Distance from cut end: 3-7 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
5	.932	.87	.826	3.153

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	198.796	198.796	19.993
RESIDUAL	3	29.829	9.943	p = .0208
TOTAL	4	228.625		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
41.618	2	3	1.395

However, as the 3-7 cm allocation has an even larger RSS than 3-6 cm, it is not appropriate and therefore the best allocation is the initial one of 3-5 cm.

Distance from cut end: 6-11 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
6	.935	.874	.842	.301

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	2.505	2.505	27.63
RESIDUAL	4	.363	.091	p = .0063
TOTAL	5	2.868		

Residual Information Table

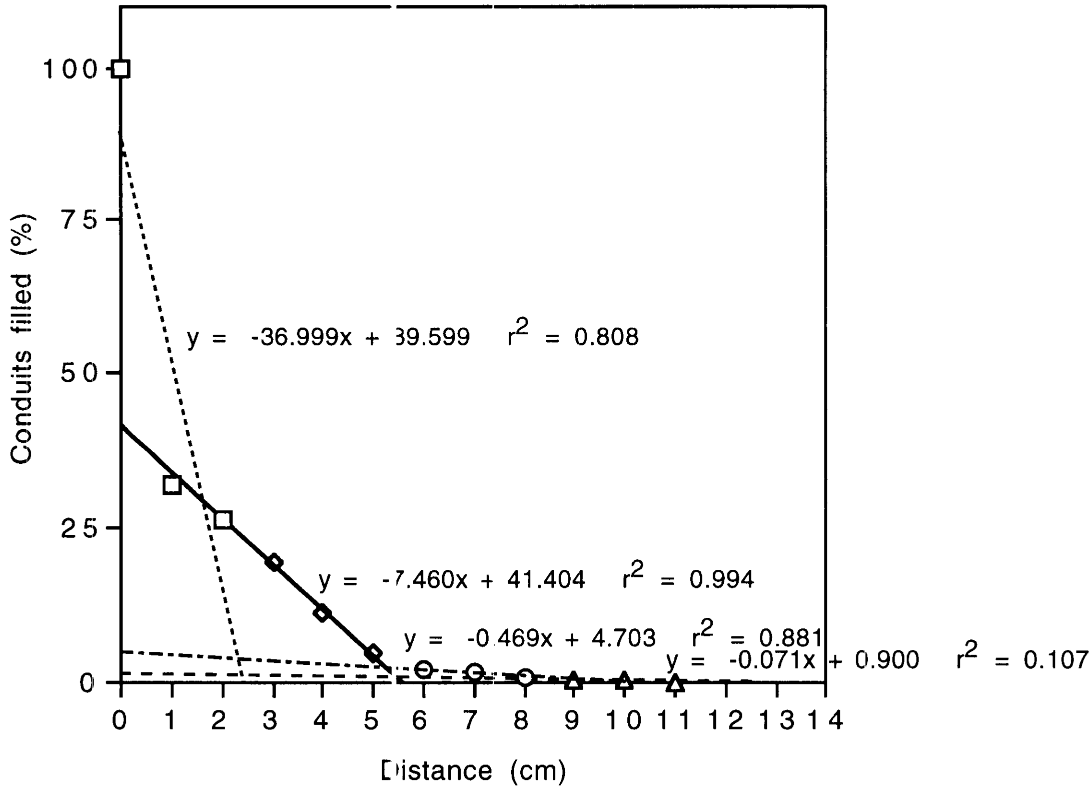
SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
.746	4	2	2.057

However, as the RSS for 6-11 cm is larger than the combined RSS for 6-8 cm and 9-11 cm, it must be discarded in favour of the latter allocation.

Therefore, after testing all possible combinations larger than 1 cm (which would be meaningless), the best conduit length allocation for the indian ink conduit length data is:

0-2 cm
3-5 cm
6-8 cm and
9-11 cm.

This allocation is represented by the regression lines in the following graph:



By applying the optimal allocation to the percentage of initially filled conduits data shown below, it is possible to calculate the percentage of conduits belonging to each class:

Conduit length (cm)	Average no. of conduits filled	Initially filled conduits (%)	Conduits per class (%)
0	234.6	100	
1	74.6	31.80	
2	61	26	74
3	45.4	19.35	
4	25.6	10.91	
5	10.4	4.43	21.57
6	4.2	1.79	
7	3.8	1.62	
8	2	0.85	3.58
9	0.3	0.14	
10	1	0.43	
11	0	0	0.85

The percentage of initially filled conduits is calculated as the:

$$(\text{Average at } x \text{ cm} \div \text{average at 0 cm}) \times 100.$$

The percentage of conduits per class is determined by:

e.g. 0-2 cm: (% of initially filled conduits at 0 cm) - (% of initially filled conduits at 2 cm)
= 100 - 26
= 74.

3-5 cm: (% of initially filled conduits at 0 cm) - (% of initially filled conduits at 5 cm) - (% of conduits per class at 2 cm)
= 100 - 4.43 - 74
= 21.57.

6-8 cm: (% of initially filled conduits at 0 cm) - (% of initially filled conduits at 8 cm) - (% of conduits per class at 2 cm) - (% of conduits per class at 5 cm)
= 100 - 0.85 - 74 - 21.57
= 3.58.

9-11cm: (% of initially filled conduits at 0 cm) - (% of initially filled conduits at 11 cm) - (% of conduits per class at 2 cm) - (% of conduits per class at 5 cm) - (% of conduits per class at 8 cm)
= 100 - 0 - 74 - 21.57 - 3.58
= 0.85.

Therefore, the conduit length classes and the percentage of conduits in each class are:

2 cm long	74.0%
5 cm long	21.6%
8 cm long	3.6% and
11 cm long	0.8%.

B. DISTILLED WATER CONDUIT LENGTH DATA

The first possible allocation of conduit lengths to be tested was:

Distance from cut end: 0-2 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
3	.924	.853	.706	26.075

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	3948.926	3948.926	5.808
RESIDUAL	1	679.893	679.893	p = .2504
TOTAL	2	4628.82		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
2039.68	2	1	3

Distance from cut end: 3-6 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
4	.89	.791	.687	.876

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	5.819	5.819	7.589
RESIDUAL	2	1.533	.767	p = .1104
TOTAL	3	7.352		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
3.972	3	1	2.59

Therefore, the total residual sum of squares for the first allocation is 681.426.

The other possible allocation of conduit length groups which was tested is shown below:

Distance from cut end: 0-3 cm

Simple Regression X $_1$: Length (cm) Y $_1$: % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
4	.878	.77	.655	26.058

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	4551.516	4551.516	6.703
RESIDUAL	2	1358.07	679.035	p = .1224
TOTAL	3	5909.587		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
2959.019	2	2	2.179

Distance from cut end: 4-6 cm

Simple Regression X $_1$: Length (cm) Y $_1$: % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
3	.866	.75	.5	.35

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	.367	.367	3
RESIDUAL	1	.122	.122	p = .3333
TOTAL	2	.489		

Residual Information Table

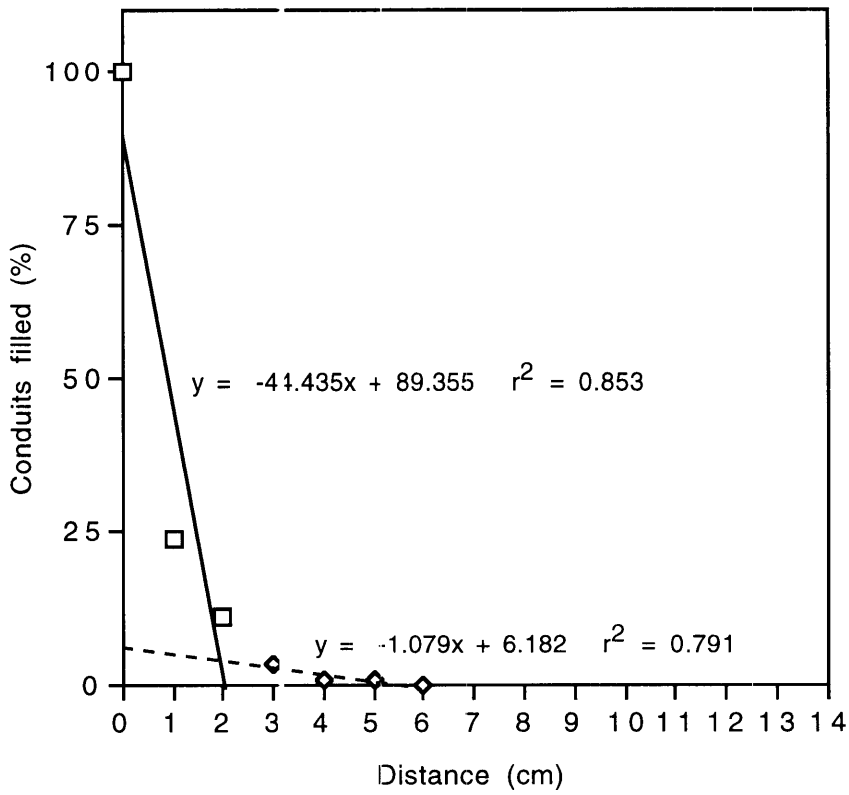
SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
.367	1	2	3

However, as the 0-3 cm and 4-6 cm allocation has a larger total RSS than the first combination of 0-2 cm and 3-6 cm, it must be discarded. Because of the small size of the data set, these are the only two possible allocations that can be tested.

Thus, after taking all possible combinations larger than 1 cm (which would be meaningless) the best conduit length allocation for the distilled water conduit length data is:

0-2 cm and
3-6 cm.

This allocation is represented by the regression lines in the following graph:



By applying the optimal allocation to the percentage of initially filled conduits data shown below, it is possible to calculate the percentage of conduits belonging to each class:

Conduit length (cm)	Average no. of conduits filled	Initially filled conduits (%)	Conduits per class (%)
0	116.8	100	
1	27.6	23.63	
2	13	11.13	88.87
3	4.2	3.60	
4	1	0.86	
5	1	0.86	
6	0	0	11.13

(For the calculation of:
the percentage of initially filled conduits; and
the percentage of conduits per class,
see the workings for the Indian Ink Conduit Length Data herein.)

Therefore, the conduit length classes and the percentage of conduits in each class are:

2 cm long	88.9% and
6 cm long	11.1%.

C. 10 mol m^{-3} CITRIC ACID CONDUIT LENGTH DATA

The first possible allocation of conduit lengths to be tested was:

Distance from cut end: 0-2 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
3	.995	.989	.979	4.531

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	1910.01	1910.01	93.029
RESIDUAL	1	20.531	20.531	p = .0658
TOTAL	2	1930.541		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
61.594	2	1	3

Distance from cut end: 3-5 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
3	.958	.918	.836	2.577

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	74.263	74.263	11.187
RESIDUAL	1	6.639	6.639	p = .185
TOTAL	2	80.902		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
19.916	2	1	3

Distance from cut end: 6-8 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
3	.987	.974	.948	.666

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	16.63	16.63	37.453
RESIDUAL	1	.444	.444	p = .1031
TOTAL	2	17.074		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
1.332	2	1	3

Distance from cut end: 9-14 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
6	.73	.533	.416	.355

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	.576	.576	4.565
RESIDUAL	4	.504	.126	p = .0995
TOTAL	5	1.08		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
1.414	3	3	2.804

Therefore, the total residual sum of squares for the first allocation is 28.118.

Alternative allocations of conduit length groups which were tested are shown below:

Distance from cut end: 0-3 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
4	.982	.964	.945	7.81

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	3222.318	3222.318	52.832
RESIDUAL	2	121.984	60.992	p = .0184
TOTAL	3	3344.303		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
243.969	2	2	2

However, as the 0-3 cm allocation has a larger RSS than 0-2 cm, it must be discarded and so 0-2 cm is the preferable allocation.

Distance from cut end: 3-6 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
4	.945	.894	.841	2.56

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	110.486	110.486	16.862
RESIDUAL	2	13.105	6.553	p = .0545
TOTAL	3	123.591		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
28.627	2	2	2.184

However, as the 3-6 cm allocation has quite a large RSS compared with, say, 3-5 cm, it is unlikely to be the best allocation.

Other alternatives are:

Distance from cut end: 6-9 cm

Simple Regression X_1 : Length (cm) Y_1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
4	.99	.981	.971	.579

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	34.385	34.385	102.436
RESIDUAL	2	.671	.336	p = .0096
TOTAL	3	35.057		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
1.582	2	2	2.357

Distance from cut end: 10-14 cm

Simple Regression X_1 : Length (cm) Y_1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
5	.667	.445	.26	.407

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	.398	.398	2.404
RESIDUAL	3	.497	.166	p = .2188
TOTAL	4	.895		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
1.37	3	2	2.758

The total RSS for the above two conduit length allocations, i.e. 6-9 cm and 10-14 cm, is 1.168, whereas the RSS total of the 6-8 cm and 9-14 cm allocations is 0.948, therefore the latter offers the better fit. The following allocation (6-10 cm) is not a valid alternative because the RSS is 3.997:

Distance from cut end: 6-10 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
5	.955	.913	.884	1.154

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	41.849	41.849	31.408
RESIDUAL	3	3.997	1.332	p = .0112
TOTAL	4	45.846		

Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
6.978	2	3	1.746

Joining the points from 6-14 cm together is not a valid option because the RSS is larger than for other combinations:

Distance from cut end: 6-14 cm

Simple Regression X 1 : Length (cm) Y 1 : % of initial filled

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
9	.848	.719	.679	1.725

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	53.293	53.293	17.918
RESIDUAL	7	20.82	2.974	p = .0039
TOTAL	8	74.113		

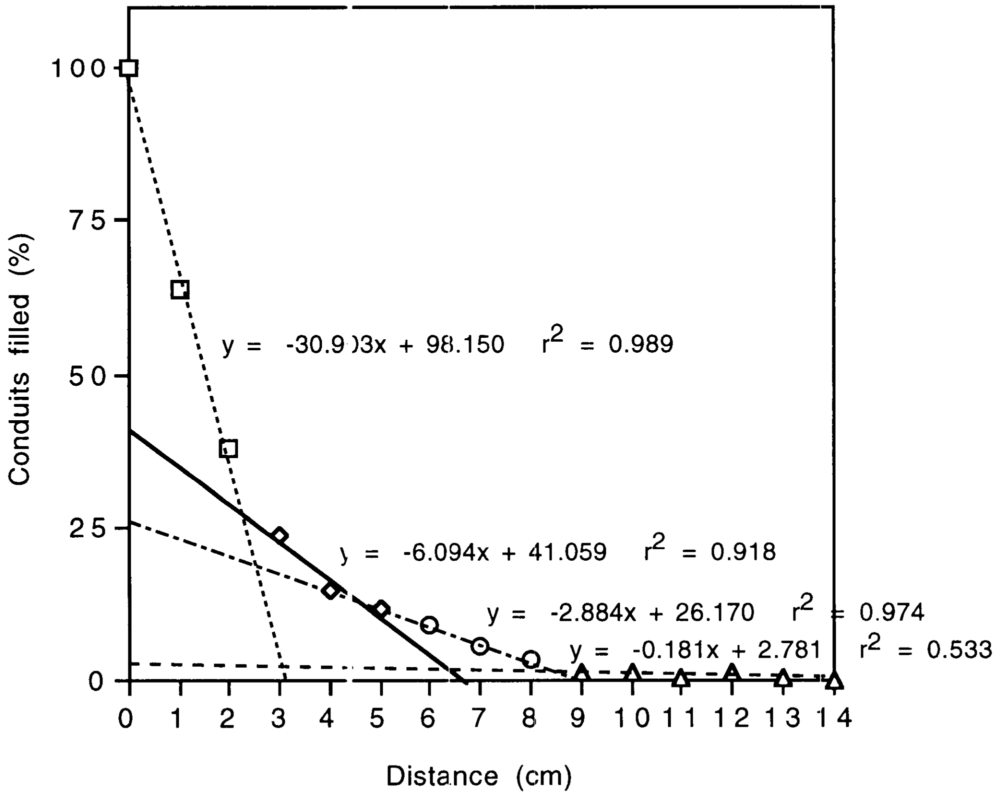
Residual Information Table

SS[e(i)-e(i-1)]:	e ≥ 0:	e < 0:	DW test:
14.705	5	4	.706

Therefore, after testing all possible combinations larger than 1 cm (which would be meaningless), the best conduit length allocation for the 10 mol m^{-3} citric acid conduit length data is:

0-2 cm
3-5 cm
6-8 cm and
9-14 cm.

This allocation is represented by the regression lines in the following graph:



By applying the optimal allocation to the percentage of initially filled conduits data shown below, it is possible to calculate the percentage of conduits belonging to each class:

Conduit length (cm)	Average no. of conduits filled	Initially filled conduits (%)	Conduits per class (%)
0	183.8	100	
1	116.8	63.55	
2	70.2	38.19	61.81
3	43.8	23.83	
4	26.8	14.58	
5	21.4	11.64	26.55
6	16.8	9.14	
7	10	5.44	
8	6.2	3.37	8.27
9	2	1.09	
10	2	1.098	
11	0.67	0.36	
12	2	1.09	
13	1	0.54	
14	0	0	3.37

(For the calculation of:
the percentage of initially filled conduits; and
the percentage of conduits per class,
see the workings for the Indian Ink Conduit Length Data herein.)

Therefore, the conduit length classes and the percentage of conduits in each class are:

2 cm long	61.8%
5 cm long	26.5%
8 cm long	8.3% and
14 cm long	3.4%.

APPENDIX N

DETERMINATION OF CONDUIT LENGTH ALLOCATION BY GEOMETRICAL ANALYSIS: DIRECT CONVERSION OF COUNTS TO PERCENTAGES (ZIMMERMANN AND JEJE 1981)

Zimmermann and Jeje (1981) believed that the Milburn and Covey-Crump (1971) method of conduit length allocation did not use actual numbers of open (i.e. ink filled) conduits at each cut segment, but rather only interpolated numbers were employed. They considered that Milburn and Covey-Crump (1971) imposed a distribution form to represent discrete conduit length groups, each class being represented by the longest conduit in the group. However, their major criticism of the Milburn and Covey-Crump (1971) method [and also of the earlier Skene and Balodis (1968) method, upon which Milburn and Covey-Crump (1971) sought to improve] was that both methods assumed a completely random distribution of conduit ends. They pointed out that such a "complete randomness" assumption might not be met for long conduits (e.g. in ring-porous wood). Nevertheless, they did find that complete randomness was "almost achieved" for short conduits. The longest conduit length in *Acacia amoena* stems infiltrated with indian ink was 10 cm (see Fig. 9.2), which must be considered as short, especially when compared with the 18 m long lengths of the ring-porous species, *Fraxinus americana* (Greenidge 1952), for example. For completeness, and as an interesting comparison, the method of Zimmermann and Jeje (1981) has been applied to the same conduit length data described in Fig. 9.2.

Zimmermann and Jeje (1981) devised a method in which the numbers of filled conduits for each cut segment (= "counts") were converted directly to percentages by geometrical analysis. This method was particularly relevant when the complete randomness assumption was not met. A series of right-angled triangles is still employed in this method, as was used by Milburn and Covey-Crump (1971). Where the Zimmermann and Jeje (1981) method differs is that the calculations are carried out from the far end (i.e. from the longest ink containing section), working backwards along the stem towards zero (i.e. the lower cut end and point of infusion).

Each count is given the designation, m, and the stem length (in cm) at which it was counted is a subscript, e.g. m_{12} is the length of stem 12 cm from the cut infused end. (Counts were made at 1 cm intervals along the stem length.) For the *Acacia amoena* data analysed in Appendix M(A), the longest ink filled conduit was 10 cm. Thus, m_{12} and m_{11} are zero. The first positive count is m_{10}. Beginning at the far end, the increase in the vessel count for each cut segment is made. Thus, the calculation is, e.g.:

$$[(m_{10} - m_{11}) - (m_{11} - m_{12})] \times \text{the number of steps to zero.}$$

The calculation is continued, step-by-step, substituting the appropriate counts, until the beginning of the stem segment is reached. The counts for the *A. amoena* data described graphically in Fig. 9.2 are:

Distance from cut end (cm)	Conduits filled (%)
0	100
1	31.8
2	26.0
3	19.35
4	10.91
5	4.43
6	1.79
7	1.62
8	0.85
9	0.14
10	0.43

Thus, the calculations are as follows:

(a) $[(m_{10} - m_{11}) - (m_{11} - m_{12})] \times 11$
$= [(0.43 - 0) - (0 - 0)] \times 11$
$= [(0.43) - (0)] \times 11 = 4.73\%$

(b) $[(m_9 - m_{10}) - (m_{10} - m_{11})] \times 10$
$= [(0.14 - 0.43) - (0.43 - 0)] \times 10$
$= [(-0.29) - (0.43)] \times 10 = -7.2\%$

(c) $[(m_8 - m_9) - (m_9 - m_{10})] \times 9$
$= [(0.85 - 0.14) - (0.14 - 0.43)] \times 9$
$= [(0.71) - (-0.29)] \times 9 = 9\%$

(d) $[(m_7 - m_8) - (m_8 - m_9)] \times 8$
$= [(1.62 - 0.85) - (0.85 - 0.14)] \times 8$
$= [(0.77) - (0.71)] \times 8 = 0.48\%$

(e) $[(m_6 - m_7) - (m_7 - m_8)] \times 7$
$= [(1.79 - 1.62) - (1.62 - 0.85)] \times 7$
$= [(0.17) - (0.77)] \times 7 = -4.2\%$

(f) $[(m_5 - m_6) - (m_6 - m_7)] \times 6$
$= [(4.43 - 1.79) - (1.79 - 1.62)] \times 6$
$= [(2.64) - (0.17)] \times 6 = 14.82\%$

(g) $[(m_4 - m_5) - (m_5 - m_6)] \times 5$
$= [(10.91 - 4.43) - (4.43 - 1.79)] \times 5$
$= [(6.48) - (2.64)] \times 5 = 19.2\%$

(h) $[(m_3 - m_4) - (m_4 - m_5)] \times 4$
$= [(19.35 - 10.91) - (10.91 - 4.43)] \times 4$
$= [(8.44) - (6.48)] \times 4 = 7.84\%$

(i) $[(m_2 - m_3) - (m_3 - m_4)] \times 3$

$= [(26 - 19.35) - (19.35 - 10.91)] \times 3$

$= [(6.65) - (8.44)] \times 3 = -5.37\%$

(j) $[(m_1 - m_2) - (m_2 - m_3)] \times 2$

$= [(31.8 - 26) - (26 - 19.35)] \times 2$

$= [(5.8) - (6.65)] \times 2 = -1.7\%$

(k) $[(m_0 - m_1) - (m_1 - m_2)] \times 1$

$= [(100 - 31.8) - (31.8 - 26)] \times 1$

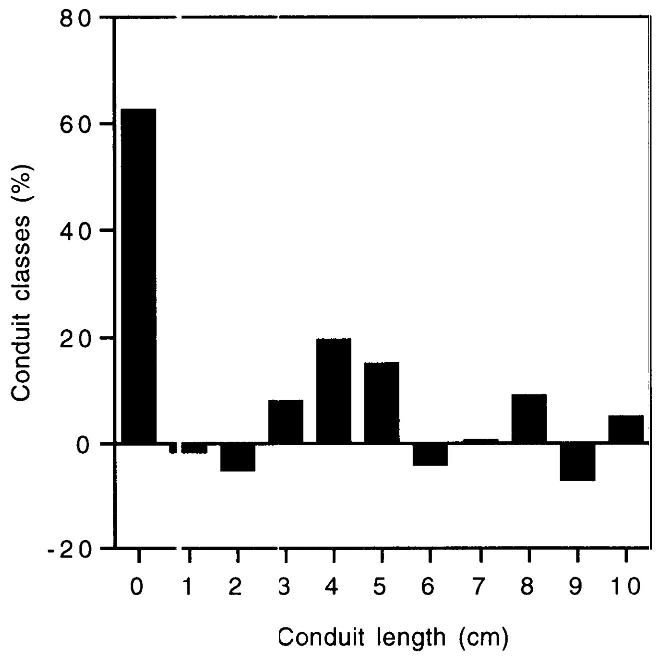
$= [(68.2) - (5.8)] \times 1 = 62.4\%$

To check the workings: 4.73% + -7.2% + 9% + 0.48% + -4.2% + 14.82% + 19.2% + 7.84% + -5.37% + -1.7% + 62.4% = 100%.

Thus, the Zimmermann and Jeje (1981) method of conduit length allocation gives a distribution of:

Distance from cut end (cm)	Conduit classes (%)
0	62.4
1	-1.7
2	-5.37
3	7.84
4	19.2
5	14.82
6	-4.2
7	0.48
8	9
9	-7.2
10	4.73

The bar graph of this distribution is:



According to Zimmermann and Jeje (1981), if the count increment diminishes towards shorter stem pieces, a negative percentage is obtained. Such negative values are not an error, but, rather, are an indication that either the conduits were not randomly arranged, or that the stem piece was shorter than the longest conduits (Zimmermann and Jeje 1981). This second possibility, that the stem piece was shorter than the longest conduits, is not relevant in this case because the stem was sectioned at 1 cm intervals from the base until well beyond any ink filled conduits were seen. This indicates that the length of stem injected with indian ink was appreciably longer than the longest conduit.

Zimmermann and Jeje (1981) recommended obtaining a net count of conduit classes when negative percentages were involved. Thus, when the negative classes are added to their surrounding positive classes until a positive figure is recorded, the conduit length distribution is:

Conduit length class (cm)	No. of conduits per class (%)
0-2	55.35
3	7.84
4	19.2
5-7	11.1
8-10	6.54
	100.0

These results are different, but not too dissimilar from, the results obtained with the Milburn and Covey-Crump (1971) method of conduit length allocation (Fig. 9.3). As would be expected from the "safety versus efficiency" hypothesis (Zimmermann and Milburn 1982), the largest percentage (55.35%) of conduits falls into the shortest (0 to 2 cm) class, and the smallest conduit percentage (6.54%) belongs to the longest conduit length class.

APPENDIX O

XYLEM CONDUIT AREAS OF STEMS USED IN HYDRAULIC CONDUCTION STUDIES

The xylem conduit areas of *A. amoena* stems were obtained using an image analyser (see Appendix K and section 9.2.4). Transverse sections of stems were cut at the base, middle and top of the 20 cm long stems and areas were calculated for all the xylem conduits shown in those sections. Within each stem, the areas of the three sections were very different. Hydraulic conduction was determined over 5 d for stems kept in either citric acid (10 mol m^{-3}) or distilled water. There were five replicates per treatment.

Citric acid (10 mol m^{-3}) (= Cit)

<u>Cit. Rep 1</u>

Base Cit 1

No. of observations:	128
Total area (mm^2):	0.632476
Mean area (mm^2):	0.00494122
SEM:	0.00040676
Variance:	0.000021178
Range:	0.000061 to 0.021766

Mid Cit 1

No. of observations:	202
Total area (mm^2):	0.509895
Mean area (mm^2):	0.00252423
SEM:	0.00024203
Variance:	0.000011832
Range:	0.000061 to 0.015705

Top Cit 1

No. of observations:	176
Total area (mm^2):	0.105644
Mean area (mm^2):	0.00060025
SEM:	0.000072109
Variance:	0.00000091515
Range:	0.000031 to 0.007286

<u>Cit. Rep 2</u>

Base Cit 2

No. of observations:	299
Total area (mm^2):	0.901286
Mean area (mm^2):	0.00301433
SEM:	0.00025386
Variance:	0.000019268
Range:	0.000061 to 0.022042

Mid Cit 2

No. of observations:	166
Total area (mm^2):	0.460092
Mean area (mm^2):	0.00277164
SEM:	0.00024671
Variance:	0.000010103
Range:	0.000031 to 0.018184

Top Cit 2

No. of observations:	92
Total area (mm^2):	0.08462
Mean area (mm^2):	0.00091971
SEM:	0.00011001
Variance:	0.0000011134
Range:	0.000061 to 0.003827

Cit. Rep 3

Base Cit 3

No. of observations:	343
Total area (mm^2):	0.630139
Mean area (mm^2):	0.00183714
SEM:	0.00019835
Variance:	0.000013494
Range:	0.000031 to 0.0[illegible]9776

Mid Cit 3

No. of observations:	124
Total area (mm^2):	0.422558
Mean area (mm^2):	0.00340773
SEM:	0.00030964
Variance:	0.000011889
Range:	0.000031 to 0.015399

Top Cit 3

No. of observations:	115
Total area (mm^2):	0.091283
Mean area (mm^2):	0.00079377
SEM:	0.00011312
Variance:	0.0000014716
Range:	0.000061 to 0.006368

Cit. Rep 4

Base Cit 4

No. of observations:	313
Total area (mm^2):	1.30861
Mean area (mm^2):	0.00418083
SEM:	0.00026147
Variance:	0.000021399
Range:	0.000061 to 0.021093

Mid Cit 4

No. of observations:	316
Total area (mm^2):	0.761568
Mean area (mm^2):	0.00241003
SEM:	0.00018478
Variance:	0.000010789
Range:	0.000061 to 0.018889

Top Cit 4

No. of observations:	82
Total area (mm^2):	0.081304
Mean area (mm^2):	0.00099151
SEM:	0.00015001
Variance:	0.0000018452
Range:	0.000061 to 0.006582

Cit. Rep 5

Base Cit 5

No. of observations:	490
Total area (mm^2):	0.87887
Mean area (mm^2):	0.00179361
SEM:	0.00017363
Variance:	0.000014773
Range:	0.000031 to 0.033185

Mid Cit 5

No. of observations:	91
Total area (mm^2):	0.422217
Mean area (mm^2):	0.00463975
SEM:	0.00035378
Variance:	0.00001139
Range:	0.000061 to 0.013531

Top Cit 5

No. of observations:	159
Total area (mm^2):	0.182481
Mean area (mm^2):	0.00114768
SEM:	0.00013189
Variance:	0.0000027657
Range:	0.000061 to 0.008051

Distilled water (= DW)

<u>DW, Rep 1</u>

Base DW 1

No. of observations:	222
Total area (mm^2):	0.923934
Mean area (mm^2):	0.00416186
SEM:	0.00028692
Variance:	0.000018276
Range:	0.000031 to 0.0[illegible]9929

Mid DW 1

No. of observations:	275
Total area (mm^2):	0.79944
Mean area (mm^2):	0.00290705
SEM:	0.00021722
Variance:	0.000012975
Range:	0.000031 to 0.015827

Top DW 1

No. of observations:	4
Total area (mm^2):	0.011297
Mean area (mm^2):	0.00282425
SEM:	0.00075227
Variance:	0.0000022636
Range:	0.001041 to 0.004378

<u>DW, Rep 2</u>

Base DW 2

No. of observations:	126
Total area (mm^2):	0.548195
Mean area (mm^2):	0.00435075
SEM:	0.00032712
Variance:	0.000013483
Range:	0.000122 to 0.017082

Mid DW 2

No. of observations:	170
Total area (mm^2):	0.509127
Mean area (mm^2):	0.00299486
SEM:	0.00024753
Variance:	0.000010416
Range:	0.000092 to 0.012368

Top DW 2

No. of observations:	127
Total area (mm^2):	0.165306
Mean area (mm^2):	0.00130162
SEM:	0.00011275
Variance:	0.0000016145
Range:	0.000122 to 0.006337

<u>DW, Rep 3</u>

Base DW 3

No. of observations:	189
Total area (mm^2):	0.549881
Mean area (mm^2):	0.00290942
SEM:	0.00024785
Variance:	0.00001161
Range:	0.000122 to 0.014327

Mid DW 3

No. of observations:	138
Total area (mm^2):	0.545134
Mean area (mm^2):	0.00395025
SEM:	0.0003013
Variance:	0.000012528
Range:	0.000122 to 0.014725

Top DW 3

No. of observations:	77
Total area (mm^2):	0.064836
Mean area (mm^2):	0.00084203
SEM:	0.00011553
Variance:	0.0000010278
Range:	0.000122 to 0.006153

<u>DW, Rep 4</u>

Base DW 4

No. of observations:	202
Total area (mm^2):	0.711305
Mean area (mm^2):	0.00352131
SEM:	0.00025819
Variance:	0.000013466
Range:	0.000122 to 0.0[illegible]6562

Mid DW 4

No. of observations:	161
Total area (mm^2):	0.469086
Mean area (mm^2):	0.00291358
SEM:	0.00026169
Variance:	0.000011026
Range:	0.000122 to 0.021705

Top DW 4

No. of observations:	133
Total area (mm^2):	0.125634
Mean area (mm^2):	0.00094462
SEM:	0.000088828
Variance:	0.0000010494
Range:	0.000061 to 0.004837

<u>DW, Rep 5</u>

Base DW 5

No. of observations:	194
Total area (mm^2):	0.952989
Mean area (mm^2):	0.00491231
SEM:	0.00037961
Variance:	0.000027956
Range:	0.000092 to 0.023113

Mid DW 5

No. of observations:	315
Total area (mm^2):	0.679918
Mean area (mm^2):	0.00215847
SEM:	0.00018381
Variance:	0.000010643
Range:	0.000031 to 0.029175

Top DW 5

No. of observations:	114
Total area (mm^2):	0.075915
Mean area (mm^2):	0.00066592
SEM:	0.000099157
Variance:	0.0000011209
Range:	0.000061 to 0.005786