60. A Classical Apple Experiment

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A commercial apple tree consists of two parts grafted together. The upper, the *scion*, determines the main characteristics of the fruit and leaves, while the lower, the *root-stock*, largely determines the size and development of the tree. At the beginning of the century it was generally accepted that a root-stock propagated asexually, for example by cuttings or from a stool-bed, gave a dwarf tree, whereas one propagated sexually, that is from seed, gave a large tree.

With increasing knowledge of genetics this was seen to be implausible and many research workers began to investigate the matter. When the East Malling Research Station was founded in 1913 one of its first activities was to collect asexually produced root-stocks from all over Europe and to study them botanically. It soon appeared that there were effectively only nine kinds, though known by a confusing range of names. These were numbered I to IX. Later seven root-stocks raised from seed in Germany were added and numbered X to XVI. A clone was raised from each of these sixteen sources, a *clone* being a set of plants raised asexually from a single parent. In the experiment considered here trees of the scion, Worcester Pearmain, were grafted on root-stocks from these clones. This classical experiment, planted in the winter of 1918-1919, went far to elucidate the effects of different kinds of root-stock.

In the winter of 1933-1934 a number of these trees were removed to make more room for the rest. The data presented here came from 104 trees, eight on each of thirteen kinds of root-stock. At that stage no trees on root-stocks VIII, XI and XIV were removed; therefore no data are available for those root-stocks.

Essentially a tree grows in two ways. Activity of the cambium, the meristematic tissue beneath the bark, may be measured by the girth, that is the circumference, of the trunk above the graft union. Activity of the meristematic tissue at the apex of shoots may be measured by the total extension of shoots, though that is a very laborious record to take. It is also indicated by the weight of the tree above ground level but that can be measured only when the tree is removed. Table 60.1 gives the measurements of the four variates representing cambial and apical activity recorded four and fifteen years after planting for the thirteen types of root-stock.

Table 60.1
Measurements of the Four Variates Representing Cambial and Apical Activity Recorded Four to Fifteen Years after Planting for 13 Types of Root-stock

	Four years		Fifteen years	
Root-stock	Trunk girth, mm.	Extension growth, cm.	Trunk girth, mm.	Weight of tree above ground, lbs.
		Root-stock I		
I	111	2569	358	760
I	119	2928	375	821
I	109	2865	393	928
I	125	3844	394	1009
I	111	3027	360	766
I	108	2336	351	726
I	111	3211	398	1209
I	116	3037	362	750
		Root-stock II		
II	105	2074	409	1036
II	117	2885	406	1094
II	111	3378	487	1635
II	125	3906	498	1517
II	117	2782	438	1197
II	115	3018	465	1244
II	117	3383	469	1495
II	119	3447	440	1026
		Root-stock III		
III	107	2505	376	912
III	99	2315	444	1398
III	106	2667	438	1197
III	102	2390	467	1613
III	115	3021	448	1476
III	120	3085	478	1571
III	120	3308	457	1506
III	117	3231	456	1458
		Root-stock IV		
IV	122	2838	389	944
IV	103	2351	405	1241
IV	114	3001	405	1023
IV	101	2439	392	1067
IV	99	2199	327	693
IV	111	3318	395	1085
IV	120	3601	427	1242
IV	108	3291	385	1017

Table 60.1 *(cont.)*

Root-stock	Four years		Fifteen years	
	Trunk girth, mm.	Extension growth, cm.	Trunk girth, mm.	Weight of tree above ground, lbs.
		Root-stock V		
V	91	1532	404	1084
V	115	2552	416	1151
V	114	3083	479	1381
V	105	2330	442	1242
V	99	2079	347	673
V	122	3366	441	1137
V	105	2416	464	1455
V	113	3100	457	1325
		Root-stock VI		
VI	111	2813	376	800
VI	75	840	314	606
VI	105	2199	375	790
VI	102	2132	399	853
VI	105	1949	334	610
VI	107	2251	321	562
VI	113	3064	363	707
VI	111	2469	395	952
		Root-stock VII		
VII	96	2091	266	414
VII	91	1583	241	335
VII	120	4099	380	885
VII	110	3383	401	1012
VII	102	2785	296	489
VII	105	2785	315	616
VII	110	3387	358	788
VII	108	3082	343	733
		Root-stock IX		
IX	83	1344	231	375
IX	90	2247	250	410
IX	87	1426	219	335
IX	94	2211	275	560
IX	69	877	205	251
IX	84	1431	213	272
IX	90	1863	266	478
IX	90	2001	226	278
		Root-stock X		
X	105	1964	299	506
X	117	2516	381	882
X	113	3016	362	737
X	113	3424	372	772
X	122	3174	369	827
X	109	2865	368	821
X	117	3634	408	1149
X	122	3393	410	1035

Table 60.1 *(cont.)*

Root-stock	Four years		Fifteen years	
	Trunk girth, mm.	Extension growth, cm.	Trunk girth, mm.	Weight of tree above ground, lbs.
		Root-stock XII		
XII	129	4387	431	1609
XII	135	4166	465	1658
XII	138	4595	484	1789
XII	142	5131	527	2375
XII	132	4041	463	1556
XII	123	3848	412	1418
XII	142	5471	514	2266
XII	144	5956	522	2508
		Root-stock XIII		
XIII	121	3705	387	1052
XIII	120	2886	414	1167
XIII	123	3856	387	981
XIII	109	2763	390	944
XIII	100	2223	327	737
XIII	116	2905	424	1392
XIII	117	3590	421	1326
XIII	105	2516	382	1052
		Root-stock XV		
XV	122	3484	448	1258
XV	116	2730	435	1304
XV	124	3924	451	1290
XV	122	3580	450	1288
XV	125	3355	428	1176
XV	122	3694	424	1177
XV	126	4698	482	1331
XV	119	3566	469	1490
		Root-stock XVI		
XVI	126	4299	452	1499
XVI	113	3432	412	1412
XVI	113	3357	425	1488
XVI	138	5475	460	1751
XVI	127	4482	464	1937
XVI	115	3333	457	1823
XVI	120	3960	463	1838
XVI	119	4040	473	1817