PRODUCTION OF BIOMASS BY TWO POPLAR CLONES IN RELATION TO SPACING

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Details of experiment

A study was laid out in February, 1984 in Pakistan Forest Institute campus for assessment and comparison of biomass production by planting cuttings of two important poplar clones viz., P. deltoides cv-I-63/51 and AY—48, an evergreen clone, with two size of pits and four spacings. The layout of experiment was as follows:

(i) Design of experiment : Split split plot design

(ii) Major treatments : Two poplar clones
- (a) I-63/51
- (b) AY-48

(iii) Minor treatments : Four spacing
- (a) 0.5 x 0.5 metre
- (b) 1.0 x 1.0 ,,
- (c) 1.5 x 1.5 ,,
- (d) 2.0 x 2.0 ,,

(iv) Sub minor treatments : Two lengths of cuttings

a, b, c, d, 20 cm long cuttings for 4 spacings

a', b', c', d' 25 cm long cuttings for 4 spacings

(v) No of replications : 6

Data collection

In December 1985 i.e. after two years growth period all the plants were cut flush with the ground. Five to ten plants under each treatment were selected randomly from each replication. Green weight (kg) for each plant was taken separately for stem, leaves and branches and then totalled. DBH and height of each plant was also measured separately. The average for each replication was then worked out. In summarised form, average stem, branches leaves and total green weight was available for each subminor treatment in each replication for a single plant with average dbh of that plant. These averages are given in Table 1.

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Table 1. Average total weight (Kg) for one plant under each treatment

(i) Poplar clone A = I–63/51

Spacing (m)

Length of cutting		0.5 x 0.5		1.0 x 1.0		1.5 x 1.5		2.0 x 2.0	
		20 cm a	25 cm a'	20 cm b	25 cm b'	20 cm c	25 cm c'	20 cm d	25 cm d'
Rep.									
I	DBH (cm)	2.5	2.8	4.6	2.6	2.8	4.1	5.1	5.2
	Wt (Kg)	1.93	2.59	6.33	3.16	2.75	5.75	8.00	7.50
II	DBH (cm)	2.7	3.1	4.5	4.2	5.9	5.0	6.8	4.4
	Wt (Kg)	2.92	1.99	6.49	6.32	12.00	8.50	13.00	6.00
III	DBH (cm)	3.1	3.4	3.8	4.0	4.1	2.4	5.6	6.3
	Wt (Kg)	3.53	3.79	5.66	5.60	5.50	3.00	11.00	14.98
IV	DBH (cm)	5.6	3.4	4.4	3.6	3.9	4.1	5.7	2.7
	Wt (Kg)	4.19	4.05	5.83	4.66	5.25	5.75	12.00	2.99
V	DBH (cm)	3.4	3.1	4.1	5.0	3.7	3.4	6.1	5.2
	Wt (Kg)	3.39	2.72	5.66	8.99	4.25	7.50	8.25	9.00
VI	DBH (cm)	3.3	3.6	4.0	4.3	5.9	3.6	4.4	5.8
	Wt (Kg)	3.33	4.13	5.16	5.79	11.50	4.00	6.50	11.50

(ii) Poplar clone B = AY — 48

Spacing (m)

Length of cutting		0.5 x 0.5		1.0 x 1.0		1.5 x 1.5		2.0 x 2.0	
		20 cm a	25 cm a'	20 cm b	25 cm b'	20 cm c	25 cm c'	20 cm d	25 cm d'
Rep.									
I	DBH (cm)	3.3	4.2	3.8	5.8	4.1	3.7	1.5	7.2
	Wt (Kg)	3.65	5.58	3.99	11.49	5.33	3.25	1.50	13.99
II	DBH (cm)	4.4	4.5	3.6	5.4	5.4	6.0	6.6	8.1
	Wt (Kg)	6.26	6.79	5.00	10.65	11.25	11.99	11.50	24.00
III	DBH (cm)	3.7	3.7	5.0	3.8	3.7	6.2	5.4	3.8
	Wt (Kg)	4.32	4.45	11.40	5.99	4.25	12.99	8.75	4.50
IV	DBH (cm)	3.7	4.3	5.1	6.1	5.1	3.2	3.0	4.8
	Wt (Kg)	4.53	5.72	8.32	11.43	7.25	2.50	3.50	6.00
V	DBH (cm)	5.0	3.9	4.4	5.2	5.9	5.7	4.1	5.7
	Wt (Kg)	8.39	9.49	5.82	9.49	12.00	9.75	6.75	9.50
VI	DBH (cm)	4.2	3.5	5.3	4.4	4.8	5.3	—	6.1
	Wt (Kg)	6.39	3.86	8.32	7.32	5.00	10.00	—	11.00

Analysis of data

A simple linear model Y = A + BX was used for estimating the total weight (Y) in kg using dbh (X) in cms for different treatments. Values of different statistics obtained for each treatment using above model are given in Table 2.

Table 2. Values of different statistics

Treatment	Values of					
	Regression constant (A)	Regression coefficient (B)	Correlation coefficient (r)	Average of Y ($\bar{Y}$)	Average of X ($\bar{X}$)	No. of measurements (n)
(i) Poplar clone A I—63/51						
a.	1.3371	0.5438	0.8141	3.21	3.45	6
a'	— 5.1618	2.5804	0.8421	3.21	3.24	6
b	0.8006	1.1916	0.7899	5.85	4.24	6
b'	— 3.4623	2.3370	.9570	5.75	3.94	6
c	— 6.7307	3.1028	.9926	6.87	4.38	6
c'	— 2.0932	2.0319	.7131	5.75	3.86	6
d	— 6.3721	2.9532	.9295	9.79	5.47	6
d'	— 6.5354	3.0784	.9385	8.66	4.94	6
(ii) Poplar clone B AY — 48						
a	— 6.1927	2.9201	.9918	5.59	4.03	6
a'	— 2.5129	2.1139	.4193	5.98	4.02	6
b	— 6.5886	3.0243	.8249	7.14	4.54	6
b'	— 3.9743	2.6035	.9878	9.39	5.13	6
c	—10.5503	3.7309	.8890	7.51	4.84	6
c'	— 9.1283	3.4943	.9885	8.41	5.02	6
d	— 1.8804	2.0088	.9927	6.40	4.12	6
d'	—13.8673	4.2488	.9452	11.50	5.97	6

The above statistics show that the length of cuttings did not contribute much towards difference in dbh, neither in biomass production. So readings under a and a', b and b' and so on were grouped together and again the simple linear model as above was used for the data. The new statistics obtained are given in Table 3.

Table 3. Values of different statistics

	Treatment	Regression constant (A)	Regression coefficient (B)	Correlation coefficient (r)	Average of Y ($\bar{Y}$)	Average of X ($\bar{X}$)	No. of measure-ments (n)
(i)	Poplar clone A 1—65/51						
a.	(0.5x0.5 m)	1.0043	0.6596	0.6630	3.21	3.35	12
b	(1.0x1.0 m)	−2.4988	2.0268	0.9141	5.80	4.09	12
c	(1.5x1.5 m)	−5.1588	2.7826	0.9273	6.31	4.12	12
d	(2.0x2.0 m)	−6.2707	2.9774	0.9349	9.23	5.20	12
(ii)	Poplar clone B AY − 48						
a	(0.5x0.5 m)	−4.9417	2.6641	0.7124	5.78	4.03	12
b	(1.0x1.0 m)	−5.8728	2.9232	0.9084	8.27	4.84	12
c	(1.5x1.5 m)	−9.6608	3.5743	0.9536	7.96	4.93	12
d	(2.0x2.0 m)	−5.8561	2.9312	0.9152	9.18	5.13	11

Results of analysis

From the above statistics following results can be deduced:

(i) For Poplar clone A (*P. deltoides* I—63/51) correlation coefficient and other parameters of estimates for 0.5 x 0.5 m spacing (a) are quite different from the same for all other three spacings i.e. b, c and d.

(ii) For Poplar clone B (AY—48) the correlation coefficient for spacing a (0.5 x 0.5 m) is again different from the same statistics obtained for all other spacings.

(iii) High value of regression coefficient (B) for poplar clone B(AY—48) in spacing c(1.5 x 1.5 m) yields higher estimates for different dbh classes as compared to wider spacing d(2.0 x 2.0 m).

Conclusions

The above results lead to the following conclusions:

(i) For both poplar clones biomass per plant in close spacing viz. 0.5 x 0.5 m is different (less) than in wider spacings i.e. 1.0 x 1.0 m and above.

(ii) The biomass per plant for both the clones is almost constant for spacing b, c, d.

The linear regression model as above was applied to combined data for b, c and d spacings for the poplar clones and parameters given in Table 4 were obtained.

Table 4. Values of different parameters

Treatments	Regression constant (A)	Regression coefficient (B)	Correlation coefficient (r)	Average of Y ($\bar{Y}$)	Average of X ($\bar{X}$)	No. of measurements (n)
Ploplar clone A (I–63/51)						
a[1] (0.5 x 0.5 m)	1.0043	0.6596	.6630	3.21	3.35	12
b,c,d combined	−5.4064	2.7990	.9417	7.11	4.47	36
Poplar clone B (AY − 48)						
a[1] (0.5 x 0.5 m)	−4.9417	2.6641	0.7124	5.78	4.03	12
b,c,d combined	−6.7502	3.0638	0.9198	8.45	4.96	35

[1] See Table 3

The original data range from 1.52 cm to 8.12 cm in dbh. Therefore estimates based on the above parameters have been worked upto 10 cm dbh class with one cm interval. The estimates are given in Table 5 below:

Table 5. Estimates of total biomass production per plant (green weight in kg) above ground level

Poplar clone	DBH Class (Cm) 1	2	3	4	5	6	7	8	9	10
	Total biomass (kg)									
I–63/51										
Spacing 0.5 x 0.5 m	1.66	2.32	2.98	3.64	4.30	4.96	5.62	6.28	6.94	7.60
Spacing combined 1.0x1.0, 1.5x1.5, 2.0x2.0	0	1.19	2.99	5.79	8.59	11.39	14.19	16.98	19.78	22.58
AY–48										
Spacing 0.5 x 0.5	0	0.39	3.05	5.71	8.38	11.04	13.71	16.37	19.03	21.70
Spacing combined 1.0x1.0, 1.5x1.5, 2.0x2.0	0	0	2.44	5.50	8.57	11.63	14.70	17.76	20.82	23.89

The estimates of Table 5 are a good guide for assessing the total biomass production on unit area basis (acres, hectares) if diameter frequency and stocking of the plants on a sampled area are determined first.