

## PROVISIONAL YIELD TABLE OF HYBRID POPLARS IN PAKISTAN

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**Summary.** In an earlier study (2) mean annual increment (MAI) of hybrid poplar ( $P \times E$  Cv I — 214) was estimated to be 235 cft for a crop of age 6 years with the assumption that 700 trees per acre of the species were available at the above age, that is, planting was done with a spacing of 10' x 6', no thinning was done upto the age of 6 years and only 26 trees were lost on account of mortality and other factors upto this age. This plantation was however not maintained properly, no soil cultivation was done and irrigation was erratic.

Since hybrid poplar had been tried in different plantations with varying spacings since 1970, sample plots were laid out to assess its growth performance. Data were available for different spacings in each locality, therefore, the data were considered separately for determination of growth parameters for each locality and for each spacing. Under proper management 6 years old crop with 10' x 10' spacing gives MAI of 400 cft or more, with 15' x 15' and 18' x 18' MAI is 200 cft to 320 cft per acre.

**Introduction.** In Pakistan there is an alarming shortage of timber and firewood. The present annual production from the state forests is meagre; actually more than 50% of the total production comes from farm lands. A substantial quantity has to be imported involving valuable foreign exchange. Rising trend in the prices of raw material as well as the finished goods is clear indication of the continued scarcity of this important commodity. In order to feed the existing wood based industry and to provide an incentive for the establishment of much needed new ones, it is imperative that the maximum sustained quantity of woody raw material is produced within a reasonable period of time.

The tree species indigenous to Pakistan are rather slow growing and take a long time to attain exploitable size. Much hope, therefore, cannot be pinned on these. It is possible to achieve the targets, to a very great extent only through introduction of suitable exotics, especially fast growing medium softwoods. The fact should be admitted without hesitation that enough is not being taken out of the potentially rich land under irrigated plantations and that there is tremendous scope for improvement in the existing age-old systems of management. In such climatically suitable areas multi-purpose trees like poplars can be successfully planted.

Poplars were introduced in the country in the late fifties. Sufficient time was spent on scientific production of nursery stock and field planting techniques.

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Management studies to find out the best spacing and comparative studies between different clones were also laid out at a number of places. Although some deltoides clones such as *P. deltoides* 63/51, 18/62, 90/60 and 69/55 have been introduced at a later stage only *P. euramericana* cv-I-214 has been planted on a large scale in different parts of the country. The clone has extensively been planted in Peshawar valley by the farmers of the area and every year about 100,000 trees are being planted either in the form of compact blocks or as wind breaks. One tree after 6 years is fetching them Rs. 100/- on the average. Compact plantations were started at Daphar, Bhagat, Bela Piran Ghaib, Changa Manga and some other areas which now vary in age from 2-8 years. With the establishment of poplar plantation, need for their volume and yield tables was felt. More so because the yield tables prepared in other countries of the world were entirely not applicable to Pakistan as the climatic conditions obtaining here are much different. The growing period is longer, weather is hot most part of the year and therefore the growth rate is also faster. Since no authentic data were available to predict the yield of hybrid poplars grown in this country, sample plots were laid out in all these plantations from 1976 to 1978. Data were collected over a period of time and it was thus possible to prepare a provisional yield table for the country.

**Basic data.** 24 sample plots laid in different plantations of the Punjab in 1976 and onwards with their annual measurements constitute the basic data. Details of sample plots are given in Table 1.

Table 1

*Details of sample plots of hybrid poplar (P x E Cv. I-214) laid in irrigated plantations of the Punjab*

S.No.	Plantation	Spacing	Year of layout	Age at layout (years)	No. of measurements.
1.	Daphar	10' x 10'	Mar. 1976	2	5
2.	Daphar	"	"	2	5
3.	Daphar	"	"	2	5
4.	Daphar	"	"	2	5
5.	Bhaghat	"	Feb. 1978	4	3
6.	Bela Piran Ghaib	"	Dec. 1977	6	3
7.	Daphar	15' x 15'	Mar. 1978	4	3
8.	Changa Manga	"	Jan. 1978	3	3
9.	Bela Piran Ghaib	"	Dec. 1977	8	3
10.	Bela Piran Ghaib	"	"	8	3
11.	Daphar	18' x 18'	Mar. 1976	3	5
12.	Daphar	"	"	3	5
13.	Daphar	"	"	3	5
14.	Daphar	"	"	3	5

Table 1 (contd)

S.No.	Plantation	Spacing	Year of Layout	Age at layout (years)	No. of measurements.
15.	Daphar	18' x 18'	Mar. 1978	5	3
16.	Changa Manga	"	Jan. 1978	2	3
17.	Changa Manga	"	"	4	3
18.	Changa Manga	"	"	5	2
19.	Changa Manga	"	"	6	2
20.	Changa Manga	"	"	7	3
21.	Changa Manga	"	"	8	3
22.	Changa Manga	"	"	9	2
23.	Bhagat	"	Feb. 1978	5	3
24.	Bela Piran Ghaib	"	Dec. 1977	7	3
Total measurements.					85

**Method and material:** Annual measurements of all the sample plots were converted on unit area basis. Volume of standing and thinned crops were calculated separately (1, 3). Total volume for different ages was obtained by adding cumulative yield of thinnings for previous years to the standing volume.

As the sample plots were laid out in hybrid poplar plantations raised under different spacings viz 10' x 10', 15' x 15' and 18' x 18' the growth statistics for one spacing differed widely from others. To get an idea about growth parameters the measurements were grouped according to spacings. Data grouped as above gave the following information.

S.No.	Locality	Spacing	No of measurements	Age range (years)
1.	Daphar	10' x 10'	20	2-6
2.	Daphar	15' x 15'	3	4-6
3.	Daphar	18' x 18'	23	3-7
4.	Changa Manga	15' x 15'	3	3-5
5.	Changa Manga	18' x 18'	18	2-10
6.	Bhaghat	10' x 10'	3	4-6
7.	Bhaghat	18' x 18'	3	5-7
8.	Bela Piran Ghaib	10' x 10'	3	6-8
9.	Bela Piran Ghaib	15' x 15'	6	8-10
10.	Bela Piran Ghaib	18' x 18'	3	7-9
			85	

Growth parameters were obtained for each spacing and each age group on unit area basis. Table 2 and table 3 show the parameters in British and metric units respectively.



Table 2  
Growth and yield of hybrid poplar (*P x E I-214*) in British units

Age years	No. of measure- ment.	dbh in.	Ht. ft.	B.A. ft <sup>2</sup>	Vol. ft <sup>3</sup>	Total No. including thinned trees	Vol. ft <sup>3</sup>	MAI ft <sup>3</sup>
SPACING 10' x 10'								
DAPHAR								
2	4	448	2.6	24	15.14	448	772.86	386.43
3	4	444	3.8	34	36.92	448	1197.69	399.27
4	4	442	4.8	46	59.33	448	1546.81	388.05
5	4	417	5.5	53	69.36	448	1796.13	375.42
6	4	417	6.3	60	92.50	448	2318.96	399.99
BELA PIRAN GHAI B								
6	1	417	8.0	73	146.25	417	2589.20	431.53
7	1	417	8.2	78	154.58	417	2785.00	397.86
8	1	417	8.4	85	159.17	417	2874.10	359.26
BHAGAT								
4	1	419	6.2	55	87.89	419	2153.07	538.27
5	1	419	6.6	57	98.93	419	2427.00	485.40
6	1	415	7.2	63	117.85	419	2924.07	491.39

## SPACING 15' x 15'

## DAPHAR

4	1	194	5.7	42	35.36	509.24	194	509.24	127.31
5	1	194	6.5	45	39.00	726.21	194	726.21	145.24
6	1	194	7.5	56	61.03	1243.48	194	1243.48	207.25

## BELA PIRAN GHAIB

8	2	200	9.9	70	107.40	2019.20	200	2019.20	252.40
9	2	198	10.3	75	117.26	2360.50	200	2370.62	263.40
10	2	189	10.8	78	117.53	2554.35	200	2643.97	264.40

## CHANGA MANGA

3	1	191	6.8	51	47.94	1315.81	191	1315.81	438.60
4	1	191	7.9	59	65.25	1889.44	191	1889.44	472.36
5	1	175	8.8	63	73.59	2004.28	191	2158.75	431.75

## SPACING 18' x 18'

## DAPHAR

3	4	130	5.2	34	19.46	488.87	130	488.87	162.96
4	4	130	6.9	44	33.98	843.84	130	843.84	210.96
5	5	130	7.5	49	40.66	982.37	130	982.37	196.47
6	5	129	8.2	54	48.02	1230.74	130	1230.82	205.14
7	5	128	9.1	62	59.09	1559.17	130	1561.99	223.14



Age years	No. of measure- ment.	No. of trees	dbh in.	Ht. ft.	B.A. ft <sup>2</sup>	Vol. ft <sup>3</sup>	Total No. including thinned trees	Vol. ft <sup>3</sup>	MAI ft <sup>3</sup>
BELA PIRAN GHAIB									
7	1	129	10.6	71	80.31	1626.90	129	1626.90	232.41
8	1	127	11.3	75	87.73	1814.40	129	1818.57	227.32
9	1	127	12.0	79	97.71	2053.10	129	2057.27	228.59
BHAGAT									
5	1	130	9.0	56	59.32	1613.00	130	1613.00	322.60
6	1	130	9.6	63	66.79	1662.53	130	1662.53	277.09
7	1	130	10.5	65	77.94	2195.79	130	2195.79	313.68
CHANGA MANGA									
2	1	134	4.8	31	17.83	501.06	134	501.06	250.53
3	1	128	6.2	42	27.56	751.08	134	770.12	256.71
4	2	128	7.4	50	38.32	1044.07	133	1062.69	265.67
5	2	132	8.2	56	49.15	1430.20	132	1430.20	286.04
6	3	132	9.3	61	63.72	1924.40	132	1927.99	321.33
7	2	134	9.8	66	71.48	2263.53	134	2263.53	323.36
8	2	125	9.5	70	62.77	1991.24	125	1991.24	248.90
9	3	126	10.9	78	83.77	2745.07	126	2745.07	305.01
10	2	122	11.5	84	91.65	2912.38	122	2912.38	291.24

Table 3

*Growth and yield of hybrid poplar (P x E Cv I-214) in metric units*

Age years	No. of measure- ment	No. of trees	dbh cm	Ht. m	B.A. m <sup>2</sup>	Vol. m <sup>3</sup>	Total No. including thinned trees	Vol. m <sup>3</sup>	MAI m <sup>3</sup>
SPACING 3 x 3 m									
DAPHAR									
2	4	1107	6.6	7.3	3.476	54.079	1107	54.079	27.040
3	4	1097	9.6	10.4	8.476	83.806	1107	83.814	27.938
4	4	1092	12.2	14.0	13.620	108.235	1107	108.613	27.153
5	4	1030	14.0	16.1	15.923	125.681	1107	131.345	26.269
6	4	1030	16.0	18.3	21.235	162.265	1107	167.929	27.988
BELA PIRAN GHAI B									
6	1	1030	20.3	22.2	33.574	181.174	1030	181.174	30.195
7	1	1030	20.8	23.8	35.487	194.875	1030	194.875	27.839
8	1	1030	21.3	25.9	36.540	201.109	1030	201.109	25.138
BHAGAT									
4	1	1035	15.7	16.8	20.177	150.657	1035	150.657	37.664
5	1	1035	16.8	17.4	22.711	169.824	1035	169.824	33.965
6	1	1025	18.3	19.2	27.055	204.606	1035	206.303	34.384

Age years	No. of measure- ment	No. of trees	dbh cm	Ht. m	B.A. m <sup>2</sup>	Vol. m <sup>3</sup>	Total No. including thinned trees	Vol. m <sup>3</sup>	MAI m <sup>3</sup>
SPACING 5m x 5m									
DAPHAR									
4	1	479	14.5	12.8	8.118	35.633	479	35.633	8.908
5	1	479	16.5	13.7	8.953	50.815	479	50.815	10.163
6	1	479	19.0	17.1	14.011	87.010	479	87.010	14.502
BELA PIRAN GHAI B									
8	2	494	25.1	21.3	24.656	141.289	494	141.289	17.661
9	2	489	26.2	22.9	26.919	165.171	494	165.879	18.431
10	2	467	27.4	23.8	26.981	178.735	494	185.006	18.501
CHANGA MANGA									
3	1	472	17.3	15.5	11.005	92.071	472	92.071	30.690
4	1	472	20.1	18.0	14.979	132.210	472	132.210	33.052
5	1	432	22.3	19.2	16.894	140.245	472	151.054	30.211
SPACING 6m x 6m									
DAPHAR									
3	4	321	13.2	10.4	4.467	34.208	321	34.208	11.403
4	4	321	17.5	13.4	7.801	59.046	321	59.046	14.761
5	5	321	19.0	14.9	9.334	68.739	321	68.739	13.748
6	5	319	20.8	16.5	11.024	86.119	321	86.124	14.354
7	5	316	23.1	18.9	13.565	109.010	321	109.297	15.614



## BELA PIRAN GHAI B

7	1	319	26.9	21.6	18.437	113.839	319	113.839	16.262
8	1	314	28.7	22.9	20.140	126.959	319	127.251	15.906
9	1	314	30.5	24.1	22.431	143.662	319	143.953	15.995
BHAGAT									
5	1	321	22.9	17.1	13.618	112.866	321	112.866	22.573
6	1	321	24.4	19.2	15.333	116.332	321	116.332	19.389
7	1	321	26.7	19.8	17.892	153.646	321	153.646	21.949

## CHANGA MANGA

2	1	331	12.2	9.4	4.093	35.061	331	35.061	17.530
3	1	316	15.7	12.8	6.327	52.555	331	53.888	17.963
4	2	316	18.8	15.2	8.797	73.057	329	74.360	18.590
5	2	326	20.8	17.1	11.283	100.075	326	100.075	20.015
6	3	326	23.6	18.6	14.628	134.656	326	134.907	22.484
7	2	331	24.9	20.1	16.409	158.386	331	158.386	22.626
8	2	309	24.1	21.3	14.410	139.333	309	139.333	17.416
9	3	311	27.7	23.8	19.231	192.081	311	192.081	21.342
10	2	301	29.2	25.6	21.040	203.788	301	203.788	20.379

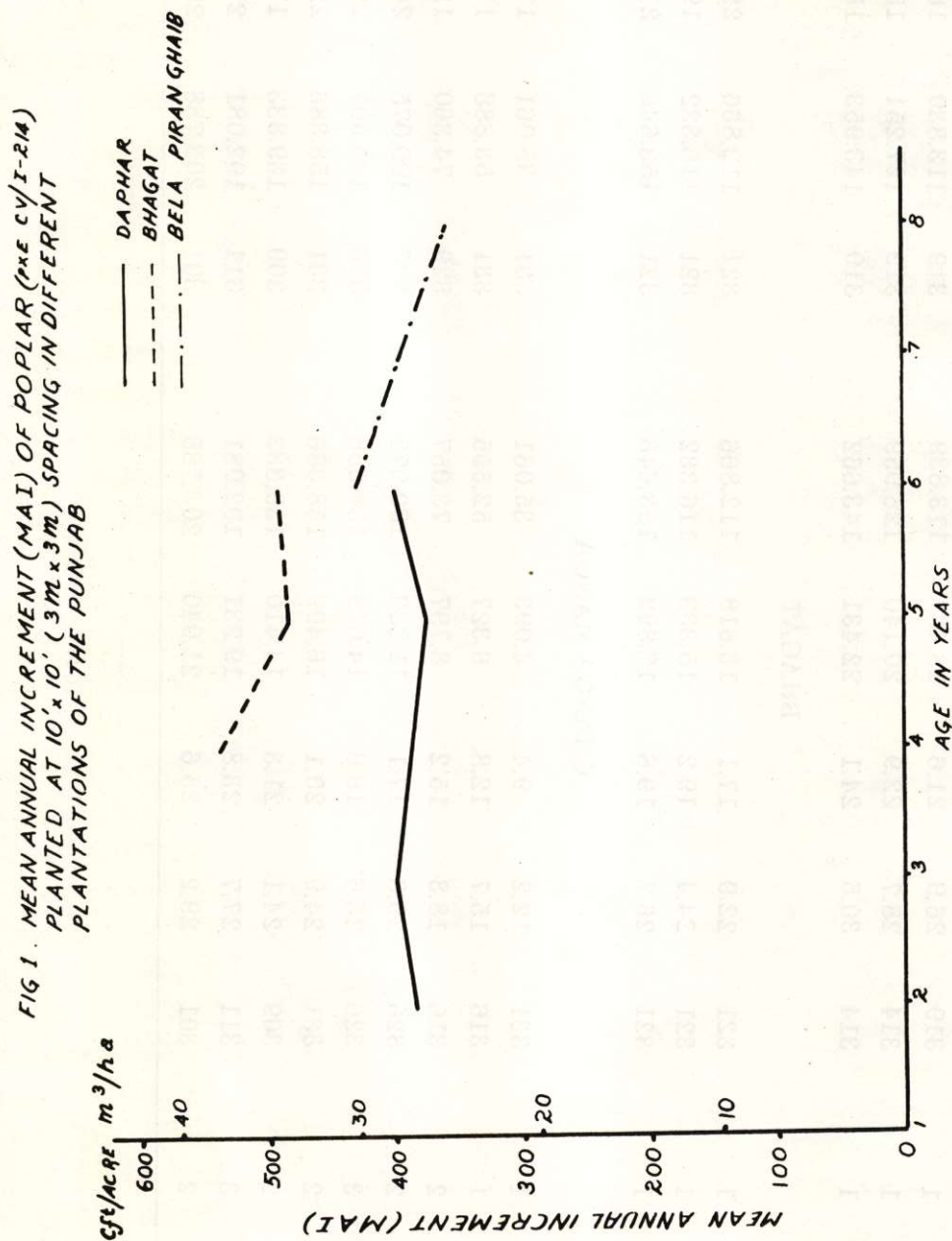




FIG 2. MEAN ANNUAL INCREMENT (MAI) OF POPLAR  
(PXE CV/I - 214) PLANTED AT 15' x 15' (5m x 5m)  
SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

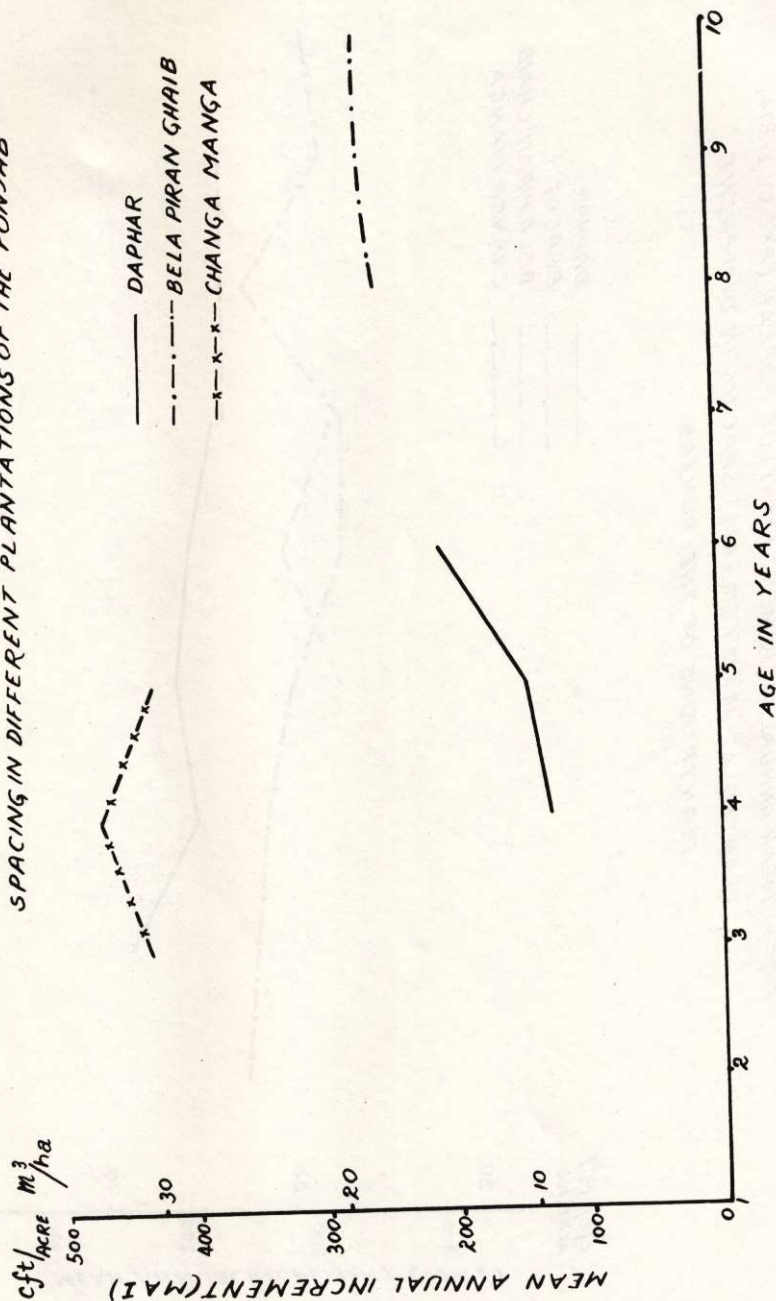


FIG-3: MEAN ANNUAL INCREMENT (MAI) OF POPLAR (PXE CV.I-214)  
PLANTED AT 18'x18' (6M x 6M) SPACING IN DIFFERENT  
PLANTATIONS OF THE PUNJAB

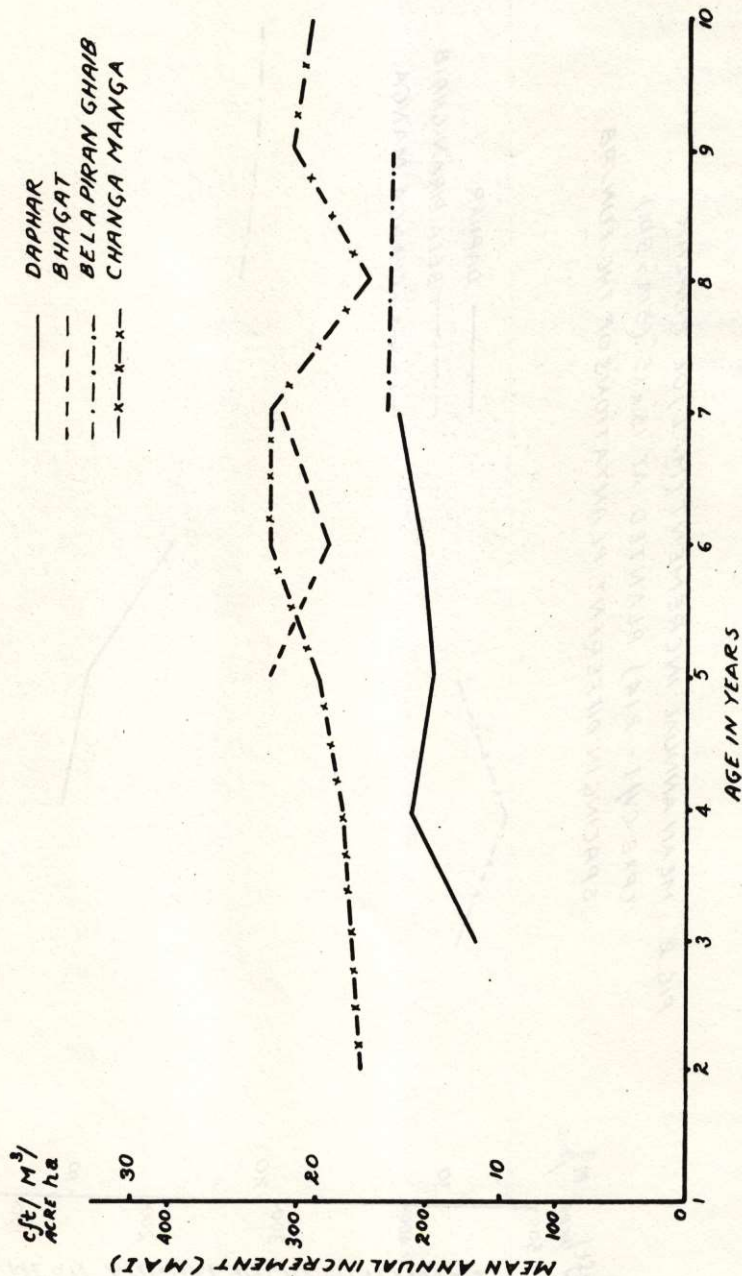
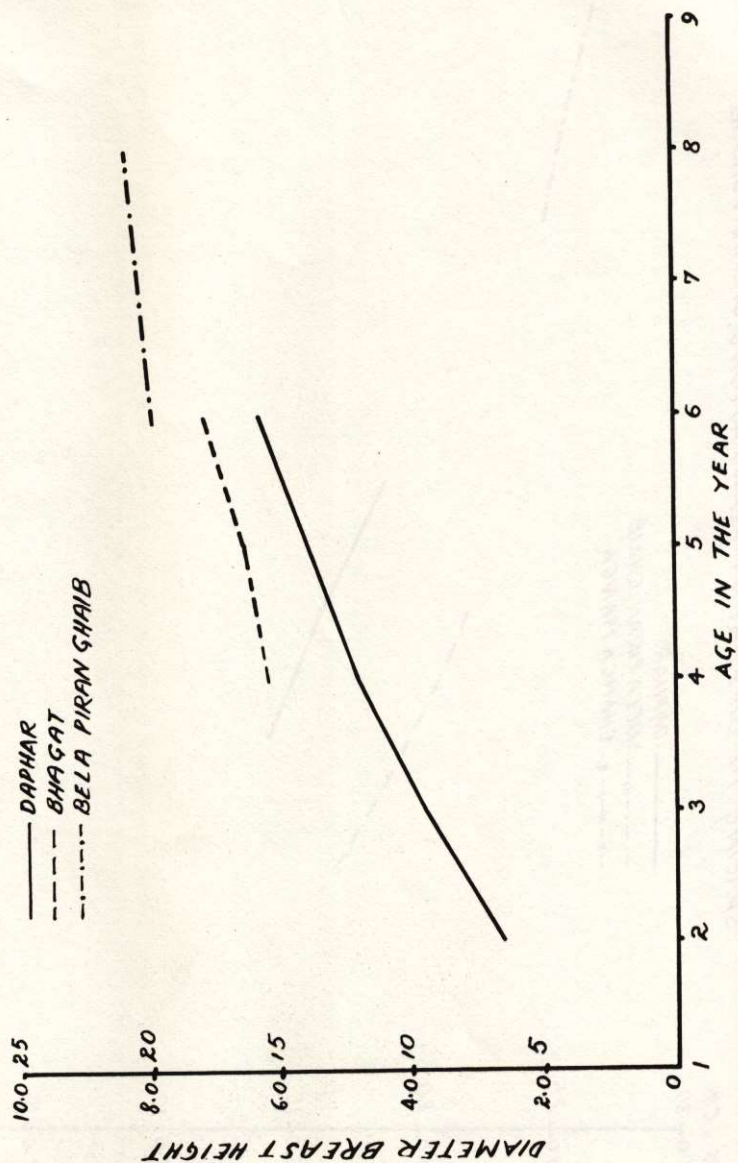




FIG. 4 DIAMETER BREAST HEIGHT (DBH) AGAINST AGE OF  
 POPLAR (P<sub>x</sub>E CV/I-214) PLANTED AT 10'x10' (3m x 3m)  
 SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB



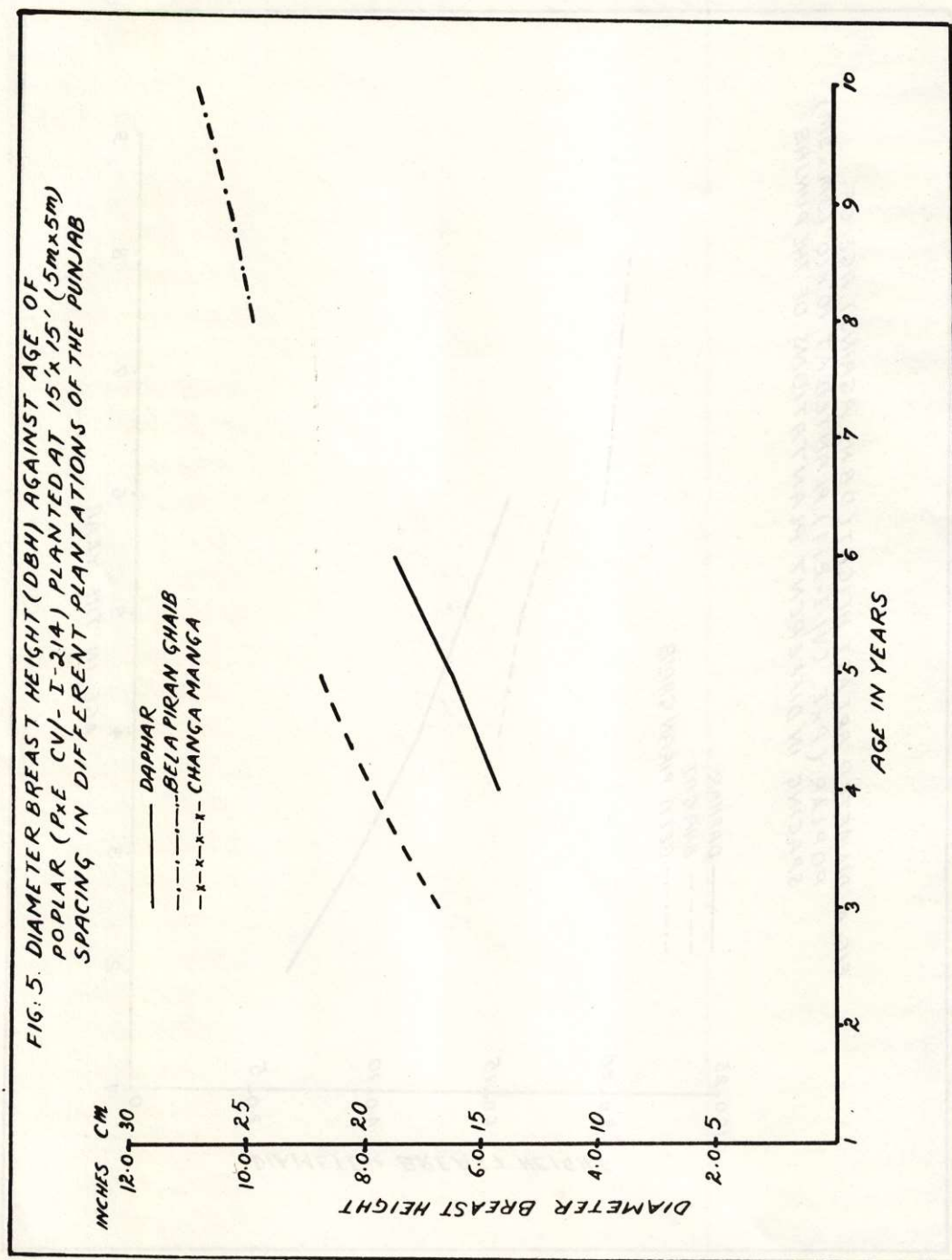




FIG. 6. DIAMETER BREAST HEIGHT (DBH) AGAINST AGE OF  
POPLAR (PxE CV. I-214) PLANTED AT 18'x18' (6m x 6m)  
SPACING IN DIFFERENT PLANTATIONS OF THE PUNJAB

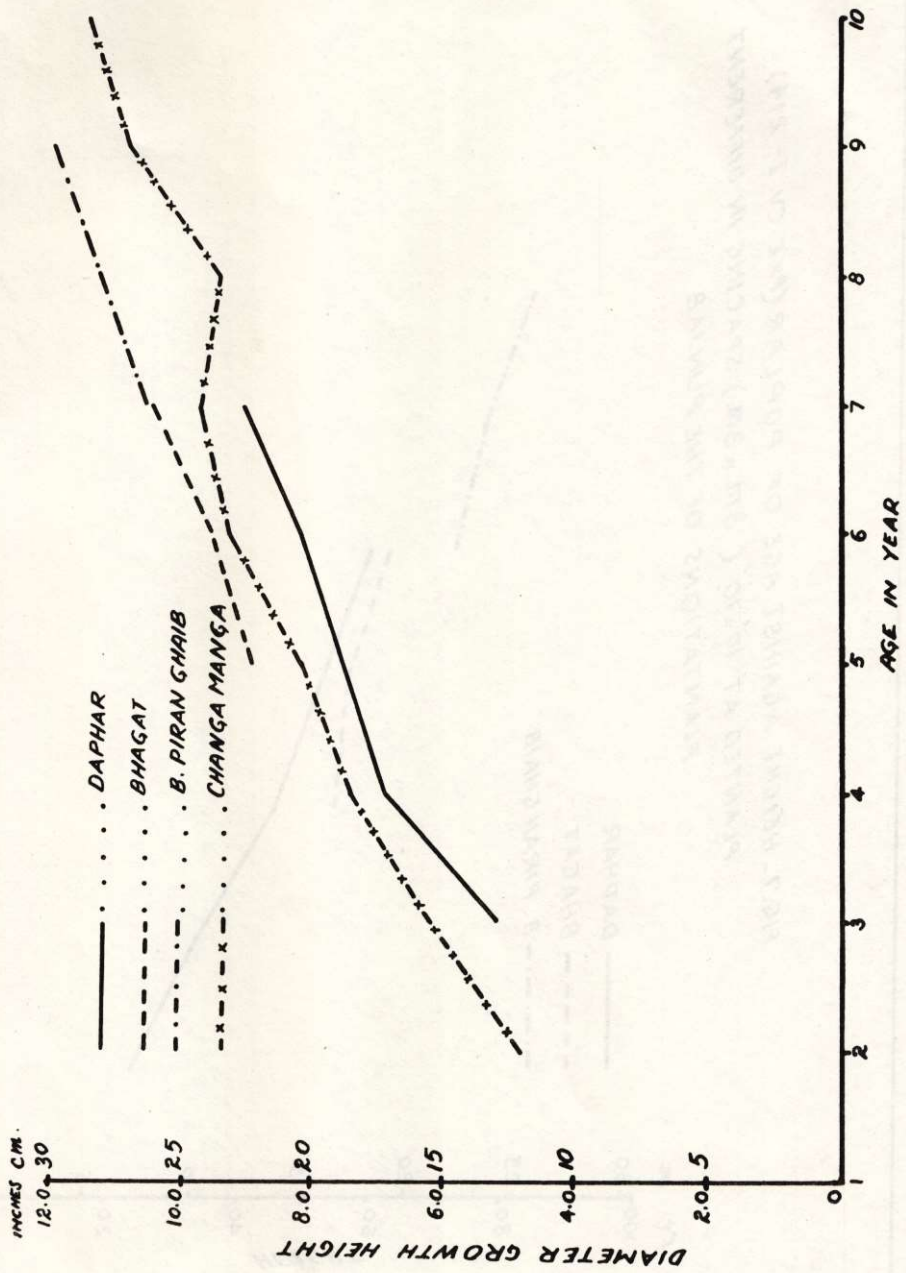


FIG. 7. HEIGHT AGAINST AGE OF POPLAR (PXE CV. I-214)  
PLANTED AT 10'x10' (3M x 3M) SPACING IN DIFFERENT  
PLANTATIONS OF THE PUNJAB

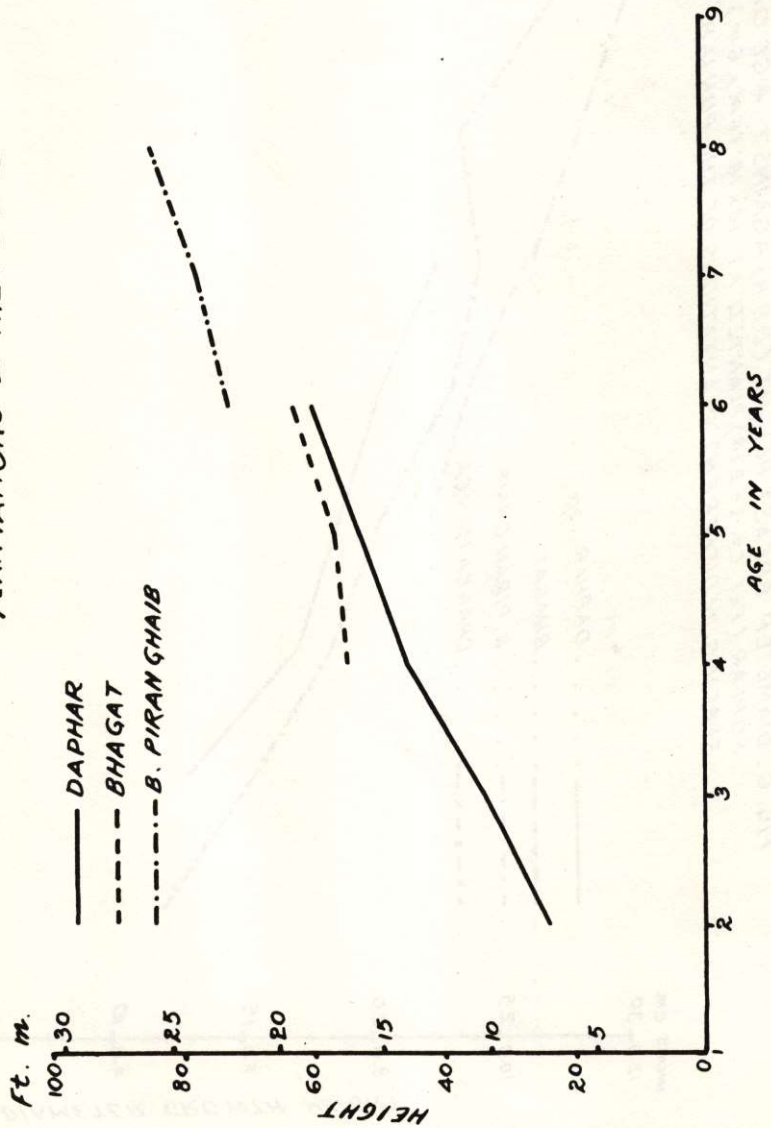




FIG. 8 HEIGHT AGAINST AGE OF POPLAR (P.K.E.C.V. I-214)  
PLANTED AT 15'x15' (5M x 5M) SPACING IN DIFFERENT  
PLANTATIONS OF THE PUNJAB

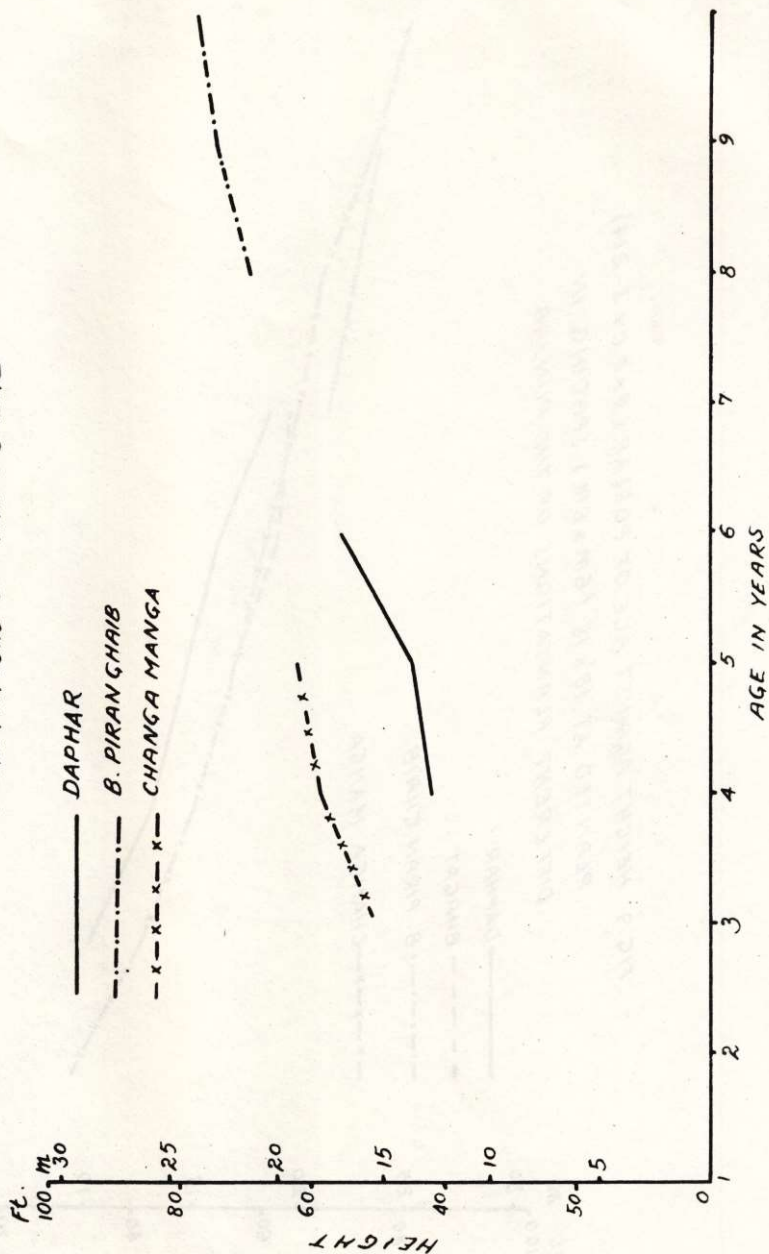
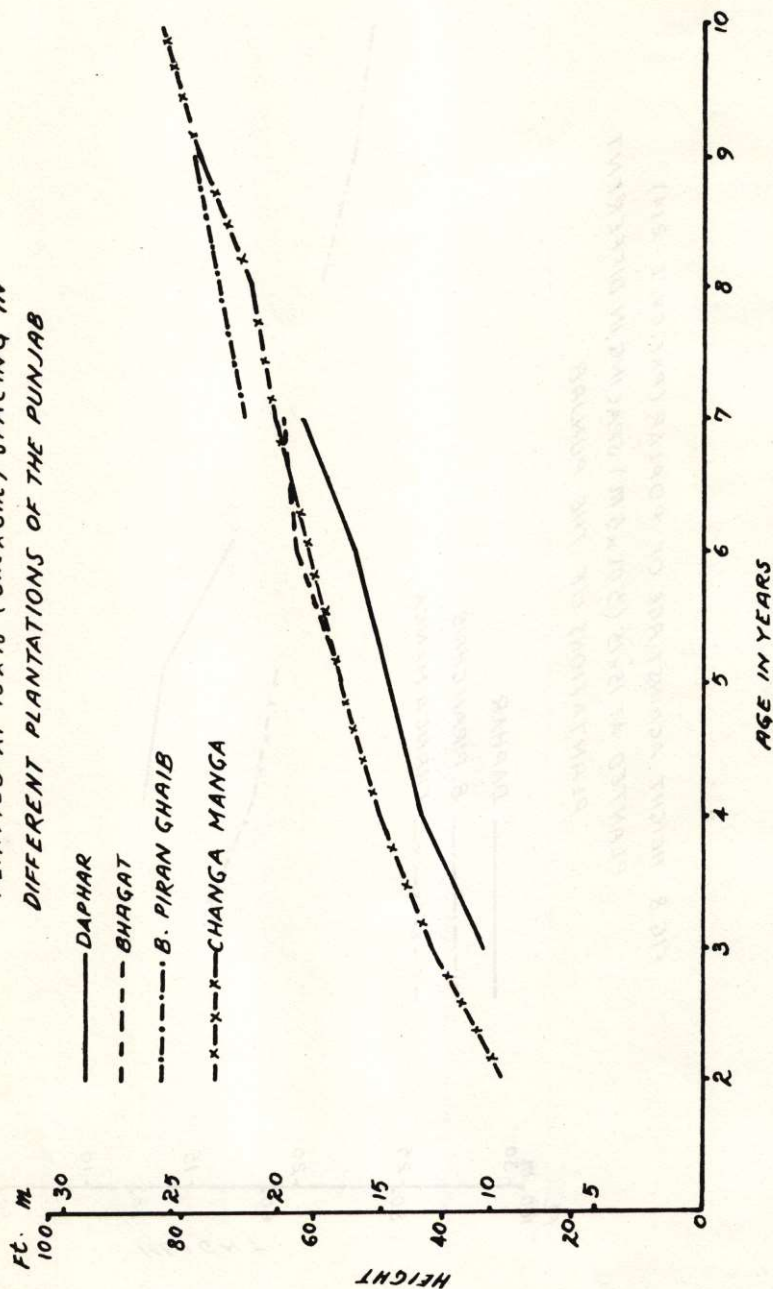


FIG. 9 HEIGHT AGAINST AGE OF POPLAR (P x E CV. I-214)  
PLANTED AT 18' x 18' (6M x 6M) SPACING IN  
DIFFERENT PLANTATIONS OF THE PUNJAB





The trend of different growth parameters was observed graphically by plotting these against age for different spacings and different localities. The following figures show the trend.

Fig. 1 Mean annual increament (MAI) for 10' x 10' spacing for different plantations.

Fig. 2 Mean annual increment (MAI) for 15' x 15' spacing for different plantations.

Fig. 3 Mean annual increment (MAI) for 18' x 18' spacing for different plantations.

Fig. 4 Diameter breast height (DBH) for 10' x 10' spacing for differnt plantations.

Fig. 5 Diameter breast height (DBH) for 15' x 15' spacing for different plantations.

Fig. 6 Diameter breast height (DBH) for 18' x 18' spacing for different plantations.

Fig. 7 Height for 10' x 10' spacing for different plantations.

Fig. 8 Height for 15' x 15' spacing for different plantations.

Fig. 9 Height for 18' x 18' spacing for different plantations.

As the number of measurements under each spacing are still in-adequate therefore accurate estimates could not be obtained. However the above figures give a good indication about the trend of different parameters under different spacing for different localities.

In 10' x 10' spacing, MAI in Daphar and Bela Piran Ghaib ranges between 350 cft to 400 cft for ages 2 to 5 years whereas for Bhaghat it is 500 cft for 4-6 years.

For 15' x 15' spacing, Changa Manga leads other localities with MAI of 450 cft for 3 to 5 years age followed by Bela Piran Ghaib with MAI of 250 cft for ages 8-10 years. The least MAI is obtained in Daphar of 150 cft for 4-6 years.

In 18' x 18' spacing, agriforestry seems to have helped the poplar crop in suppressing weeds, soil working and good irrigation. The highest MAI is exhibited by Changa Manga and Bhagnat where on the average it remained 250-300 cft for crop with age of 2-10 years.

Daphar and Bela Piran Ghaib gave MAI between 150 cft to 225 cft for ages ranging from 3 to 9 years.

It is difficult to determine rotation of maximum volume production at this stage due to insufficiency of data. With more annual measurements taken of the plots accurate estimates will be available after a couple of years.

For the present the figures given in the tables can be used as a rough guide for planning and management purposes.

### References

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