GROWTH BEHAVIOUR OF DIFFERENT PLANTS UNDER GULLIED AREA OF POTHWAR PLATEAU

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Abstract

Out of total pothwar area (1.82 m.h.) about 1.21 m.h. are classified as gullied lands. The unfavourable site factors i.e. shortage of moisture and plant nutrients, in these gullied lands are challenging for a desirable land management practices. Therefore, the purpose of this study was to explore the potential capabilities of the gullied land for establishment of tree plantations and also to test the adoptability/suitability of some tree species. Four tree species (*Leucaena leucocephala, Euclayptus camaldulensis, Morus alba* and *Ailanthus altissima*) were tested during the year 1983-84 at Mangial (Fateh-Jang) under rainfed conditions. The survival percentage was 86, 88, 73 and 77 whereas mean monthly growth (height) attained was 18 cm, 16 cm and 4 cm respectively.

Introduction.

Total land area of Pakistan is 79.61 million hectare (m.h) out of which 4.8% (6) is under forests but the area of productive forests is only 1.5% of total land area, yielding only 0.3 m^3/ha/year (1). A country requires atleast 25% of its area under forests for fulfilling its economic and domestic needs besides maintaining proper ecological equilibrium. Further more factors and even political leaders all over the world have recognized the need to integrate forestry into rural development on modern techniques.

About 90% of the rural and 50% of urban population in the country depends on fuel wood (1). The demand of fuel wood will increase with the increase of population of the country. The total annual consumption of timber and other wood products of the country is 1.98 million cubic meters. Out of which the state owned forests are contributing only 0.3 million cubic meters. The farm land and tribal areas are contributing 0.92 million cubic meters. while the remaining is imported (8). A foreign exchange of $ 80 million is being spent on the import of wood and wood products (6). In addition to these the annual fire wood consumption is 16.55 million cubic meters.

Area under forests is in-adequate to meet the requirements of timber and other forest products. The problem has taken its acute position due to ruthless cutting of trees and heavy grazing pressure. The removal of vegetation have subjected the soil to erosion. A study of history bears out that many flourishing countries in the past have parished due to misuse of land and destruction of vegetation. Out of the total Pothwar area (1.82 m.h.) only 0.61 m.h. is cultivated. Whereas, remaining gullied land which is mainly used for rough grazing.

The scope for extension of irrigated forest plantation is very limited due to crop competi-

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tion. However, under rainfed conditions the gullied lands (1.02 m.h.) so called waste lands, may be utilized for this purpose. The plantation under these conditions will not only provide timber/fuel wood, but will also protect soil from erosion and supply forage for livestock.

Keeping in view the increasing demands for timber and firewood utilize the waste land the study was carried out at Mangial (Fateh-Jang) to explore the possibilities for growing different plant species in gully eroded areas of Pothwar plateau.

Literature Review.

In a review of watershed works in Pakistan it was recommended that for the protection of water-shed and reduce sediment yield, cultivation should be stopped on the land with severe erosion hazard. Adopt effective soil and water conservation measures of hazardous slopes reduce intensity of grazing to enable the vegetation to recoupe. Adopt engineering techniques to reduce soil erosion and runoff (12).

KHAN (3) stated that plants can be raised through trickle irrigation planted at 7x7 meters with rainfall of 40 mm/year and temperature range of 35–50°C.

SIDDIQUI (10) studied the survival, height growth and average diameter of 52 Spp. of Eucalyptus at Peshawar. Large variation was observed for these parameters in all species. These differences were found to be highly significant for height and dia. and not for survival percent.

SHEIKH (8) tested *Acacia aneura, A. tortilis* and *Tecoma undulata* by planting at two depths (30 and 18 cm). After 1½ year it was found that 64% plants of all species survived in deep planting while in shallow planting the survival was 54%. The average height of plants was 76 cm in deep planting and in shallow planting it was 60 cm. *A. tortilis* showed better rate of growth.

In Nigeria, it has been demonstrated that the yield of maize can be increased three times without adding fertilizer when planted between rows of Leucaena trees (1).

Ipil ipil (Leucaena) is a tropical leguminous tree native to Mexico and Central America. Presently it is naturalized throughout tropics between 30°N and 30°S latitude on less arid soils upto 1500m elevation. An average growth rate of 25.9 m^3/ha/yr was recorded at Peshawar, which is much higher than that of 12 m^3 reported for commonly planted *Eucalyptus camaldulensis*. (11)

Material and Methods.

The study was carried out during 1983-84 at Mangial (Fateh-Jang) under gully land management project. The soils of the project area belongs to Rajer soil series and its eroded phase. These are moderately deep some that excessively surface drained silt loam developed in disected loess plain. The area lies on latitude 33.67 degree north and longitude 72.35 degree east. The elevation of the area is 495 m. from sea level and falls in isohyetes of 750–100 mm

and rainfall received during growth study period was 998 mm. (1983) and 961 mm (1984). About 60% of this was received during monsoon season (July–September). The rainfall distribution pattern is given in Fig. (1). The mean monthly temperature varied from 4°C (January) to 39°C (June) and its seasonal variation is depicted in Fig. (2).

The nature of gully is such that it produces maximum surface flow and a little amount of water is conserved in the soil for the plants. In addition the infiltration rate of soil and holding capacity is low in eroded areas. Therefore, under these situations dry zone afforestation techniques must be developed. One of such methods is to concentrate water received by a watershed without vegetation on a smaller area where trees are planted. This principle was tested at the project site. The land development technique consisted of eye brow terraces (Fig. 3) which were constructed fairly along the contour lines.

As in gullied areas top fertile soil has been washed out therefore, to supplement fertility and give initial and better establishment FYM @ 2 balchas/pit was added. The pits were planted with one year old seedlings during spring 1983. The detail of plant species is given in Table (1) and the characteristics of selected plants are given in Table (2). Only one hand watering was given at the time of planting and the plants attacked by white ants were treated with Dieldrin.

The planting was done at a spacing of 2.5 x 2.5 metre on the fringes of gullies bearing moderate to steep slopes. Each species was planted in separate blocks under similar conditions.

Table No. 1. Detail of plants planted at Mangial site (Fateh-Jang).

Name of species	Average plant height at the time of planting (m)	No. of plants planted	No. of plants survived as on 19-9-84	Survival percentage
Leucaena leucocephala (Ipil – ipil)	1.04	361	311	86
Eucalyptus camaldulensis (Eucalyptus)	0.88	412	364	88
Morus alba (Mulberry)	0.90	174	127	73
Ailanthus altissima (Ailanthus)	0.35	175	135	77

Randomly 10 plants were selected in each case and data in respect of growth (height and diameter) was recorded. Diameters were measured at collar level. The growth performance of different plants is given Fig. (4 & 5).

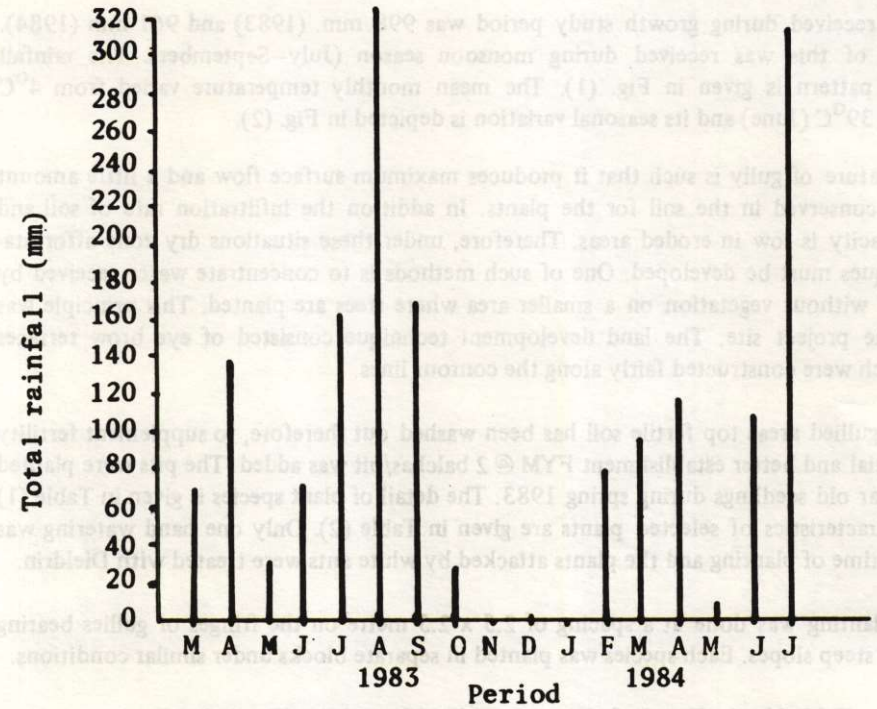

Fig. (1): Rainfall distribution pattern during the plant growth period at Mangial (Fateh-Jang).

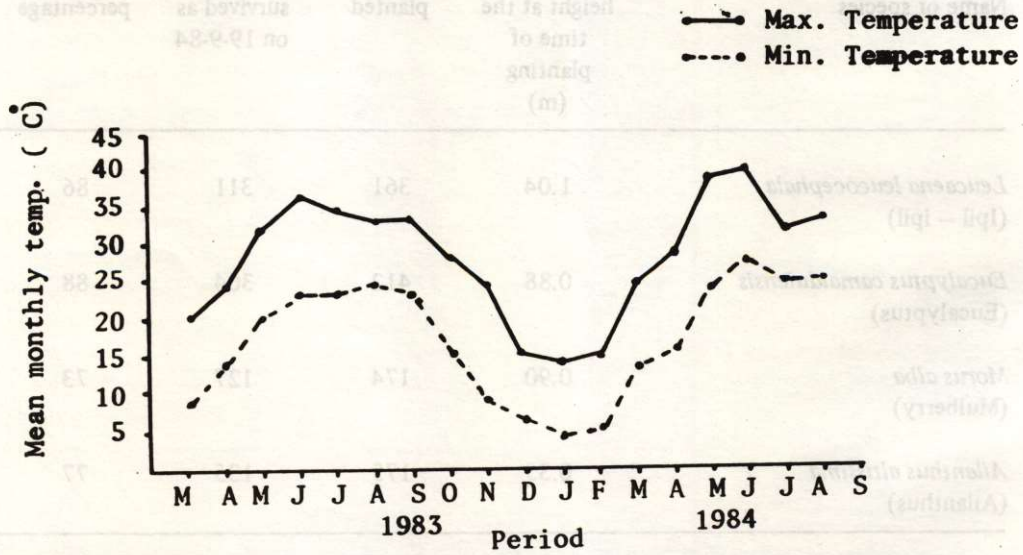

Fig.(2): Temperature variation during the plant growth period at Mangial (Fateh-Jang)

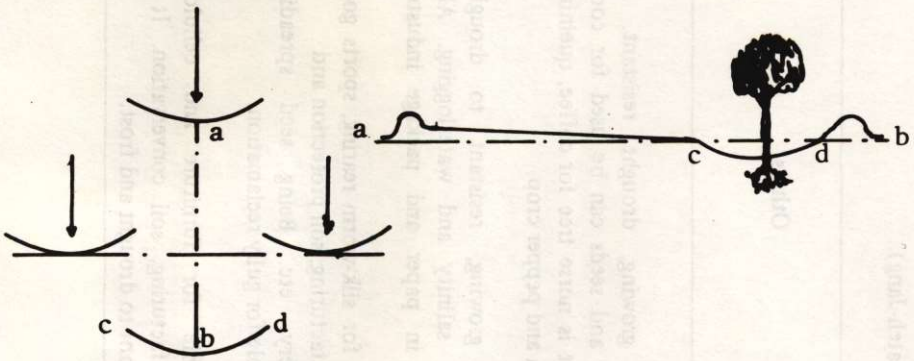

Fig.(3): Plan and Cross section of an Eye-brow terraces designed for tree plantation. Arrows indicate the direction of run-off flow.

Results and Discussion.

The rate of cumulative growth for the different species is given in Fig. (4). It was observed that the average monthly rate of growth was 18 cm, 16 cm, 5 cm and 4 cm. for Leucaena, Eucalyptus, Mulberry and Ailanthus respectively. It was further noticed that growth was faster during the months of July to September which was 44 cm, 40 cm, 14 cm and 12 cm/month for Leucaena, Eucalyptus, Mulberry and Ailanthus respectively. During the months of November through January the curves leveled off which show negligible growth. The difference among growth rate of Leucaena and Eucalyptus is non-significant whereas, it is highly significant than Mulberry and Ailanthus. As Leucaena being the only N-fixing species in the experiment has improved the soil and attained more growth as compared with others. The increase in cumulative plant girth has also shown the similar trend. However, there was negligible increase in girth from March to June at the time of planting. On the average the girth at the collar level increased @ of 0.75 cm, 0.68 cm, 0.3 cm and 0.23 cm/month respectively. The survival of Leucaena, Eucalyptus, Mulberry and Ailanthus was 86%, 88%, 73% and 77% respectively on 19-9-84 (18 months after planting).

Table No. 2. Characteristics of species planted in gullied land at Mangial (Fateh-Jang).

Name of species	Ecological zone	Economic importance				Others
		Timber	Fire wood	Fodder	N fixing	
Leucaena leucocephala (Iple – iple)	Semi-arid plains, Sub-tropical and Sub-humid.	√	√	√	√	Fast growing, drought resistant. Its fruits and seeds can be used for cooking, it is nurse tree for coffee, queinine, cocoa and pepper crop.
Eucalyptus camaldulensis (Eucalyptus)	Semi-arid plains, Sub-tropical and Sub-humid	√	√	—	—	Fast growing, resistant to drought, frost, salinity and waterlogging. Also used in paper and package industry.
Morus alba (Mulberry)	Semi-arid plains and temperate.	√	√	√	—	Used for silk-worm rearing, sports good manufacturing, soil protection and Turnery, etc. Being seed spreading suitable for gully reclamation.
Ailanthus altissima (Ailanthus)	Sub-tropical, Sub-humid and temperate.	√	√	—	—	Suitable for furniture and cellulose manufacturing, soil convervation. It is resistant to drought and frost.

REFERENCES

1. Din, Z., and A. Amin 1982. Scope of Agro-forestry, Research and Development in Pakistan. RM&F Deptt. NRD, PARC.

2. Hussain, R.W. and S.H. Abbas (1983). Provisional Yield table of *Eucalyptus camaldulensis* in Pakistan. Pak. J. For 32 (2)

3. Khan, M.I.R., 1979. Taming of the Desert in Abu-Dhabi, UAE, Pak. J. For. 29(1) 1–13.

4. Khan, S.M. and M.I. Sheikh. 1983 Annual Research Report (1983) To Develop Techniques for Utilizing Arid and Semi-arid Lands through Planting under Dry Conditions.

5. Qadir, S.A., 1983. Acreage and Yield Estimation of Agricultural Crops in Pakistan. Quarterly research review 1983, No. 4, Federal Bureau of Statistics, Statistics Division, Govt. of Pakistan.

6. Qadri, S.M.A., 1983. Monograph on Eucalyptus spp. Printed at Karachi (Pakistan).

7. Champion, S.H.G., S.K. Seth and G.M. Khattak (1965). Manual of Silviculture for Pakistan.

8. Sheikh, M.I., B.H. Shah and A. Aleem. 1982, Effect of depth of Planting on the Establishment of Trees in Arid Conditions. Pak. J. For. 32(4) 152–159.

9. Siddiqui, K.M. and H. Ahmad., 1980. Comparative Growth of 52 Eucalyptus species at Peshawar. Pak. J. For. 30(1) 18–30.

10. Siddiqui, K.M. and S.R. Khan. 1983. Growth characteristics of Different Varieties of Ipil – ipil (*Leucaena leucocephala*) under Irrigated Conditions in Pakistan. Pak. J. For. 33(1) 19–24.

11. Aleem, A. 1979 A review of Watershed Maintenance Carried out in Pakistan till June, 1978. Pak. J. For. 29(1) 53.

12. Annon, 1980., Firewood Crops Shrub and Tree species for Energy Production. National Academy of Science Washington, Dec. 1980.