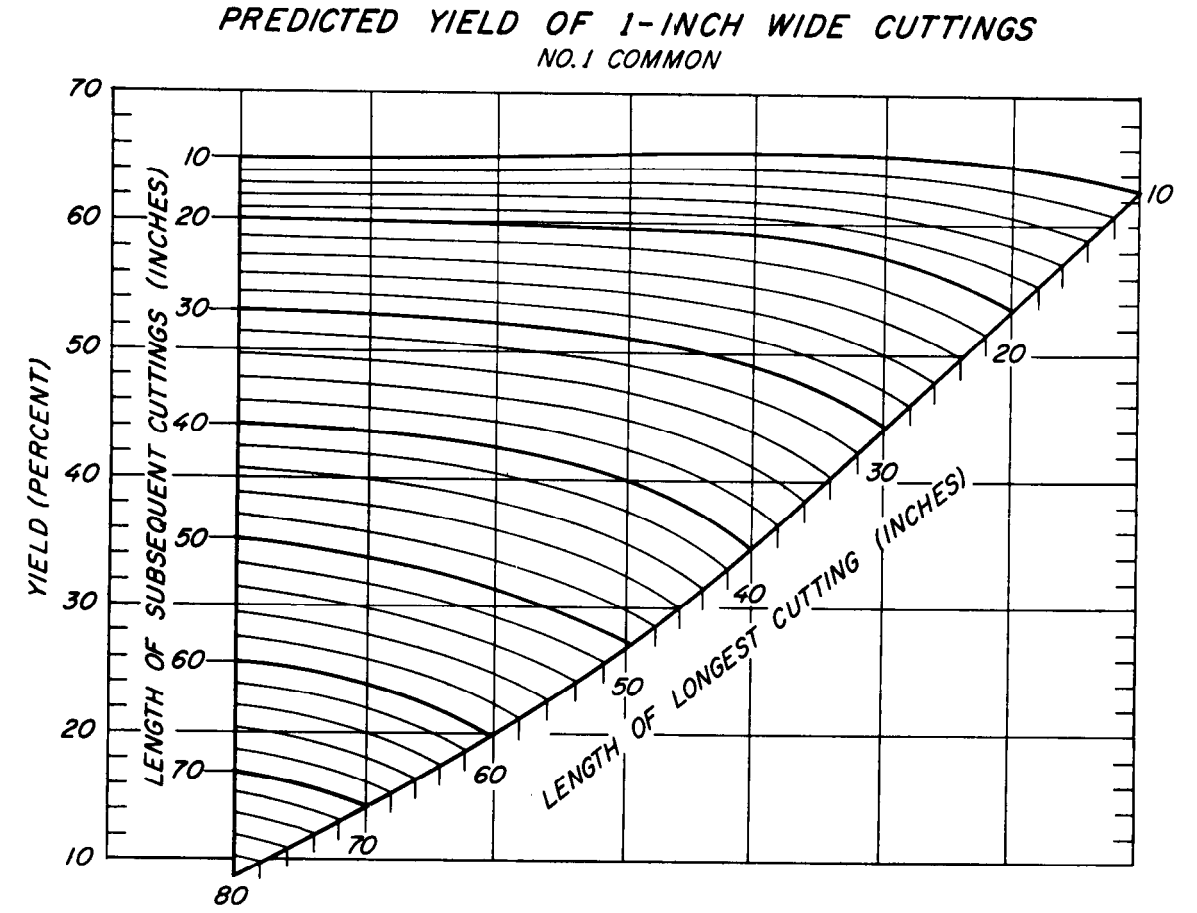
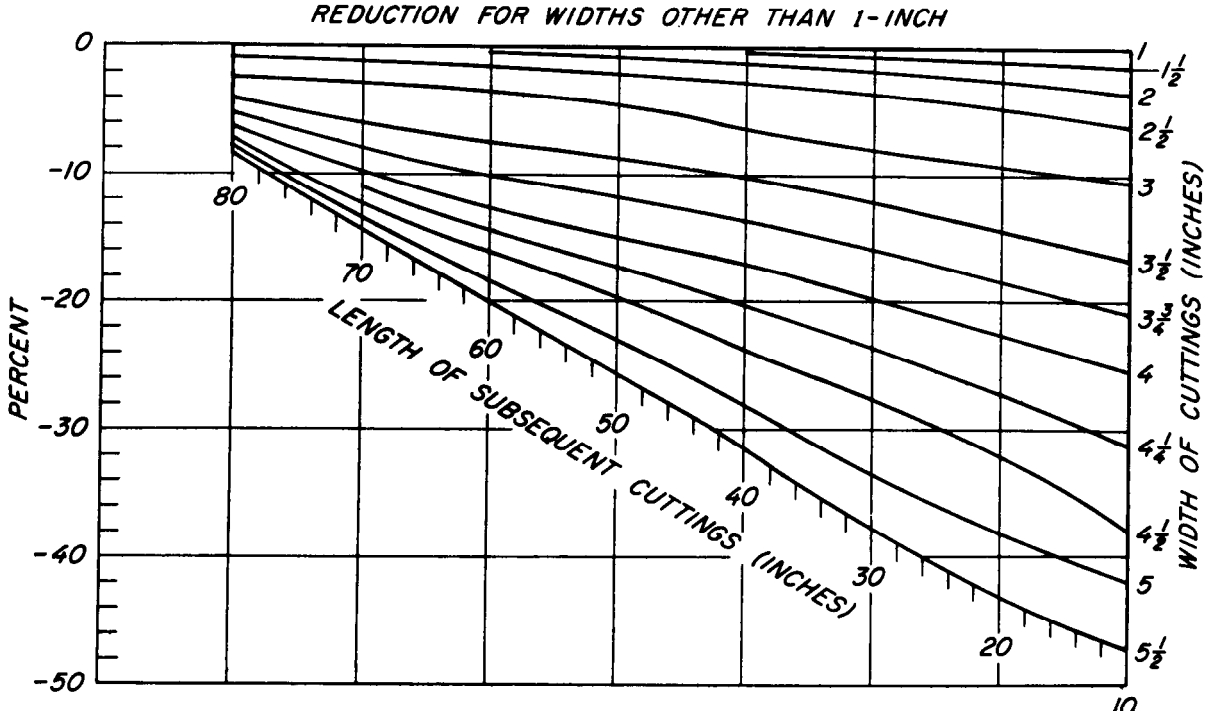

PREDICTED YIELD OF 1-INCH WIDE CUTTINGS
NO. 1 COMMON
YIELD (PERCENT)
LENGTH OF SUBSEQUENT CUTTINGS (INCHES)
LENGTH OF LONGEST CUTTING (INCHES)
70
60
50
40
30
20
10
80
70
60
50
40
30
20
10


REDUCTION FOR WIDTHS OTHER THAN 1-INCH
PERCENT
LENGTH OF SUBSEQUENT CUTTINGS (INCHES)
WIDTH OF CUTTINGS (INCHES)
0
-10
-20
-30
-40
-50
80
70
60
50
40
30
20
10
1
1½
2
2½
3
3½
3¾
4
4¼
4½
5
5½

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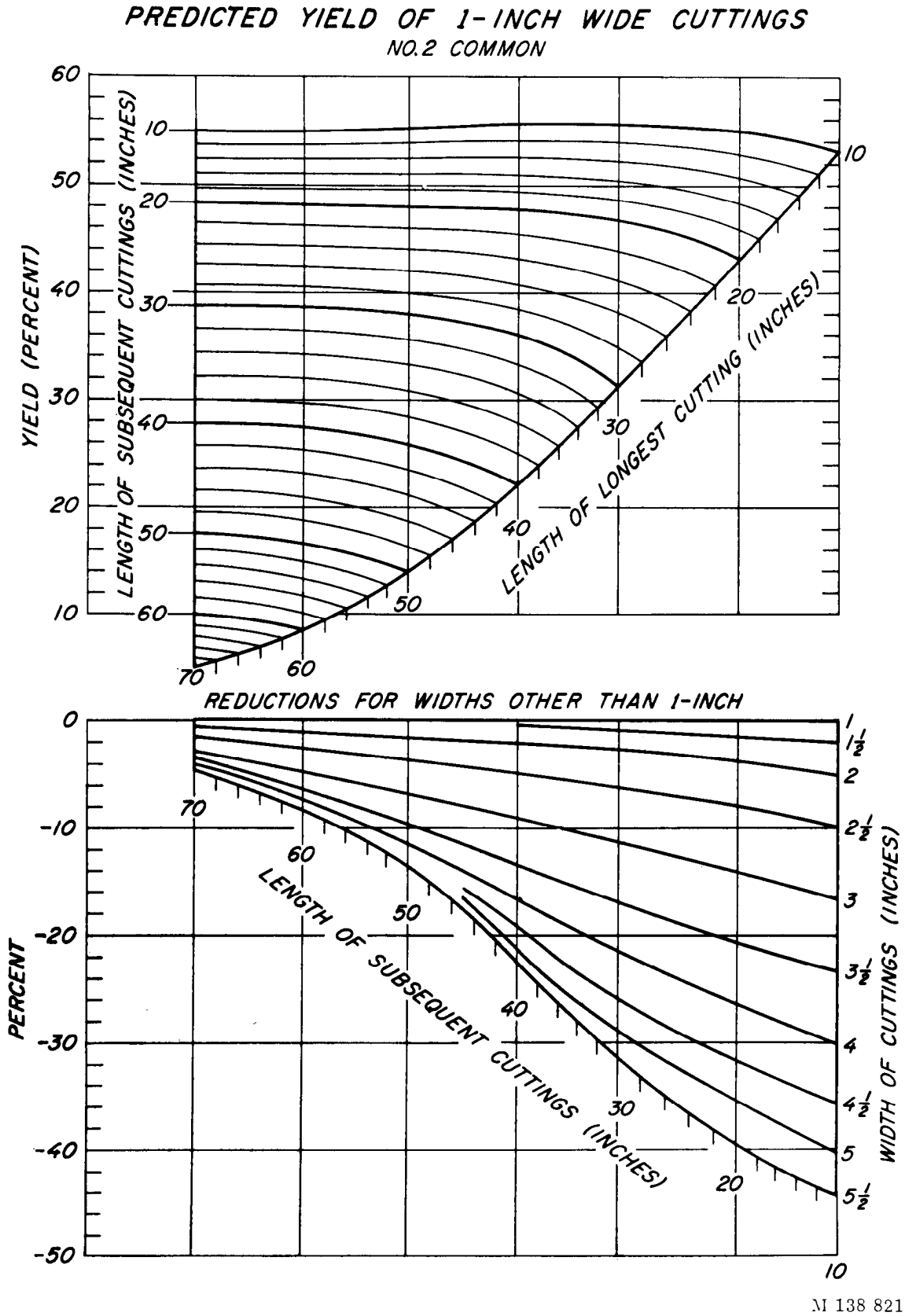
PREDICTED YIELD OF 1-INCH WIDE CUTTINGS
NO.2 COMMON
YIELD (PERCENT)
LENGTH OF SUBSEQUENT CUTTINGS (INCHES)
LENGTH OF LONGEST CUTTING (INCHES)
REDUCTIONS FOR WIDTHS OTHER THAN 1-INCH
PERCENT
LENGTH OF SUBSEQUENT CUTTINGS (INCHES)
WIDTH OF CUTTINGS (INCHES)
M 138 821

Odd Sizes

Lengths and widths of cuttings in practice are seldom in even inches. Yields of such can be determined by interpolating between the length and width lines as shown in table 4 for the FAS1F grade,

The yield of any combination of cutting lengths and widths can be determined in like manner for any of the lumber grades.

Although fractions of percentages are given in these examples, these generally would be rounded off to even numbers in practice.

DETERMINING NUMBER OF CUTTINGS PER THOUSAND BOARD FEET

The yields so far have been in percentages. These, however, are easily converted to number of cuttings per thousand board feet by multiplying the percent yield expressed as a decimal times 1,000 and dividing by the cutting surface in square feet, Using the previous example of sizes and yields for the FAS grade, the number of cuttings per thousand board feet is as shown in table 5.

That is, a 45.0 percent yield means that 450 board feet of clear, one-face cuttings 60 by 2-1/2 inches in size, can be obtained from a thousand board feet of FAS black walnut lumber, Thus

450 ÷ 1.042 = 431 cuttings per 1,000 board feet

In addition, 75, 450, and 963 cuttings for the 48-, 24-, and 12-inch lengths, respectively, can be obtained from the same thousand board feet of lumber.

CALCULATING FOOTAGE REQUIREMENTS

The number of cuttings obtainable from a thousand board feet of lumber is divided into the number of cuttings required, and multiplied by 1,000, to give the amount of lumber needed. This is shown in table 6 using the previous cutting sizes for the FAS grade,

As an illustration, the following cutting bill with the required number of cuttings was used: 1,500 of 60-inch length and 2-1/2-inch width, 500 of the 48-inch length and 3-inch width, 1,800 of 24-inch length and 2-inch width, and 4,100 of 12-inch length and random width,

Thus, 1,500 cuttings of the 60-inch length divided by 431 times 1,000 equals 3,481 board feet required.

Then, 75 of the 48-inch length obtainable from a thousand board feet times 3,481 and divided by 1,000 shows that 261 cuttings of this length can also be obtained. A total of 239 pieces are still needed.

Table 4 .--Example of how to obtain yields of odd-size cuttings from 4/4 FAS1F walnut lumber

Cutting size		Random width reading	Adjustment	Adjusted reading	Yield
Length	Width				
In.	In.	Pct.	Pct.	Pct.	Pct.
57-1/2	3-1/8	33.5	Subtract 4.5	29.0	29.0
43-3/4	1-5/8	49.5	Subtract 1.5	48.0	19.0
21-1/8	2-1/4	66.0	Subtract 4.0	62.0	14.0
11-1/2	Random width	70.5	--	70.5	8.5
Total yield					70.5

Table 5.--Number of cuttings per thousand board feet of four cutting sizes from 4/4 FAS walnut lumber

Cutting size		Surface measure	Yield	Cuttings per 1,000 board feet
Length	Width			
In.	In.	Sq. ft.	Pct.	No.
60	2-1/2	1.042	45.0	431
48	3	1.000	7.5	75
24	2	.333	15.0	450
12	Random width	.083	8.0	963

Table 6.--Number of cuttings for four cutting sizes from 3,481 board feet of 4/4 FAS walnut lumber

Cutting size		Cuttings per 1,000 board feet	Cuttings required	Cuttings per 3,481 board feet	Cutting balance
Length	Width				
In.	In.	No.	No.	No.	No.
60	2-1/2	431	1,500	1,500	--
48	3	75	500	261	-239
24	2	450	1,800	1,566	-234
12	Random width	963	4,100	3,352	-748

The method of determining cuttings obtained from the 24- and 12-inch lengths follows the same pattern.

Since the cutting bill requires 500 of the 48-inch cuttings and only 261 were obtained from 3,481 board feet, the 48- by 3-inch size becomes the longest length for the other 239 pieces, The same procedure is followed as outlined in tables 3 and 5. The results of these computations are shown in table 7.

Now, 239 divided by 470 cuttings per MBF times 1,000 equals 509 board feet required to cut the balance of the cuttings in the 48-inch length (table 8).

Subsequently, 313 24-inch cuttings can also be obtained from this 509 board feet, However, only 234 are required, and as in practice, the lumber for the excess pieces would be used to cut shorter lengths. In this example, the 79 pieces would cut 158 of the 12-inch lengths. One hundred thirty-one 12-inch pieces are still needed. An additional 16 board feet will meet this requirement, when only 12-inch random width cuttings are cut.

A total of 4,006 board feet (3,481 + 509 + 16) is required to cut this order from the FAS grade, This, divided into the surface measure of all the cuttings (3,002.7 sq. ft.), results in a total yield of 75.0 percent.

SHORTCUT TO DETERMINING REQUIRED FOOTAGE

A rule-of-thumb method of determining the required footage may be used, especially when a relatively large number of short, narrow cuttings are needed in the order. As seen in table 2 and figure 3, the total yield in the FAS grade is usually very close to 75.5 percent regardless of the cutting order--provided there is a requirement for the short, narrow cuttings.

First, obtain the reciprocal of the total yield, which in the last example presented is 1 divided by 0.750 equals 1.333. This number, multiplied by the surface measure in board feet of all the cuttings, gives the estimated footage (1.333 x 3,002.7 = 4,003 bd. ft.). The difference between the two footages, 4,006 and 4,003, is due to rounding, When using the approximate value of 75.5 percent, we see 1 divided by 0.755 equals 1.325 and 1.325 times 3,002.7 equals 3,979 board feet. This readily obtainable estimate is 27 board feet less than the actual, 4,006. In many instances, this degree of accuracy is tolerable.

Table 7.--Example of how to obtain yields of three cutting sizes from 4/4 FAS walnut lumber

Cutting size		Random width reading	Adjustment	Adjusted reading	Yield	Surface measure	Cuttings per 1,000 board feet
Length	Width						
In.	In.	Pct.	Pct.	Pct.	Pct.	Sq. ft.	No.
48	3	51.0	Subtract 4.0	47.0	47.0	1.000	470
24	2	71.0	Subtract 3.5	67.5	20.5	.333	615
12	Random width	75.5	--	75.0	7.5	.083	903
Total yield					75.0		

COST COMPARISON BY GRADE

Material cost comparisons can be made between grades, or a mixture of grades, for any given cutting order. Assume, for example, that cuttings are wanted in the following quantities and sizes: 500 60- by 2-1/2-inch, 500 48- by 3-inch, 1,000 24- by 2-inch, and 2,000 12- by 1-inch, What is the most economical grade, or mixture of grades? Assume a cost per thousand board feet for FAS of $795, FAS1F $695, No. 1 Common $360, and No, 2 Common $145. Table 9 shows the cost comparisons for the 10 possible choices.

With the assumed costs, using entirely No, 1 Common lumber is the most economical. The FAS1F grade is the least economical. The difference between these two extremes is $517 or 39 percent of the cost of lumber. A mix of No. 1 and No. 2 Common lumber is $48 more expensive than using entirely No. 1 Common.

Two and one-half times as much lumber is required in the No. 2 Common grade to fill this order and the cost is $77 more than No. 1 Common. This large volume was required because of the low yield in the longer cuttings, As a result a considerable number of short narrow cuttings were produced. These could accumulate rather rapidly unless there is a requirement for them.

One must remember that these values are based solely on the quoted prices, Substitution of prices that are particular to a certain locale may show that another grade or mix of grades is more economical. Also keep in mind that these values are based entirely on the price of lumber and that handling and processing cost must be included,

With the large price differential that currently exists among the lumber grades, it might be surprising to find how the lower lumber grades will most economically meet specific cutting requirements.

Table 8.--Number of cuttings for three cutting sizes from 509 board feet of 4/4 FAS walnut lumber

Cutting size		Cuttings per 1,000 board feet	Cuttings required	Cuttings per 509 board feet	Cutting balance	
					Initial	Final
Length	Width					
In.	In.	No.	No.	No.	No.	No.
48	3	470	239	239	--	--
24	2	615	234	313	79	--
12	Random width	903	748	459	158	-131

Table 9.--Comparison of costs to cut 500 60- by 2-1/2 inch, 500 48 by 3-inch, 1,000 24- by 2-inch, and 2,000 12- by 1-inch clear, one-face dimension from various grades of 4/4 walnut lumber

Grades and grade mix	Lumber required	Cost per thousand	Cost	
			Subtotal	Total
	Bd. ft.	Dol.	Dol.	Dol.
FAS for all lengths	2,040	795	--	1,621.80
FAS for only 60-inch length[1]	1,161	795	923.00	
FAS1F for remainder	1,198	695	832.61	1,755.61
FAS for only 60-inch length[1]	1,161	795	923.00	
N1C for remainder	1,686	360	606.96	1,529.96
FAS for only 60-inch length[1]	1,161	795	923.00	
N2C for remainder	4,859	145	704.56	1,627.56
FAS1F for all lengths	2,639	695	--	1,834.11
FAS1F for only 60-inch length[2]	1,743	695	1,211.39	
N1C for only 48-inch length	1,262	360	454.32	1,665.71
FAS1F for only 60-inch length[2]	1,743	695	1,211.39	
N2C for only 48-inch length	3,636	145	527.22	1,738.61
N1C for all lengths	3,658	360	--	1,316.88
N1C for only 60-inch length[3]	2,825	360	1,017.00	
N2C for only 48-inch length	2,400	145	348.00	1,365.00
N2C for all lengths	9,616	145	--	1,394.32

[1]Includes 87 of 48-inch, 522 of 24-inch, and 1,118 of 12-inch lengths.

[2]Includes all of the 24- and 12-inch, plus 191 of 48-inch lengths.

[3]Includes all of the 24- and 12-inch, plus 296 of 48-inch lengths.

ABOUT THE FOREST SERVICE. . . .

As our Nation grows, people expect and need more from their forests--more wood; more water, fish and wildlife: more recreation and natural beauty: more special forest products and forage. The Forest Service of the U.S. Department of Agriculture helps to fulfill these expectations and needs through three major activities:

* Conducting forest and range research at over 75 locations ranging from Puerto Rico to Alaska to Hawaii.

* Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.

* Managing and protecting the 187-million acre National Forest System.

The Forest Service does this by encouraging use of the new knowledge that research scientists develop; by setting an example in managing, under sustained yield, the National Forests and Grasslands for multiple use purposes; and by cooperating with all States and with private citizens in their efforts to achieve better management, protection, and use of forest resources.

Traditionally, Forest Service people have been active members of the communities and towns in which they live and work. They strive to secure for all, continuous benefits from the Country's forest resources.

For more than 60 years, the Forest Service has been serving the Nation as a leading natural resource conservation agency.

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