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TREE-RING STUDIES IN THE SOMERSET LEVELS: THE SA SITE OF THE SWEET TRACK

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The 7.5m excavation of the Sweet track immediately north of the South Drain in 1979 gave a further opportunity for the comparison of material with the Railway site (Morgan, 1976) and the Drove site (Morgan, 1979) of the same trackway. Also, new wood species, the potential of which had not been appreciated in the Railway site excavation in 1973, such as elm and willow have been examined. The continued collection of tree-ring samples along this and other trackways is proving extremely fruitful in the amount of detail on woodland sources and construction techniques which is gradually emerging. This has only been possible by such continuous surveillance.

The preservation of the wood had undoubtedly suffered at this site due to the lowering of the water table, and much of the oak in particular was too decayed to withstand the process of deep-freezing and surfacing necessary for ring-width measurement. The techniques used in the Sheffield laboratory have already been described (Morgan, 1979 65).

The total of 63 samples examined will be discussed under wood species; a summary is given in Table 1.

OAK

The oak boards and slats provided a total of 32 samples for analysis, of which 9 were so degraded and distorted as to be valueless. Pressure on the soft wood squashes the structure beyond recognition, and freezing split the wood radially to a much greater extent than usual. Growth rings could not even be counted on these

samples. Included among these was the 320mm wide plank (no. 1) at the north end of the site, the thinness of which had caused its decay; it would probably have provided a valuable ring-width record even longer than that for the other major plank (no. 12).

The samples consisted of:

7 planks (1,8,12,32,34,41,50)

11 stray boards or slats (31,36,45,57,58,60,61,71,74,84,88)

6 rail or board pegs (9,18,21,37,69,82)

2 ? rails (39,73)

1 unidentified (22)

Ring-width measurement was possible on 9 timbers (two pairs of samples from the same piece in the case of 9 and 12 i.e. 11 samples), which included 3 planks, 2 stray boards or slats and 4 rail or board pegs. Numbers of rings ranged from 35 to 214 in the radially split boards of widths between 70 and 240mm. Average ring-widths thus extend from 0.89 to 2.3mm (see Table 2).

Computer comparison revealed high degrees of cross-matching with the 314 year Sweet Railway oak chronology which is based on 129 boards (Morgan, 1976 Table 9). All the curves were matched with the exception of board 88 which had only 35 rings. They mostly lie within the first half of the Railway chronology (Fig. 1) and in fact extend it by 34 years at the beginning, so that the arbitrary year scale in Morgan (1976 Table 9) has been changed. The entire chronology for the Sweet trackway, including the Drove site material (Morgan, 1979) and samples from field collection, now extends over 382 years and involves 168 boards. The number of individual trees is impossible to estimate from the ring-width relationships, as in the Meare Heath trackway (cf Morgan in Coles & Orme, 1976a).

The two wide boards 12 and 34, with ring sequences of 214 and 189 years respectively, lie nearer the centre of the Railway chronology. If sample 12A is part of the same board as 12, which it is likely to be (but the overlap is only 30 years), the curve for this timber extends from arbitrary year 1 to year 267.

The location of each curve within the master framework is of course related to the original position of the timber within the tree. Curves which lie early in the series came from the centre of the tree around the pith, while later curves come from boards split from around the outside of the tree trunk. Most of the SA curves lie in the early part of the chronology (Fig. 2) and thus represent inner tree boards.

Fig. 2 shows the distribution of the Railway and SA curves within the master framework (by their end years) plotted against their position within the trackway (the Railway site is labelled A-W from south to north). It is immediately noticeable that, in contrast to the concentration of inner tree boards from SA, area W immediately across the South Drain was constructed of boards almost entirely from the outer trunk. It is possible that these came from the same tree, but this would suggest more on-site processing than the random mixing of material already proposed (Morgan, 1976 74). The remainder of the Railway site shows a more even scatter of boards from both the inner and outer parts of the tree; the concentration of inner pieces in G-N may be the result of the preservation of fewer boards in this area of the track.

Cross-matched curves include 4 board or rail pegs, all narrower fatter pieces of radially split oak (nos. 9,18,21,69). Evidently the wood used for pegs was split from the same trees as that for the boards, and is further evidence of the use of any

immediately available wood for this function regardless of species, shape or size. Nonetheless extensive preparation would be required to trim down these oak pegs in contrast to the usual roundwood of other species. The total of 6 pegs were 6-9 by 3-4cm in size.

The rest of the oak from the SA site which had insufficient or unclear growth rings consisted mostly of small stray pieces cut both radially and tangentially, probably representing packing and broken boards. Two boards (8,41) were split at an angle to the rays.

The oak results from the SA site indicate a body of material comparable to that from the Railway site, and equally unlike the Drove wood, as might be expected. However the contrast in curve distribution between this area and Railway area W only a few metres to the south is of interest. The ring-width data will be integrated with that from the Railway curves when analysis of further finds from field collection and excavation hasbeen completed. The extension and consolidation of the early part of the Railway site chronology has been one valuable result of the SA analysis.

HAZEL

The 18 hazel samples examined consisted of 12 rail pags, 4 plank pegs and 2 stray or unidentified pieces. Several of the pegs were paired together ie. lying either side of the rail to hold it in place, and the relationship of these pairs was one aspect of interest.

Among the peg samples of all species, the hazel was the smallest and youngest (Table 1 ; Fig. 3) with an average age of 21.1 years and diameter of 45.2mm. Function seems to have been unrelated to size or age - rail pegs could be substantial relatively mature stems or tiny young ones. Average ring-width, or rate of growth, remained low compared to the other species; in two measured examples, the innermost 3 growth rings were very wide as may be

typical of coppice growth, but otherwise little evidence of specific management could be determined from the figures. Sample quantities are too low on this site for such deductions based on age distribution, and also to alter the age distribution pattern found in Morgan (1979 Fig. 48) from the Railway and Drove sites. Winter could be assumed to have been the major cutting season, since at least 12 out of the 18 samples had completed the last year's growth (or at least a wide outer ring).

A total of 8 stems had sufficient clear rings for ring-width measurement; they were aged between 17 and 39 years. Four lay in two pairs across the rail at 2m (5/6) and 7m (26/27), and in each case the growth patterns of the pairs were almost identical within each pair, but not between each pair. This suggests that one length of stem was chopped in two and trimmed, to provide an identical pair of pegs for each side of the rail, at the time of construction. Prior preparation would have led to too much mixing for such an occurrence to happen by chance; it is unfortunate that the study of such aspects as this was not appreciated on the Railway site in 1973, and sampling carried out accordingly. It is yet another example of the advantage of total sampling (cf Morgan et al ?).

In several cases, the outer few growth rings were very narrow and also damaged by decay and injury to the surface; representation of the bark edge in Fig. 7 is not therefore always certainly exact to the year and it is likely that all the matched curves end in or around the same year - arbitrary year 39.

The 6 cross-matched samples include the two rail peg pairs as well as an unidentified board-like piece (59) at about 5m and a rail peg (76) at about 4m. A mean curve of these 6 was compared visually to hazel curves from Railway and Drove site samples (Morgan, 1979) and many demonstrated very similar patterns of growth. In particular the Drove mean curve based on 3 posts matched well and indicated a similar cutting year (Fig. 5) - little evidence to link the wood of the Drove site with the trackway further north has so far come to

light from wood species other than oak. The SA hazel also matched the Railway W area hazel as might be expected; little had been collected from the remainder of the Railway site. The difficulty over measuring or even accurately counting the very narrow and damaged outermost rings leads to an uncertainty over the felling year of the hazel and whether all were cut at the same time.

A comparison of the hazel stems used in the Drove, Railway and SA sites is to be found in Fig. 4 ; the SA material is considerably smaller in diameter while reaching a similar age, indicating growth under less suitable conditions.

WILLOW

Initiated on this site was a study of the tree-ring potential of willow (Salix sp.), represented by 8 samples. It was not widely used on the Railway site (Coles & Orme, 1976 62) and is not recorded at all at the Drove site (Coles & Orme,1979 56), so perhaps it was growing more widely along the northern edge of the Levels nearer to the SA site. The wood was also examined from the Neolithic Baker site (Morgan, 1980 24) where none of the samples proved suitable for ring-width measurement, most being very immature and wide-ringed.

Of the 8 samples, 3 were split radial or squared pieces from substantial trunks and 5 were roundwood; only the latter are recorded on Fig. 3 . They are of similar size and age to the elm and hazel, and appear rather slower-grown than is usual for willow, which prefers water courses for its habitat.

Five of the samples are from an almost continuous rail between 3.5m and 7.4m, which surely cannot represent one stem. The ring-width patterns are so similar as to suggest two or more stems from the same or adjacent trees, about 25-30 years old (Fig. 6). Samples 16, 30, 79, 85 and a stray piece were all cut within a year or two of each other (Fig. 7) (or possibly the same year - as with the hazel, the outer-

most few rings are often narrow and indistinct). Their growth patterns are almost identical, as is also that from a rail peg (20) at 5.5m which was radially split from a larger trunk with wider rings, perhaps from the basal area of the same tree.

So the willow has now produced a sensitive 28 year mean curve for comparison with material along the length of the trackway.

ELM

Despite elm's frequent appearance at the southern end of the Railway site (Coles & Orme, 1976 62), no samples had been examined previously. Four sections were collected from SA -from the rail at 1-2.6m (4), peg at 5m (13), a broken piece of peg (40) thought to be part of 13 though some distance away, and the rail at 2.7m (70). Their size and age was consistent with the other round wood material (Table 1 ; Fig 3) and all four had been cut in winter - this can be very clearly determined in elm as in oak and ash. Their ring-width patterns matched well into a 26 year mean series, each having the same cutting year.

Tree-ring analysis on the Sweet SA site has thus enabled new wood species to be considered, the potential of which had not been realised when the Railway site was excavated - this includes willow and elm, as well as hazel which could be usefully compared to the Drove site. Ash has always formed a large proportion of the Sweet track samples, but none occurred on this site. The extension of the oak chronology by 34 years at the beginning is extremely valuable, and the concentration of the SA boards in the early part of the chronology offers further insight into the processing of the large trees used in the structure.

References:

Coles, J.M. & Orme, B.J. 1976 The Sweet track, Railway site Somerset Levels Papers 2 34-65

Coles, J.M. & Orme, B.J. 1976a

Coles, J.M. & Orme, B.J. 1979 The Sweet track: Drove site SLP 5 43-64

Morgan, R.A. 1976 Tree-ring studies in the Somerset Levels: the Sweet track SLP 2 66-77

Morgan, R.A. 1976b Dendrochronological analysis. in The Meare Heath trackway - excavation of a Bronze Age structure in the Somerset Levels. Coles, J.M. & Orme, B.J. Proc. Preh. Soc. 42 293-318

Morgan, R.A. 1979 Tree-ring studies in the Somerset Levels: the Drove site of the Sweet trackway SLP 5 65-75

Morgan, R.A. 1980 Tree-ring studies in the Somerset Levels: the Baker site SLP 6 24-28

Morgan, R.A., Hillam, J., Coles J.M. & McGrail, S. forthcoming Reconciling tree-ring sampling with conservation.

pecies	Age Ave	Age Range	Diameter mm Ave	Diameter mm Range	Ring-widths measured	Felling season W-winter	Average ring-width mm	Round-wood	Worked	Total examin-ed
AK		-214		width 40-320	9	-	0.89-2.3	-	32	32
AZEL	21.1	11-39	45.2	28-69	8	12W	0.69-1.34	18	-	18
ILLOW	24.8	24-27+	65.4	52-230+	7	-	1.32-1.68	5	3	8
LM	22.2	20-26	57.2	50-66	4	4W	1.22-1.37	4	-	4
LDER	(18)		(80)		1	-	(2.09)	1	-	1

Table 1. Summary of the tree-ring samples examined from the Sweet SA site.

ample o.	Years spanned on new scale Railway=34-347 Drove=229-382	No. of rings	Average ring width mm	t value with Railway chronology	width of radial board, mm	function
A	1-82	82	1.46	4.67	120	plank
	50-96	47	2.3	6.67	110	stray slat
	12-106	95	1.36	7.84	130	board
	67-120	54	1.13	3.86	65	slat
	101-136	36	2.14	4.62	80	rail peg
	98-147	50	1.85	4.09	90	rail peg
	37-165	77	0.89	6.19	70	board peg
	85-171	87	0.91	4.18	80	board peg
	53-267	214	1.1	7.61	240	plank
	89-277	189	1.15	10.9	220	board

Table 2. Details of the curves from Sweet SA oak boards which are cross-matched with the Railway site chronology. The years spanned are 34 years earlier than those given in Morgan (1976).

Legends to figures:

Fig. 1 Block diagram illustrating the positions of Sweet SA oak curves cross-matched with the Railway site chronology; the arbitrary year scale lies 34 years earlier than that given in Morgan (1976).

Fig. 2 Distribution of the end years of each curve within the master framework, plotted against the position of the board within the Sweet trackway (Railway/SA). The Railway site was divided into 6m blocks labelled from A to Z in the north; SA lies north. The early curves originated in boards split from the inner tree, while the later curves at the top of the diagram are from the outer tree.

Fig. 3 Age-size distribution of the hazel, elm and willow samples examined.

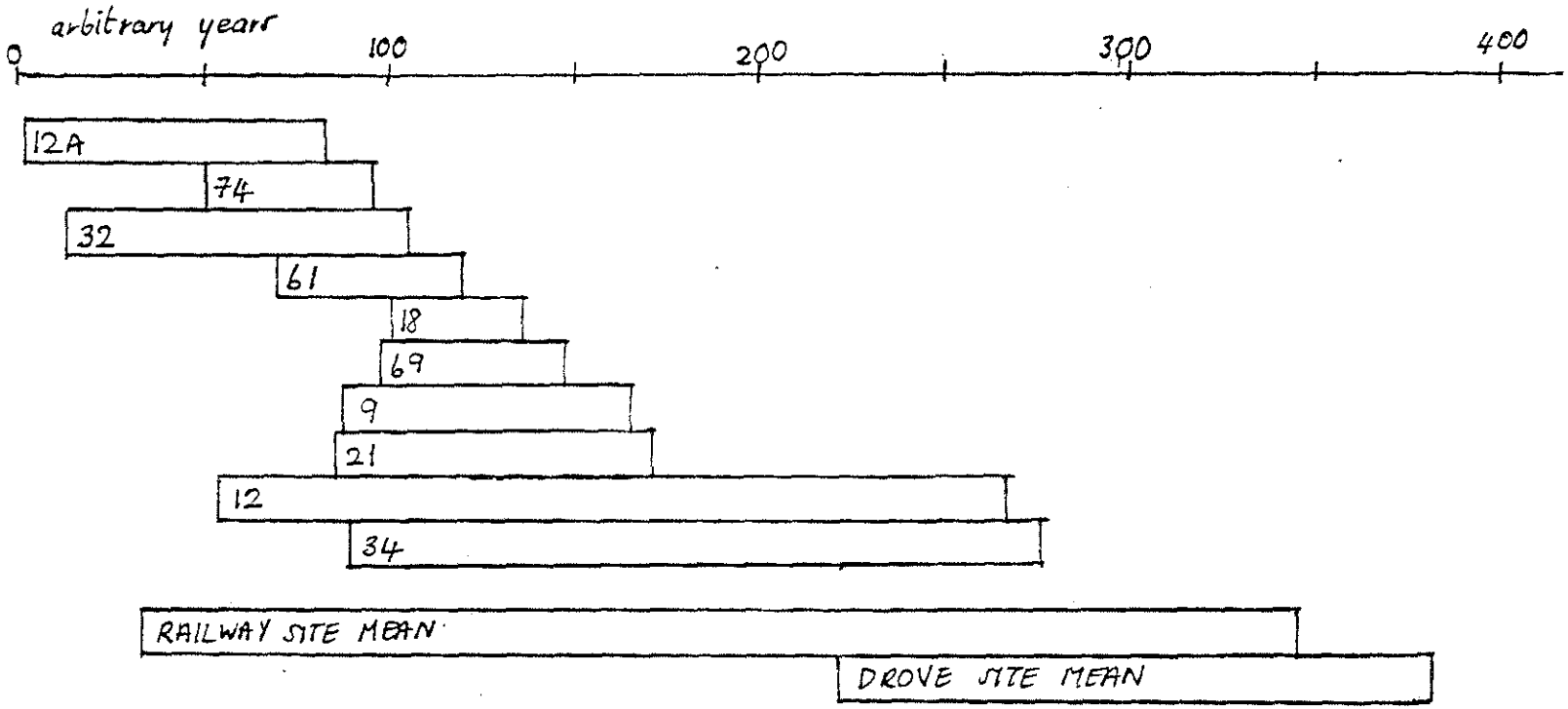
Fig. 4 Age-size distribution of the hazel samples examined from three areas of the Sweet track - Railway, Drove and SA. The SA stems are rather smaller in diameter though of similar age, ie they grew more slowly. The straight lines represent a least squares linear regression through the data points.

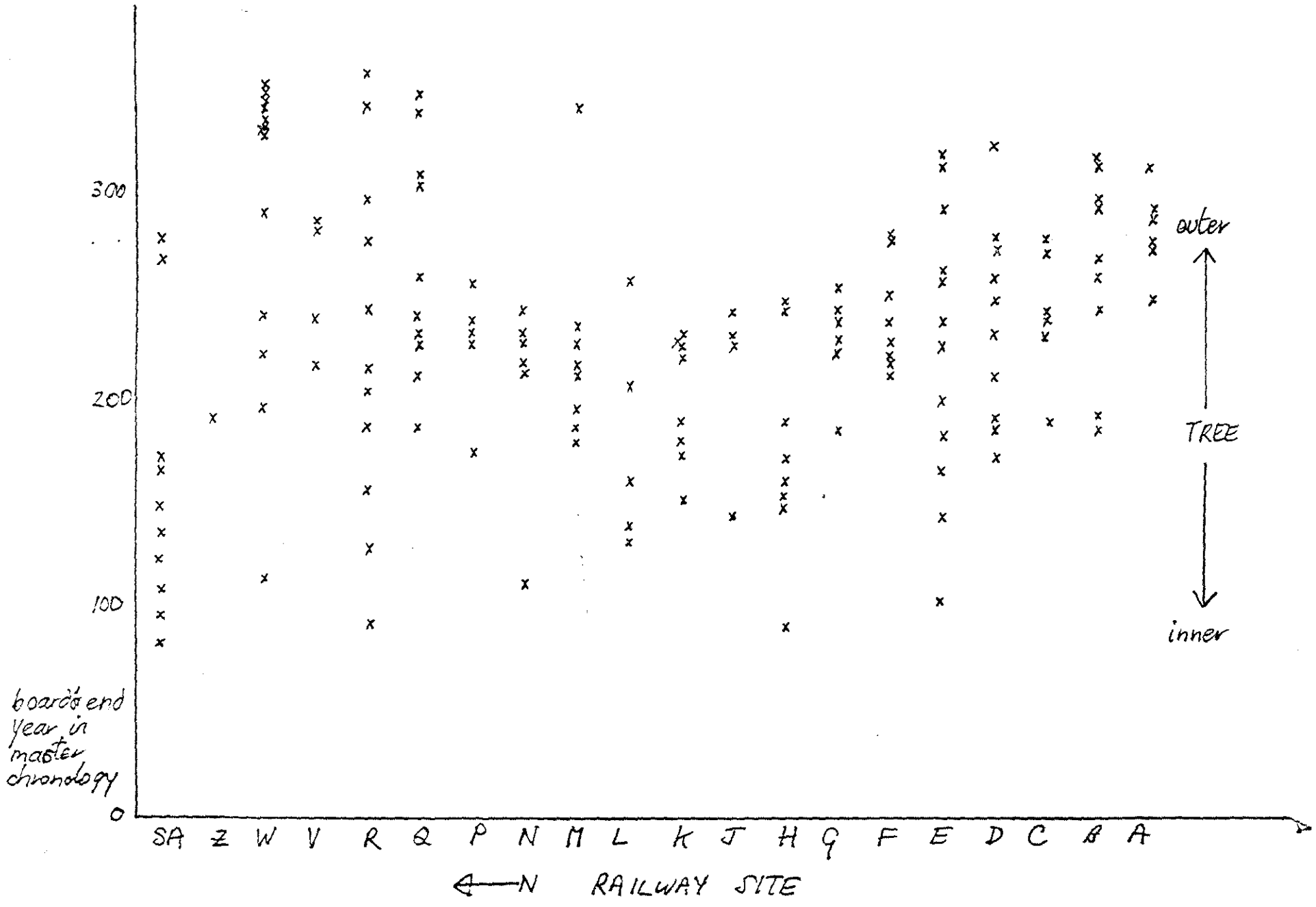
Fig. 5 Comparison of mean hazel curves from the Drove and SA sites of the Sweet track.

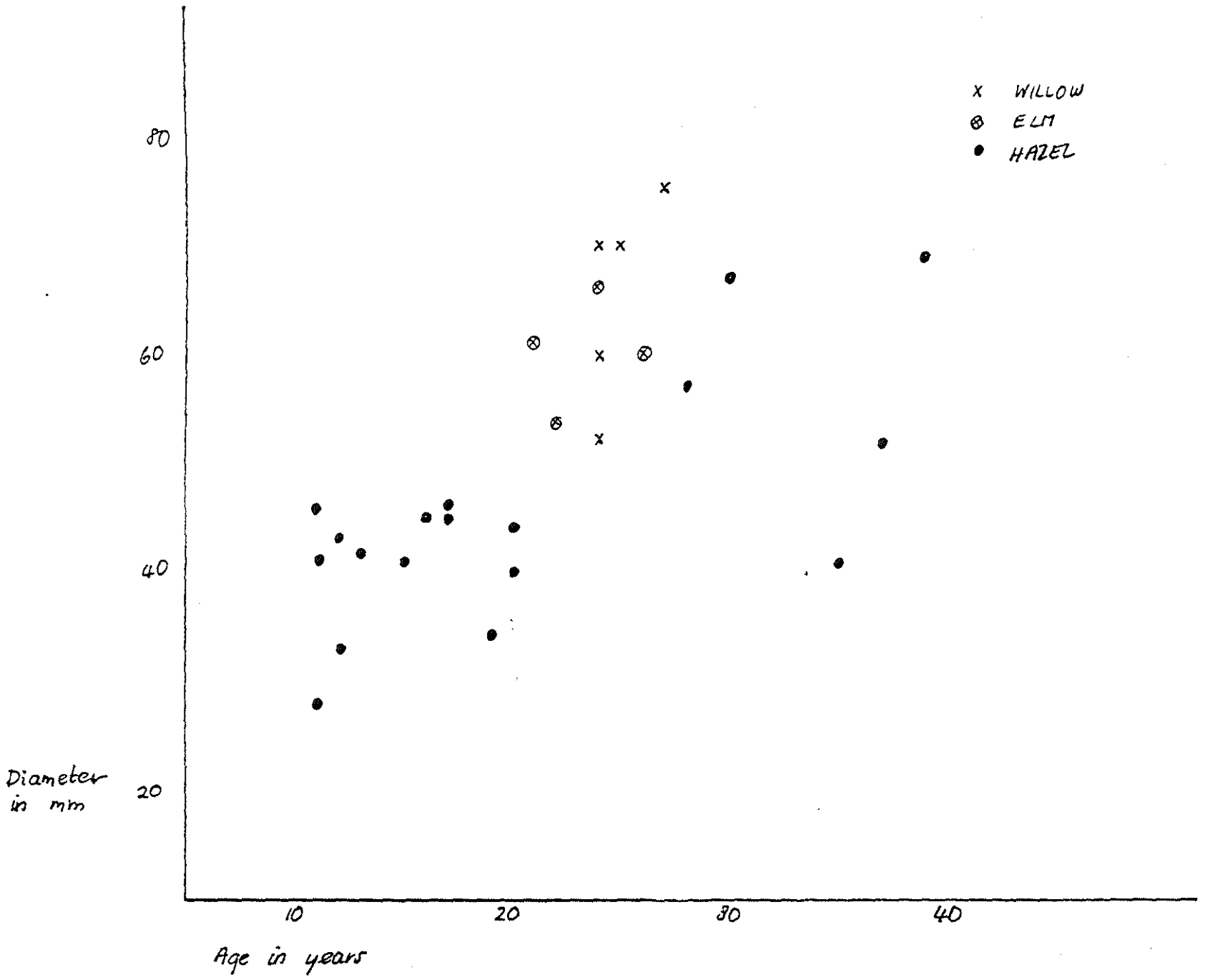
Fig. 6 The cross-matching potential of willow growth patterns is demonstrated by four of the Sweet SA samples from rails.

Fig. 7 Relationship of the willow (above) and hazel (below) stems the ring-width patterns of which could be matched. The double line on the right is the suggested bark edge or very close to it; wavy lines indicate difficult zones of narrow rings which may affect the position of the bark edge.

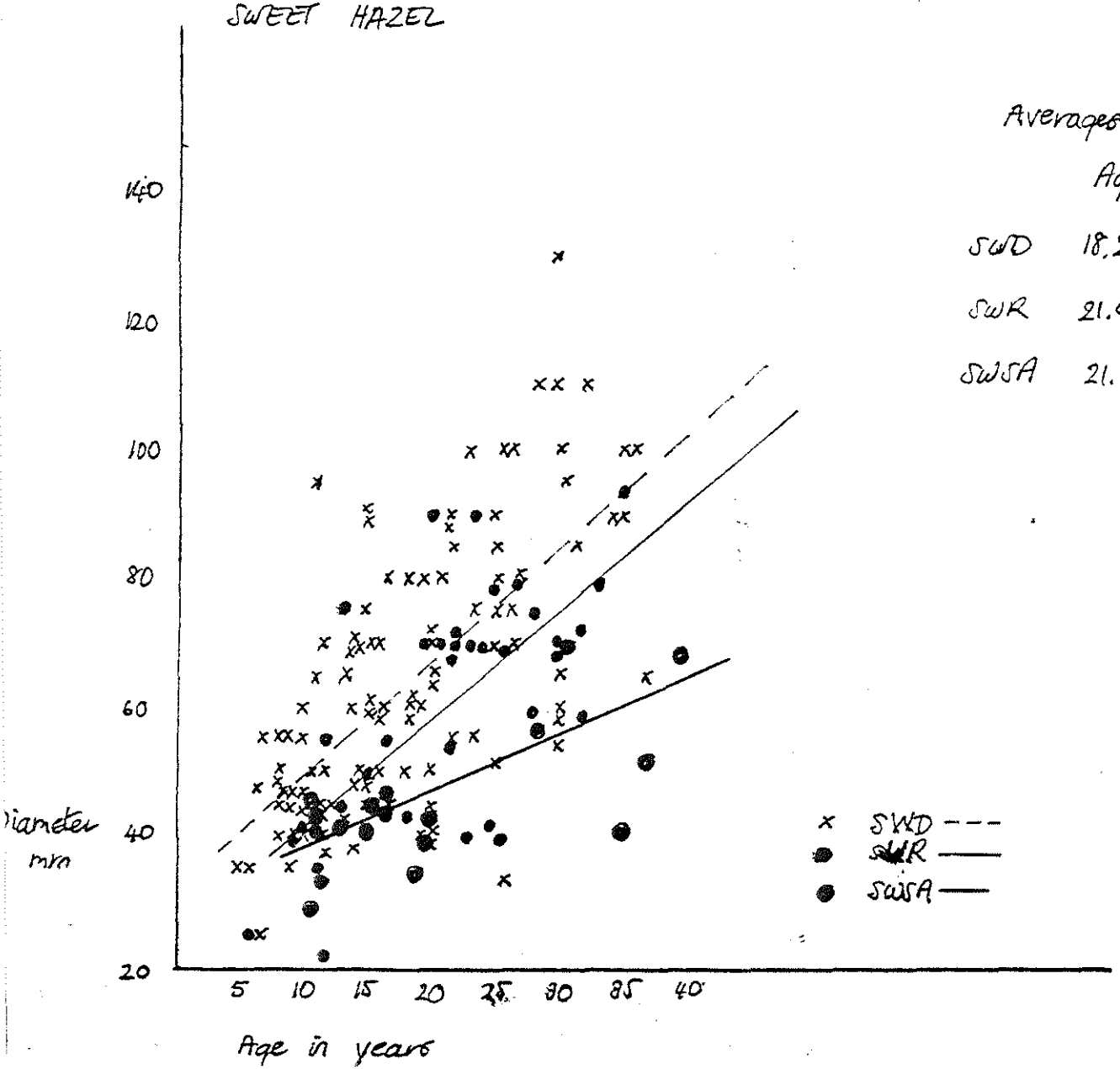
SWEET SA OAK


arbitrary years
0
100
200
300
400
12A
74
32
61
18
69
9
21
12
34
RAILWAY SITE MEAN
DROVE SITE MEAN


300
200
100
0
board's end year in master chronology
outer
TREE
inner
SA Z W V R Q P N M L K J H G F E D C B A
← N RAILWAY SITE


x WILLOW
⊗ ELM
• HAZEL
80
60
40
20
Diameter in mm
10
20
30
40
Age in years

SWEET HAZEL



Averages.

	Age	Diameter	Samples
SWD	18.2 (5-37)	64.2 (25-130)	106
SWR	21.4 (7-35)	61.3 (15+-95)	37
SWSA	21.1 (11-39	45.2 (28-69)	18

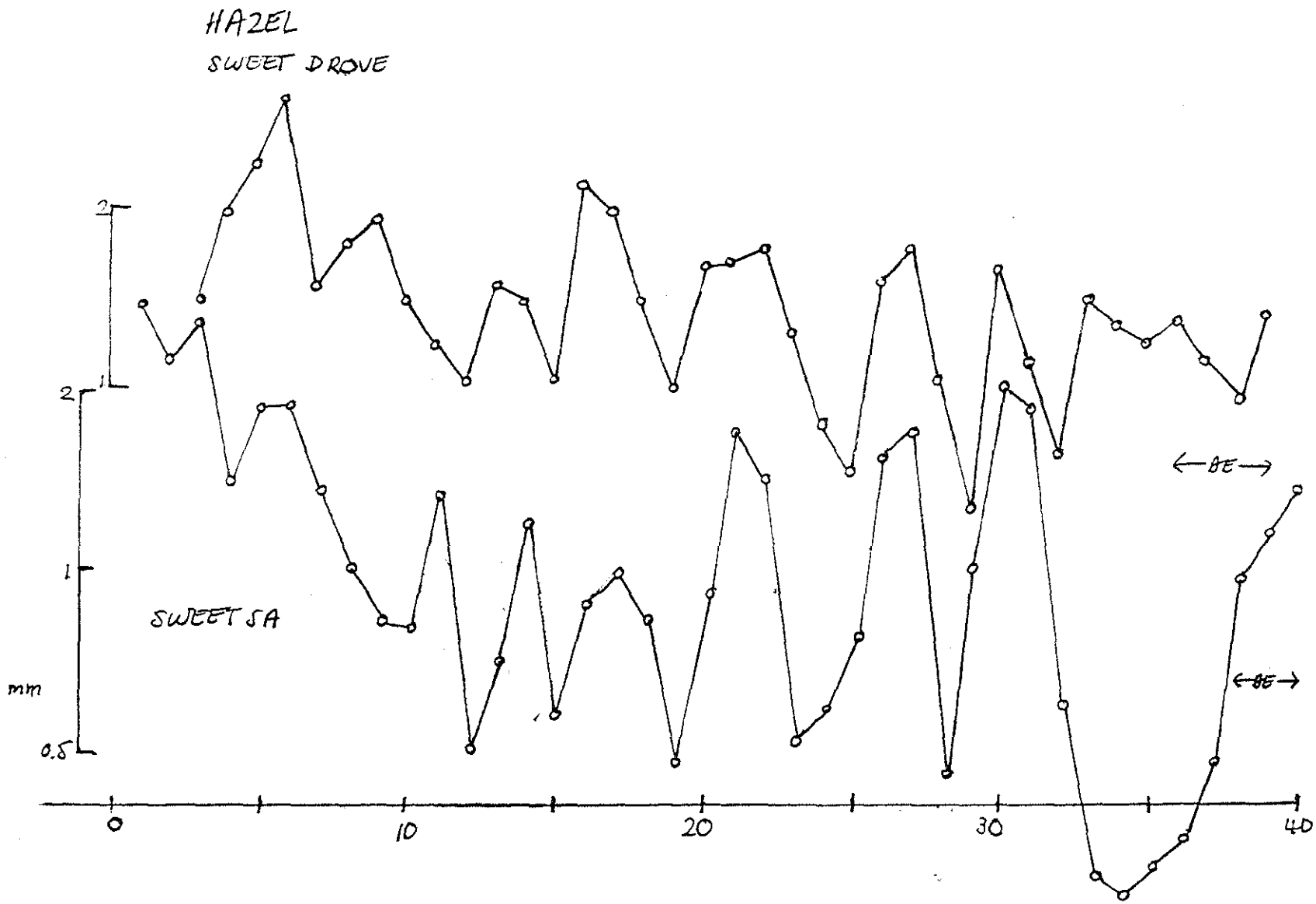
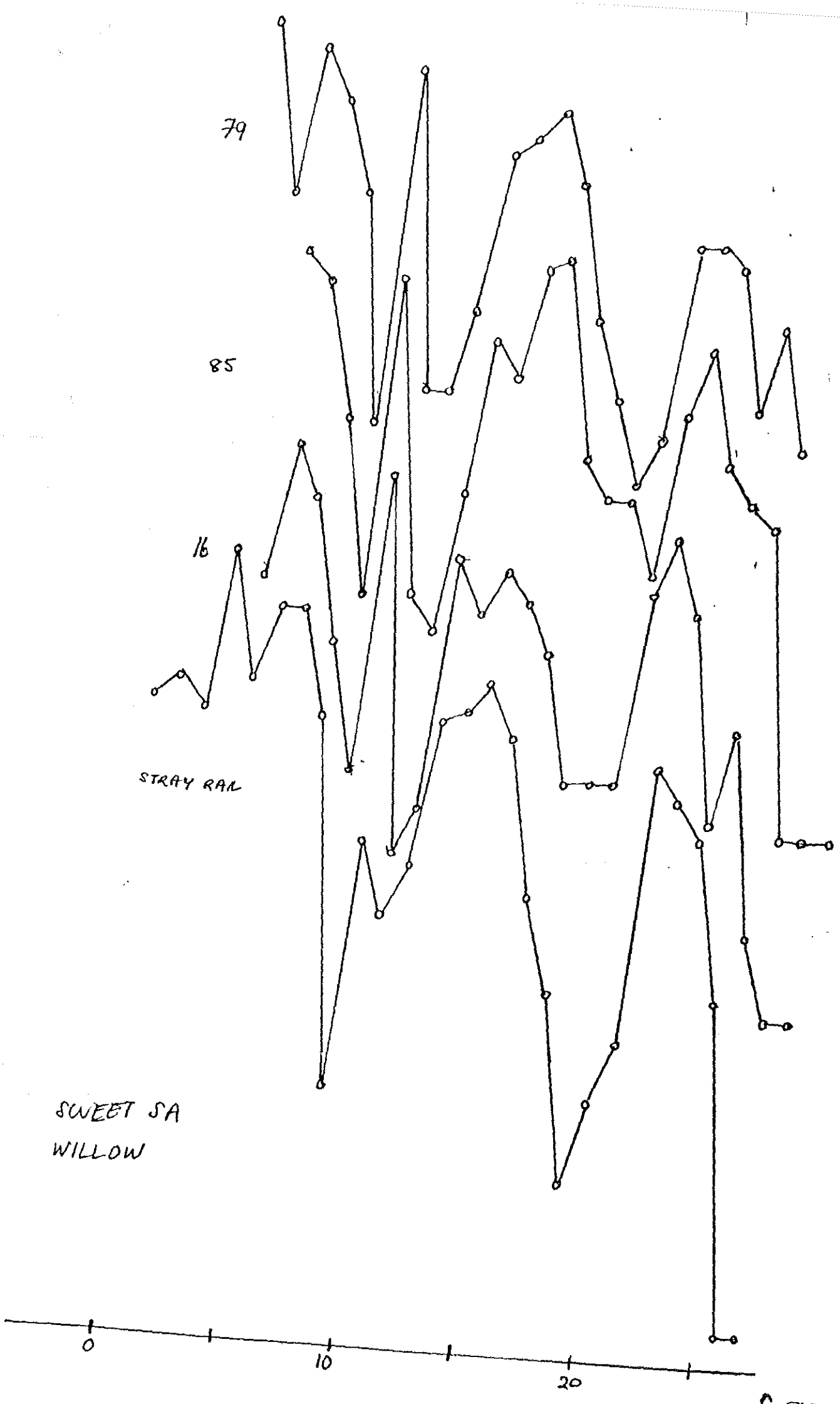
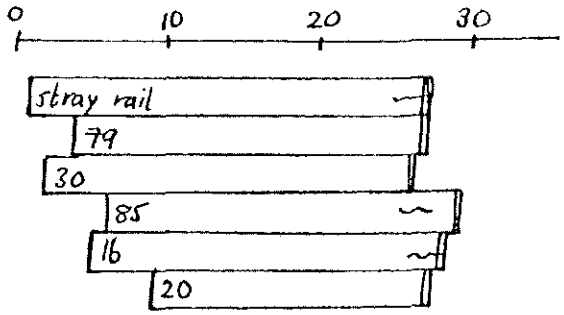


FIG 5


79
85
16
STRAY RAIL
SWEET SA
WILLOW
0
10
20

SWSA WILLOW



SWSA HAZEL

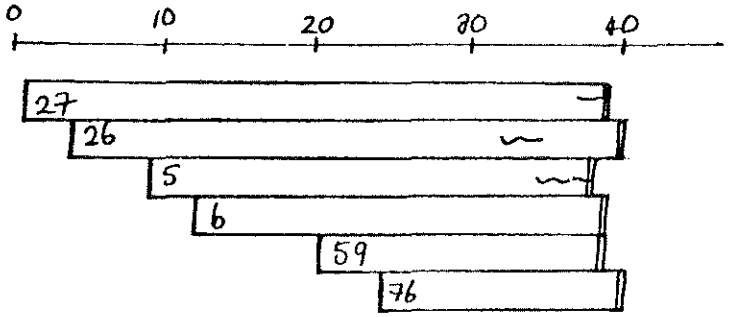


FIG.