

PROSPECTS OF LEUCAENA PLANTATIONS UNDER GULLIED AND RAINFED CONDITIONS OF POTHWAR PLATEAU

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Abstract

Leucaena leucocephala (Ipil Ipil) variety K-8 was studied at Mangial, Fatehjang to evaluate the growth, survival, fire-wood and forage production, under gullied and rainfed conditions during 1983-86. It revealed that *Leucaena* can be successfully planted (86% survival) to obtain short time forage and firewood in addition to its effective role in soil conservation even under the drought, severe and unfavourable climatic conditions.

Introduction

a) It is generally stated that a country should bear atleast 25 percent area under forest to fulfill its economic and domestic needs beside maintaining proper ecological equilibrium. In Pakistan out of 79.61 million hectares (m.h.) total land area only 5.20 percent is under forest (8) which provides only 0.37 million cubic meter (mm) timber and 0.29 mm³ firewood against consumption of about 1.97 mm³ timber and 16.55 mm³ firewood (1). whereas the country has to spend U.S. \$80 millions on import of various categories of wood and wood products. At the same time wood demand is rapidly, rather enormously increasing due to the high growth rate of human population.

In Pakistan, ecological factors such as temperature, drought in arid and semi-arid areas, frost and freezing stresses, salinity, water-logging, soil erosion, low soil fertility and biotic factors are the most serious and challenging limitations in bridging up the yawning gap between supply and demand of wood. The scope for irrigated forest plantations in the country is very limited due to crop competitions. However the gullied lands of pothwar (so called waste lands) under rainfed conditions may be taken up for this purpose.

b) Pothwar:

Pothwar plateau is lying north of salt Range and between the rivers, Jehlum and Indus. It is comprised of 1.82 m.h. out of which 0.61 m.h. is cultivated whereas the remaining 1.21 m.h. is gullied land, where rough grazing is the only land use. Most of the vegetation in this tract has been depleted due to ruthless cutting, grazing and subsequently the soil erosion has become very serious. In extensive areas the top fertile soils have been washed away causing exposure of kankers and leaving a little scope for growing of desirable tree species. The water holding capacity of left over soil is very low.

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c) *Importance of Leucaena:*

Leucaena leucocephala (Ipil-Ipil) is one of the best tropical leguminous trees, native to Mexico and Central America (5). It offers probably the widest assortments of use by providing nutritious forage, excellent firewood, rich organic fertilizer and timber. It has great adoptability and provides excellent vegetative cover to control soil erosion. Maximum yield of 24.8 tons/ha has been obtained from the closest spacing of 0.5x0.5 m and tapering off with the widest spacing of 1.75x1.75m (8). In Philippines extensive leucaena plantations are being raised as energy forest to provide fuel to the steam power plants, whereas in Indonesia and Africa this Sp. is used as shade or nitrogen nurse tree for coffee and pepper crops. In Nigeria it has demonstrated that the yield of maize can be increased 3 times without adding fertilizers, when planted between rows of leucaena trees (6).

Not only multifarious uses of leucaena but also its high growth rate, adoptability against drought and success in less fertile/eroded lands are the basic criteria for its spread all over the tropics, upto 1500m elevation from sea level between 30° N & S latitudes on arid soils. Keeping in view its adoptability and need to increase the wood production this study was conducted at Mangial, (Fatehjang) during 1983–86.

The Site:

The study area is situated on 33.67 degree north latitude and 72.35 degree east longitude. The elevation from sea level is 495 meters and falls in isohyetal lines of 750–1000mm. About 60% of the total annual rainfall, is received during monsoon. The actual rainfalls recorded at the site for three consecutive years (1983–85) were 1116, 900 and 800 mm. The distribution pattern is given in fig-1. The mean monthly maximum and minimum temperatures were also recorded (Fig-2). The mean monthly lowest and highest temperature of 4°C was observed during the month of January and June respectively. It was further noticed that the minimum temperature fell below freezing point occasionally.

The experimental site belonged to Rajar soil series and its eroded phase where the top fertile soil has been washed away leaving the unfertile subsoil with very low water holding capacity. The physico-chemical characteristics of soil are given in Table-1.

Table 1. Physico-chemical characteristics of soil at Mangial Fateh Jang.

S. No.	Depth	Textural class.	P.H.	O.M. %	N %	P ₂ O ₅ (ppm)	K ₂ (ppm)
1.	0-30	loam	8.33	0.54	0.035	0.2	68.6
2.	30-60	loam	8.29	0.42	0.42	0.4	75.6
3.	60-90	loam	8.33	0.35	0.042	0.4	90.5

Therefore dry afforestation techniques were adopted where in eyebrow terraces (Fig-4) were developed fairly along the contour lines to supplement fertility and give initial and better establishment FYM @ 2 belches/pit was added. The pits were planted with one year old nursery raised potted leucaena seedlings of variety K-8 during spring 1983. The plants were planted at the spacing of 2x2 meter distance by staggered. To monitor the growth rate 10 sample plants were selected randomly. The monthly growth rate was observed throughout the growing season and the averages are given in Fig-3. At the end of study period the total and average increase/month was also recorded and is given in table-2. The yield estimates were made by cutting five representative plants (Table-3). The fresh weight was recorded just after cutting and dry weight after air drying.

Table 2. Increase in height and girth of Leucaena plants variety K-8
April 83–Sept. 1986).

Plant No.	Total Increase in height(m)	Average monthly increase in height(cm).	Total increase in plant growth(cm)	Average monthly increase in girth (cm).
1.	4.52	11	26.3	.64
2.	5.80	14	21.5	.52
3.	4.99	12	22.6	.55
4.	6.33	15	23.7	.58
5.	5.87	14	17.9	.44
6.	5.29	13	12.9	.31
7.	5.84	14	18.1	.44
8.	6.17	15	22.8	.56
9.	5.78	14	10.4	.25
10.	6.3	15	17.7	0.43

Table 3. Yield of wood in Leucaena plants.

Plant No.	Plant height (m)	Plant girth (cm)	Fresh wood Wt. (kg)	Dry wood (kg)
1.	7.5	21.0	21.0	19.4
2.	6.5	17.0	16.0	13.5
3.	7.0	22.1	23.0	19.0
4.	7.0	21.1	20.5	17.0
5.	6.70	16.1	10.0	8.8

Results and Discussion :

Total number of plants planted in the area were 349 out of them 300 plants were survived and the survival percentage come to be 86%. As indicated in table-4 the minimum plant height gain achieved during 42 months (April 1983 to Sept. 1986) was 4.5 meters. The maximum height increase was 6.3 meters. The average was 5.7 m with 3.2 percent coefficient of variation (c.v). The mean monthly height was during Sept. which was 63.8 cm. Whereas minimum of 1.3 cm was during the month of January. The average increase per month for the sample plants ranged from 11.5-15 cm with 3.1 percent coefficient of variation. The total increase in girth during study period ranged from 10.4–26.3 cm with 19.4 cm average increase in girth ranged from 0.25–0.64 cm with 8.3 percent c.v. (Table-4).

Table-3 indicated the yield estimates of fresh and dry wood. The fresh cut ranged from 10–23 Kg/plant and dry cut was 8.8–19.4 Kg/plant. If this is extrapolated on hectare basis the dry wood yields ranged from 12.76 to 28.13 tons/ha. On the average of 22.5 tons/ha. In addition to firewood about 7.53 tons/ha of fresh fodder was also achieved. The correlation analysis showed that there exists a strong positive relationship between plant height & girth with the value of 0.734. Strong relationship was also found between plant height and fresh and dry cut with values of .627 and 0.742 respectively. The coefficient values of 0.953 and 0.939 were found between girth and fresh and dry cut respectively.

Table 4 Growth of *Leucaena* plants during (April 83–Sept. 86) 42 months at Mangjal.

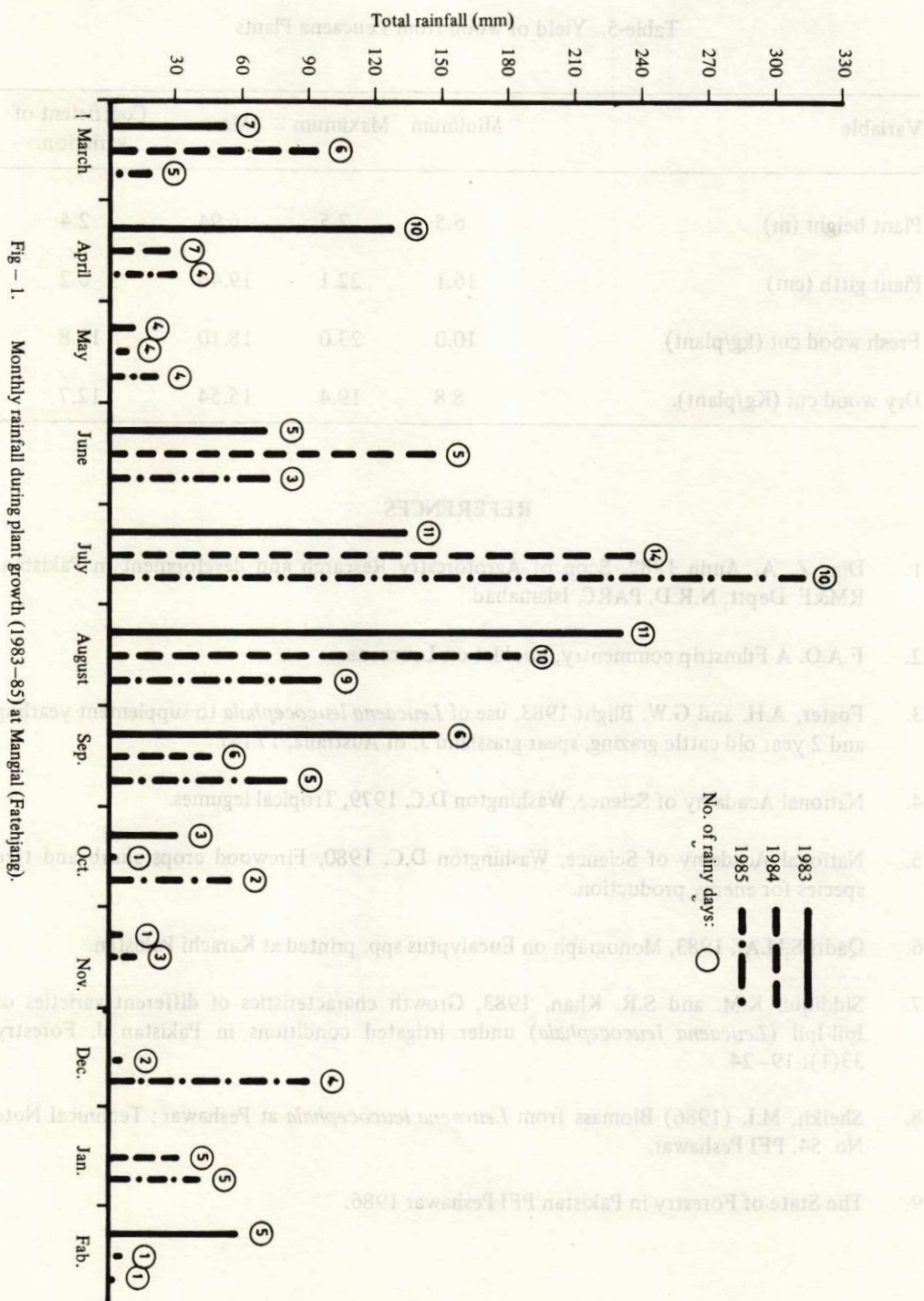
Variable.	Minimum	Maximum	Mean	Coefficient of variation.
Total increase in height (m).	4.5	6.3	5.7	3.2
Average increase/month (cm).	11.0	15.00	13.7	3.1
Total increase in girth (cm).	10.4	26.3	19.4	8.1
Average increase month (cm).	0.25	0.64	0.47	8.3

Table-5. Yield of wood from *Leucaena* Plants

Variable	Minimum	Maximum	Mean	Coefficient of variation.
Plant height (m)	6.5	7.5	6.94	2.4
Plant girth (cm)	16.1	22.1	19.46	6.2
Fresh wood cut (kg/plant)	10.0	23.0	18.10	12.8
Dry wood cut (Kg/plant).	8.8	19.4	15.54	12.7

REFERENCES

1. Din, Z. A. Amin 1982, Scop of Agroforestry Research and development in Pakistan. RM&F Deptt. N.R.D. PARC, Islamabad.
2. F.A.O. A Filmstrip commentry, booklet on *Leucaena*.
3. Foster, A.H. and G.W. Blight 1983, use of *Leucaena leucocephala* to supplement yearling and 2 year old cattle grazing, spear grassland J. of Australia, 17 (4).
4. National Acadamy of Science, Washington D.C. 1979, Tropical legumes.
5. National Academy of Science, Washington D.C. 1980, Firewood crops shurb and tree species for energy production.
6. Qadri S.M.A., 1983, Monograph on *Eucalyptus* spp. printed at Karachi Pakistan.
7. Siddiqui, K.M. and S.R. Khan, 1983, Growth characteristics of different varieties of Ipil-Ipil (*Leucaena leucocephala*) under irrigated conditions in Pakistan J. Forestry 33(1): 19-24.
8. Sheikh, M.I. (1986) Biomass from *Leucaena leucocephala* at Peshawar: Technical Note No. 54. PFI Peshawar.
9. The State of Forestry in Pakistan PFI Peshawar 1986.



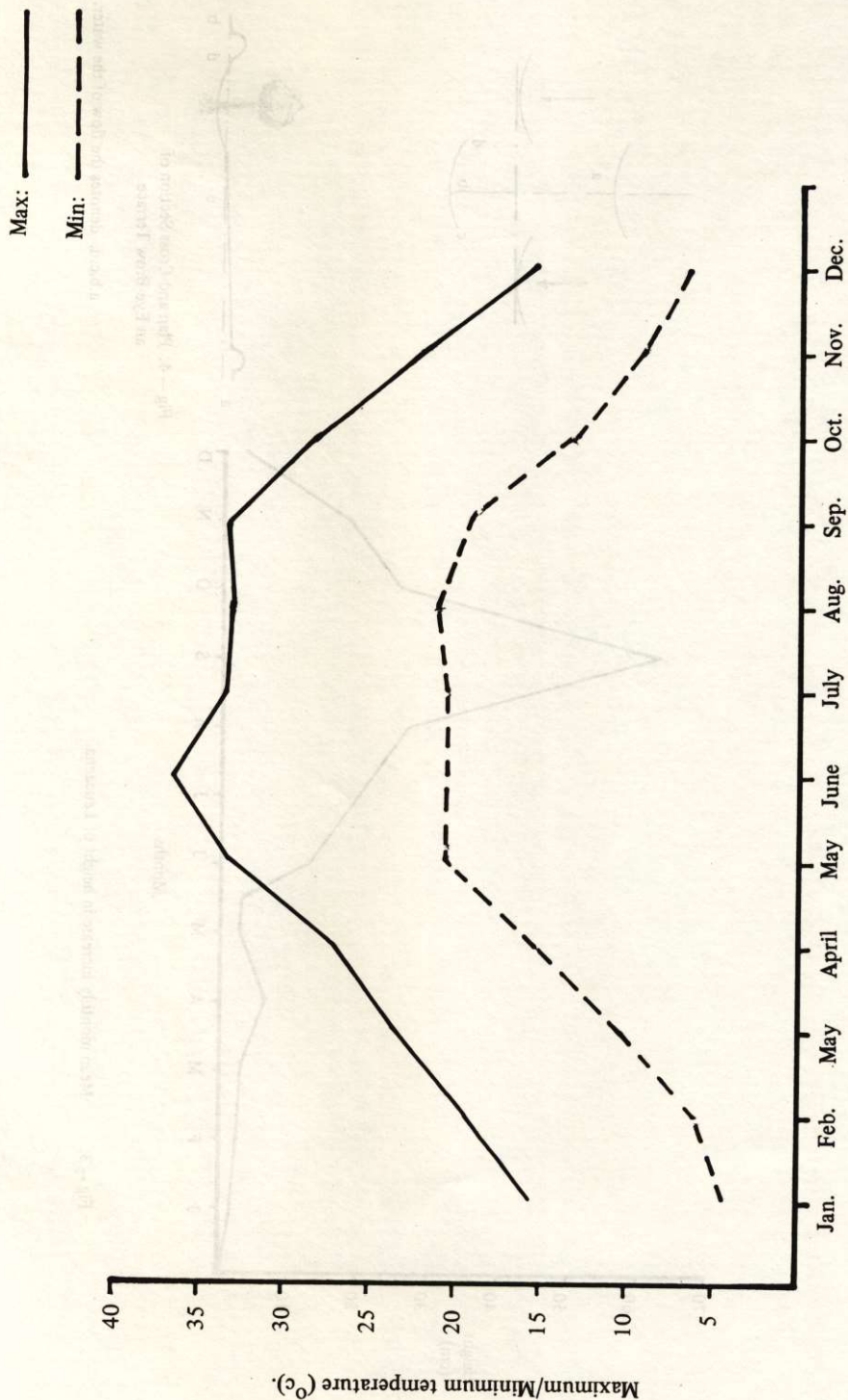


Fig - 2. Mean monthly temperature (°C) recorded at Mangial during 1983-85.

Fig. 3. Mean monthly increase in height of Leucaena.

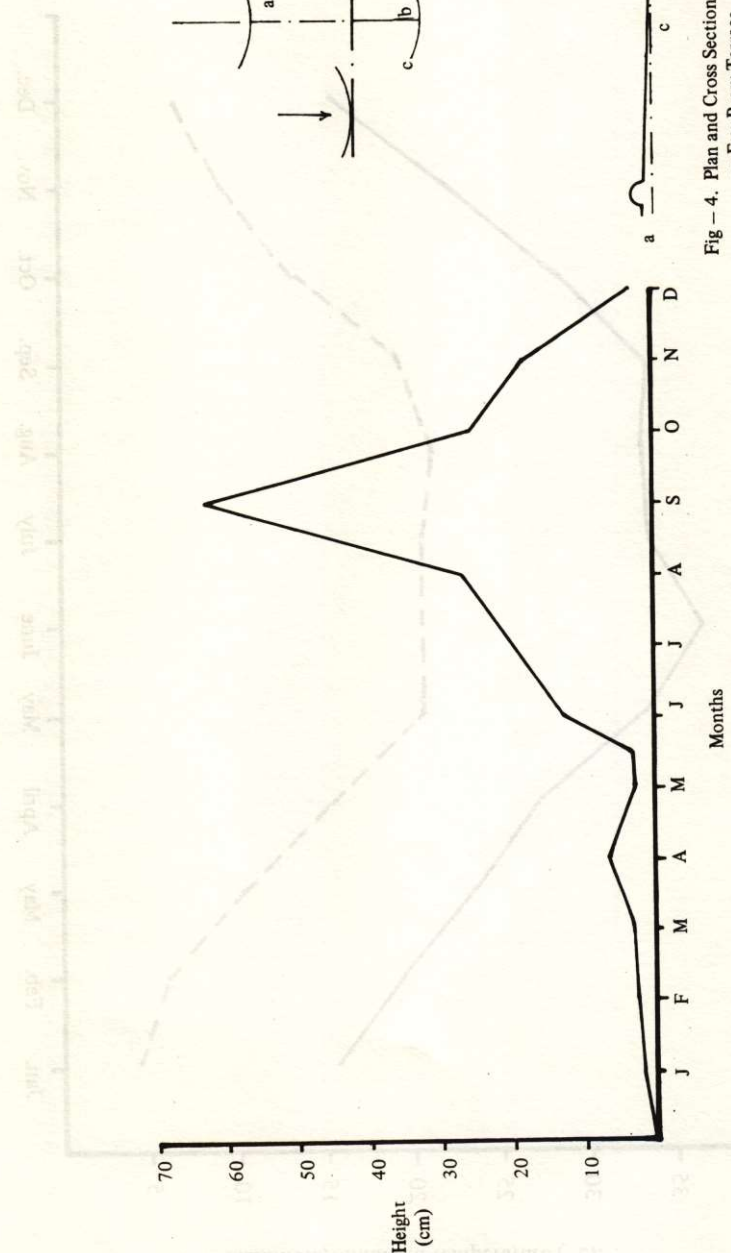


Fig - 3. Mean monthly increase in height of Leucaena.

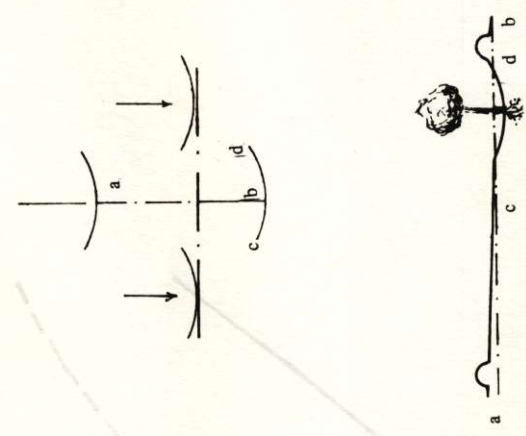


Fig - 4. Plan and Cross Section of an Eye-Brow Terrace.

a.b.c.d. denotes the flow of the water.