

GROWTH ASSESSMENT OF SOME ARID ZONE SPECIES AND SEED SOURCES IN PAKISTAN

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Abstract

Various species of *Acacia* and *Prosopis* are considered as most suitable for hot deserts of Pakistan. In order to evaluate the performance of 24 species and seed sources of these genii, 2 field trials were established one each under arid and semi-arid conditions following RCB and single tree plot designs. The height-growth data of indigenous species were compared with exotics.

Preliminary results have shown that under arid and semi-arid conditions (rainfall between 300-900 mm per annum) exotic species like, *Prosopis chilensis*, *P. alba* and *P. pallida* exhibited 1½ to 3 times better growth than *P. cineraria* indicating the scope of improvement of exotic *Prosopis* species on marginal and low nutrient lands in the country including saline and waterlogged areas. Large scale planting of these species is therefore, recommended in the country.

Introduction

Prosopis is indigenous to west tropical, north and south America specially to Mexico, Texas, Brazil, Argentina and Chile (Sheikh, 1987). It was introduced in southern Pakistan in 1878 and was found as one of the most hardy species in the deserts of this region. In Pakistan, it occurs in areas where the altitude is around 500-600 m and annual rainfall is 200-300 mm. In areas where *Prosopis* is grown, the rainfall pattern is not only scanty but also erratic with summer temperature reaching upto 45°C (113°F). In spite of these harsh climatic conditions, the species thrives well on marginal lands. Only 2 major native species (*P. juliflora* SW and *P. cineraria* L.) are commonly found in Pakistan. Among these, *P. juliflora* is multistemmed, spiny and rarely attains tree form. *P. cineraria* is arboreal with no thorns. *Acacia* and *Prosopis* do grow well under arid and semi-arid conditions where the soil is stony with low nutrients. The species have been found to be good soil binders.

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In view of the suitability of these species in the desert areas and on account of their multipurpose characteristics, work on genetic improvement of arid zone species was initiated at PFI in mid 80,s in collaboration with Forestry/Fuelwood Research and Development Project (F/FRED). Later on with the initiation of Forestry Planning and Development Project in 1987, seed of *Prosopis* species with varying number of seed sources for each species were procured for testing under low rainfall conditions in the scrub forests of Pabbi Hills (Punjab). It is expected that these trials would not only help in reducing desertification but would also reduce the fodder/fuelwood problems of the rural inhabitants. Suitable species could also assist in stabilizing land against wind erosion which is a common feature of the deserts in Pakistan. The present paper describes the results of two trials established under arid conditions in D.I. Khan (NWFP) and under semi-arid conditions at Kharian (Punjab).

Materials and Methods

The seed of *Prosopis pallida* was received under F/FRED project in 1988. For growth comparison, seed of other 3 indigenous species (*Acacia modesta*, *A. nilotica* and *P. cineraria*) was also included as these species have been found growing well under arid conditions at D.I. Khan. The seed of 8 *Prosopis* species (20 seed sources) was also procured in 1988 and sown in April at PFI for planting under semi-arid conditions at Kharian. A geoclimatic data of field trial sites are given in Table 1. Early height growth data were recorded and analysed for further assessment.

Table 1. Geoclimatic data of planting sites of arid zones species

Sl. No.	Location	<u>Lat N°</u> <u>Long E°</u>	Alt. (m)	Rainfall (mm)	Temp. (C°)	Name of species/seed sources
1.	D.I. Khan (Arid)	<u>31.54</u> <u>70.54</u>	172	234	24.5	1. <i>P. cineraria</i> 2. <i>P. pallida</i> 3. <i>A. modesta</i> 4. <i>A. nilotica</i>
2.	Kharian (Semi-arid)	<u>32.28</u> <u>72.08</u>	170	500	24	1. <i>P. alba</i> (1574, 1575) 2. <i>P. chilensis</i> (1419, 1420) 3. <i>P. cineraria</i> (1204, 1244) 4. <i>P. flexuosa</i> (3 sources) 5. <i>P. glandulosa</i> (2 sources) 6. <i>P. juliflora</i> (1204) 7. <i>P. pallida</i> (1350, 1120, 1337, 1338 & 1351) 8. <i>P. siliquastrum</i> (1578, 1581, 1583)

Seed lot numbers assigned by FAO.

Maximum care was taken to grow seedlings under as uniform conditions as possible in the nursery as well as under field conditions. The seedlings were outplanted after attaining the age of one year. Measured quantity of water (7 liters per plant per fortnight) was provided upto 1 year for the arid zone species trial at D.I. Khan after which the water supply was discontinued. However, no water was supplied to the seedlings for the semi-arid trial at Kharian. At both sites, planting was accomplished in August, 1989 at Kharian and in February, 1990 at D.I. Khan. The field lay-out and design is given below (Table 2).

Table 2. Details of field lay-out at 2 sites

Site	Design	Spacing (m)	Trees/Plot	Reps.
D.I. Khan	RCB	2 x 2	36	3
Kharian	Single-tree plot	2 x 2	Single	20

For D.I. Khan trial the height (m) was recorded at age 2 while for Kharian, the growth was recorded at age 8. The data were statistically analysed and results are given in the following paragraphs.

Results and Discussion

Survival and height growth data on 2 year old 4 species (*Acacia modesta*, *A. nilotica*, *P. cineraria* and *P. pallida*) were recorded for D.I. Khan trial. There were significant differences ($F = 46.7$) among species (Table 3).

Table 3. ANOVA for 4 height (m) for 4 arid zone species at D.I. Khan

Sources of variation	DF	SS	MS	F
Species	3	4.2	1.4	46.7*
Replications	2	0.4	0.2	6.7
Error	6	0.2	0.03	

The Duncan Multiple Range Test showed that the height of *P. pallida* (2.34 m) was significantly different from *Acacia nilotica* (1.8 m), *Acacia modesta* (0.9 m) and *P. cineraria* (0.69 m). The h^2 value ($1-1/F$) was also high which equals 0.98 indicating the suitability of species under arid conditions of D.I.Khan. The species is also considered to improve the nutrient status of the soil as it fixes the atmospheric nitrogen through nodules. However, no such investigations on the level of N,P and K in the soil were carried out in present studies. At age 8, exotic *Prosopis* species/seed sources grown under semi-arid conditions at Kharian were also assessed (Table 4).

Table 4. Ranking of best *Prosopis* species at age 8 at Kharian

Species	Mean height (m)
<i>P. chilensis</i>	3.6
<i>P. alba</i>	3.3
<i>P. pallida</i>	3.3
<i>P. siliquastrum</i>	3.1
<i>P. flexuosa</i>	3.1
<i>P. juliflora</i>	3.1
<i>P. glandulosa</i>	2.9
<i>P. cineraria</i>	2.4

It is clear from the above table that *P. cineraria* is comparatively a slow growing species under semi arid conditions of Pakistan.

However, before any genetic improvement studies in *Prosopis* are undertaken, it would be desirable to confirm the existing taxonomic status of some species. Ffolliott and Thames (1983) declared *P. juliflora* and *P. glandulosa* var. *torreyana* and *P. pallida* as separate species. FAO (1985) also reported *P. juliflora* and *P. pallida* as separate species while F/FRED in a report (1989) has put them as synonyms. Keeping into consideration the above taxonomic

differences in the species, it is desirable to conduct taxonomic studies on *P. juliflora* and *P. pallida* separately.

Jain *et al.* (1989) observed dramatic changes in the soil chemistry four years after the establishment of *P. juliflora* in northern India. It was found that the soil pH and sodium content decreased in all horizons by planting *P. juliflora*. It was suggested that the establishment of selected tree species may ameliorate the negative impact of high salt contents in soil. Such investigations are also needed in the *P. juliflora* stands in Pakistan. Exotic *Prosopis* species/seed sources grown under semi-arid field conditions at Kharian were also assessed for their height growth.

Based upon the results of above studies it is concluded that *Prosopis* may be field planted on low nutrient soils in Pakistan to improve their physical and chemical structure. *Prosopis chilensis* and *P. pallida* may be used instead of *P. juliflora* and *P. cineraria* due to fast growth. The establishment of provenance trials in aforementioned two promising *Prosopis* species may further bring about genetic improvement in the species.

References

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