

**II. Observations on the Growth of Trees: By Robert Marsham, of Stratton in Norfolk, Esq; communicated by the Rev. Steph. Hales, D. D. F. R. S.**

*Measures of Trees, taken in April 1743, before they began to shoot; and again in Autumn 1758, after the Year's Growth was completed. The Measure taken at 5 Feet from the Earth.*

**FIRST TABLE.**

Read Jan. 11, 1759.

	Circumf. in Spring 1743.		Circumf. in Autumn 1758.		Increase in 16 years.		Content in 1743.		Content in 1758.		Solid increase in 16 years.					
	Feet.	8ths of In.	Feet.	8ths of In.	Feet.	8ths of In.	Cubic feet.	Quarters.	Inches.	Cubic feet.	Quarters.	Inches.				
1. Ash, planted since 1647	—	—	—	—	1	2	4	60	1	318	76	3	43	16	1	157
2. Oak, past thriving, but found	—	—	9	4	10	1	0	54	1	336	63	2	80	9	0	176
3. Oak, about 80 years old	—	—	6	3	7	8	3	24	1	284	36	2	408	12	1	124
4. Scotch Fir, seed in 1698	—	—	5	4	6	6	0	17	3	48	26	1	270	8	2	222
5. Oak, planted above 60 years	—	—	5	11	1	7	2	21	3	224	32	0	174	10	0	382
6. Spanish Chefnut, near 60 years old	4	4	0	5	6	3	1	11	2	408	18	3	270	7	0	294
7. Another, 45 or 46 years old	—	—	2	9	6	4	4	4	2	391	11	2	408	7	0	17
8. Oak, planted by me in 1720	—	—	2	11	2	5	1	5	1	116	16	0	260	10	3	144
9. Scotch Fir, planted 1734, 2 feet high	1	11	6	4	0	0	2	2	2	0	10	0	0	7	2	0
10. Pinaster, planted in 1734 or 1735	2	5	1	4	3	1	10	3	2	260	11	1	68	7	2	240
11. Oak, set an acorn in spring 1719	1	7	0	2	8	2	1	1	2	116	4	1	336	2	3	220
12. Oak, planted in 1720 or 1721	—	—	2	9	4	9	4	4	2	391	14	0	176	9	1	217
								213	0	300	322	0	333	109	0	33

Now

Now as the twelve trees above, contained 213 cubic feet 300 inches of timber in spring 1743, and have increased to 322 cubic feet 333 inches in autumn 1758; that is, 109 cubic feet 33 inches in 16 years growth; if all the trees were of the same kind, 109 feet pays 3 *per cent.* for standing: and the six oaks pay near the same interest, although one of them, N<sup>o</sup> 2. appeared past thriving in 1743; for the increase of the six oaks is from 112 feet 1 quarter 171 inches of timber, to 167 feet 138 inches, *i. e.* 54 feet 2 quarters 399 inches; which is above 3 *per cent.* But if you take only the five thriving oaks, then their content is, from 57 feet 3 quarters 267 inches, to 103 feet 2 quarters 58 inches; *i. e.* 45 feet 2 quarters 223 inches of timber; or near 5 *per cent.* And the increase of the most thriving oak, N<sup>o</sup> 8. appears, by the above table, to pay above 12  $\frac{1}{2}$  *per cent.* and the Scotch fir, N<sup>o</sup> 9. being under 2 feet and half of timber in spring 1743, and 10 feet in autumn 1758, pays above 18  $\frac{1}{2}$  *per cent.* Besides it should be considered, altho' I measured the largest and most thriving oak and Scotch fir in 1743, yet several others of the same age, both oaks and Scotch firs, have greatly exceeded the measured trees for many years past; *e. g.* the oak N<sup>o</sup> 11. appears by the table two feet 8 inches 2-8ths in circumference; and another just by it is 2 feet 11 inches 6-8ths; and an oak transplanted from this grove, is 3 feet 9 inches 5-8ths round; yet this last tree was considerably less than the first when removed, and not planted in a better soil, and yet is 1 foot 1 inch 3-8ths larger than the original tree. The first contains 4 feet 1 quarter 336 inches, and has gained 2 feet 3 quarters 220 inches

inches in sixteen years: the last contains 8 feet 3 quarters 68 inches; and, supposing them equal in 1743, gains 7 feet 384 inches; *i. e.* above  $2\frac{1}{2}$  the increase of the first tree. But notwithstanding the transplanted oak is thus much larger than the original oaks in the grove, yet as the transplanted tree does not run half the height of the trees in the grove before it heads, they differ but little in their quantity of timber.

The following table shews the monthly increase of trees in the years 1757 and 1758. As I endeavoured to take the measures with as much exactness as was in my power, I cut three, four, or more notches in the bark of each tree, that my line might always be confined exactly to the same place. I observed, if I measured soon after a rain, whilst the bark was saturated with water, the tree would be  $\frac{1}{8}$  of an inch larger than after a day or two of dry weather. I may here add, that all the measures of circumferences of trees are taken at 5 feet from the earth: and consequently the solid measures must include 10 feet in length. I generally made use of Keay's Tables in the solid measures, which go no lower than quarters of inches in girts: which is not so exact as it ought to be.

*Measures of the monthly Increase of the most thriving Trees I had, of the following several Kinds, taken at 5 Feet from the Ground in the Years 1757 and 1758.*

**TABLE II.**

1. An Oak planted in 1720, No. 8. }  
in the other table — — — }
2. A Beech, a feed in 1741 — — — }
3. A Scotch Fir, planted in 1734. }  
about 2 feet high — — — }
4. An Oak, an acorn in spring 1719. }  
never removed — — — }
5. A Spanish Chestnut 45 or 46 years }  
old, No. 7. in the other table — — }
6. An Elm, about 25 years old — — — }
7. A Spruce Fir, planted in 1735. }  
about 2 feet high — — — }
8. A Larch, planted in 1749 — — — }
9. A Willow, set in spring 1756 — — — }
10. A Beech, a feed in 1733 — — — }

Feet.	Inches.	Gths of In.	Measured October 6, 1756; and on the 6th of November they were rather less.																												
			1 June 1757.	3 July 1757.	3 Aug. 1757.	4 Sept. 1757.	Nov. 1757.	1 June 1758.	30 June 1758.	31 July 1758.	29 Aug. 1758.	29 Sept. 1758.																			
4	9	7	4	10	1	4	10	2	4	11	2	4	11	3	4	5	1	2	5	1	2	5	1	2							
0	11	0	1	10	1	1	10	1	1	0	4	1	0	4	1	0	7	1	3	1	7	1	2	2	3						
4	2	4	4	3	0	4	3	1	4	3	2	4	3	6	4	4	4	1	4	4	4	4	4	6	4	6					
2	9	4	2	9	5	2	9	6	2	10	1	2	10	2	2	10	4	2	10	6	2	11	1	2	11	5	2	11	6		
4	2	5	4	2	7	4	3	0	4	3	1	4	3	4	4	3	4	4	3	5	4	4	1	4	4	4	4	4	4	4	
1	7	0	1	7	4	1	8	0	1	8	2	1	8	4	1	9	0	1	9	4	1	9	7	1	10	2	1	10	3		
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	7	0	3	7	1	3	7	4	3	8	0	3	8	0	
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0	7	1	1	5	1	2	2	1	2	5	1	2	7	1	3	3	6	1	3	6	1	3	7	4	3	8	0	3	8	0
1	0																														

TABLE III. Shows the Increase in Circumference, and in Solid Measure, of each Tree in 1758.

	Circumfer. in 1757.		Circumfer. in 1758.		Content in 1757.		Content in 1758.		The year's solid Increase of 1758.		Interest the Trees pay for standing, Per Cent.							
	Feet.	Inches.	8ths of In.	Inches.	8ths.	Cubicfeet.	Quarters.	Inches.	Cubicfeet.	Quarters.		Inches.						
1. The Oak	4	11	2	5	1	2	15	0	188	16	0	260	1	0	72	or near	7	
2. The Beech	1	0	4	1	2	3	0	2	216	0	3	174	0	0	390	above	36	
3. The Scotch Fir	4	3	9	4	4	6	11	1	68	11	2	408	0	1	340	about	4	
A Scotch Fir, not in the 2d Table, planted in 1735	4	1	4	4	4	0	10	1	296	11	2	408	1	1	112	above	12½	
4. The Oak	2	10	2	2	11	6	5	0	30	5	2	216	0	2	186	above	12½	
5. The Spanish Chestnut	4	3	4	4	4	4	11	1	68	11	2	408	0	1	340	near	4	
6. The Elm	1	8	4	1	10	3	1	2	408	2	0	174	0	1	198	near	21	
7. The Spruce Fir	3	6	2	3	8	0	7	2	270	8	1	264	0	2	426	above	9½	
8. The Larch	1	3	1	1	5	1	0	3	392	1	1	8	0	1	48	above	28½	
9. The Willow	5	2	3	5	4	3	16	2	318	17	3	48	1	0	162	above	6½	
10. The Beech	1	10	4	2	0	5	2	0	174	2	2	2	0	0	1	258	above	19
A Weymouth Pine	1	6	2	1	9	0	1	1	270	1	3	284	0	2	14	about	36	

N. B. I measure the oak N<sup>o</sup> 4. as three feet round, as it wants only 1-4th of an inch of that measure; and the Weymouth pine as 1 foot and 6 inches, tho' it is 1-4th of an inch more.

As the Scotch fir, N<sup>o</sup> 3. has been sickly for two years past; therefore I add another Scotch fir (one year younger) to show the growth of that kind of tree; and the extraordinary increase of the Weymouth pine induced me to put that in also, tho' I had not measured it monthly.

The great Lord Bacon says, “ *the improvement of the ground is the most natural way of obtaining riches.*” What great fortunes might be raised, by those that have property, in the vast heaths and downs, or fields of poor land, in this kingdom, by planting parts of them? which would also add great beauty to the country, and render the dwelling much more comfortable to the neighbourhood, by the shade in summer, and warmth in winter. Some parts of these great wastes would produce good oak; and where the soil is moist, poplar, alder, and other aquatics, would be very profitable to the planter. The chalky soil seems the least promising; yet beeches sometimes thrive well upon it. The fir kind, especially the Scotch fir, will grow surprisngly upon poor sandy land; but woods of fir should be guarded with an out-line of birch and beech, to break the force of strong winds. Birch, being the quickest grower, will best protect the young fir; but as birch, after a few years, is easily blown down, so beech will be wanted to defend the firs as they become large: for I have seen broad glades made by the wind through great woods of fir in Switzerland: which, perhaps, might have been prevented, at least in part, by an out-line of beech.

I know some think, that poor land cannot produce large trees; yet the oak at Northall in Hertfordshire, whose beautiful head spreads a circle of above 40 yards diameter, stands on a dry and deep sand; and the fine chestnuts and beeches by Mr. Naylor’s grand castle of Herst Monceux in Suffex, grow in a light sandy soil: and I have found, by experience, the Weymouth, Scotch, spruce, and silver firs, which I planted in a poor sandy soil, are larger and finer trees, than others set at the same time in much better land. Perhaps it may require a rich clay to produce such trees as the noble grove of oak in the Earl of Powis’s park by Ludlow, or Lord Ducie’s vast chestnut at Tortworth, in Gloucestershire, which I measured  $46\frac{1}{2}$  feet in circumference at near 6 feet from the ground.

Although these slight observations are not so deserving the attention of the Royal Society as I could wish; yet they may possibly be the means of producing better; and for my own part, I shall always esteem it a great honour that they were communicated by Dr. Hales.