

## PAULOWNIA SPECIES TRIALS IN PAKISTAN

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### Abstract

Paulownia species comparative trials were carried out on three sites under irrigated conditions, viz; PFI, Peshawar, farmland at Garhi Saeed near Peshawar and Changa Manga irrigated plantation (Punjab). The data on diameter and height growth of trees of different Paulownia species after 5 years of planting indicated that *Paulownia catalpifolia*, *P. fortunei* and *P. elongata* are faster growing tree species than the other Paulownia species tested in the trials. Fast growth rates, sparse crowns and deep root system of these species make them ideal for planting on farmlands in Pakistan.

**Keyword:** Paulownia species, species trial, comparative trials.

### Introduction

Because of the high demand for wood and scarced forest resources in Pakistan, the need for intensifying tree planting on farm and state lands has been realized and given due importance by the governments and forest departments. However, with a parallel increase in food requirements, it is unlikely that more lands can be brought under tree plantations. Increased wood production should therefore, needs to be pursued from the perspective of higher yields from existing planted areas rather than from larger plantation areas. Similarly, agroforestry systems adding fast growing multipurpose tree species to the present farming system without reducing crop production are likely to be one of the best alternatives for enhanced wood production in the future.

It is with this view that Pakistan Forest Institute (PFI) has been endeavoring over decades to introduce the fast growing multipurpose tree species in the country

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from other parts of the world. In this contest, it was highly successful in identifying the most suitable clones of Poplar for different ecological regions of the country. The Institute continued to look for other species, which could be suitable for farm plantations and learning from the Chinese experience, Paulownia species appeared to be the most promising. Keeping this in view Paulownia Introduction Trials were carried out at various places in Pakistan during the period from 1990 to 1995. The results of these Paulownia introduction trials are presented in this paper.

## Review of Literature

Paulownia is a genus represented by nine species of fast growing trees indigenous to China and widely distributed from 22° to 40° latitude North and from 100° to 124° longitude East. Paulownia is one of the fastest growing tree species of the world. It can produce commercial timber at six years age under optimal conditions, and at 10-18 years age under normal conditions (1).

Paulownia has strong, light weight and white to straw coloured wood with low shrinkage co-efficient and resistance to warping, cracking and deformation. It is easy to plane, saw and carve. It has beautiful wood colour and grain, and is rot-resistant. An added advantage is that Paulownia can be grown in conjunction with agricultural crops. Its deciduous nature, late leaf emergence and deep root system make it a suitable tree species for intercropping (1).

Pakistan lies between 23° – 30' and 36° – 45' latitude North, the range within which all Paulownia species are found in China. A study of temperature, rainfall and soil conditions in Pakistan indicated possibility of successful introduction of some of the Paulownia species in parts of the country, if high temperature and low rainfall are compensated for by irrigation (2, 3).

## Materials and methods

One year old entire plants of six Paulownia species/sources, vizi; *Paulownia elongata*, *P. tomentosa* (China-N), *P. tomentosa* (China-O), *P. catalpifolia*, *P. fortunei* and *P. fargesii*, were planted in field trials to determine their performance under irrigated conditions at PFI, Peshawr, Garhi Saeed (Farmland in Peshawar district) and Changa Manga. Locations, soil types and climatic conditions of these sites are shown in table 1.

Table 1. Location, soil type and climatic conditions of Paulownia elimination trial sites

S. No.	Site	District	Province	Climate	Rainfall (mm)	Soil	Irrigated/ Rainfed
1.	PFI, Peshawar	Peshawar	NWFP	Cool Semi-arid	250-500	Loamy-clayey flood plains	Irrigated
2.	Garhi Saeed (Farmland)	-do-	-do-	-do-	-do-	-do-	-do-
3.	Changa Manga (Irrigated Plantation)	Kasur	Punjab	Warm, Semi-arid	-do-	Loamy clayey, Non-cal-careous flood plains	-do-

The studies were laid out February/March, 1990 in randomized complete block design with four replications. 12-20 plants per species/source per replication were planted in 70 cm x 70 cm size pits at a spacing of 5m x 6m. Mixture of farmyard manure and top soil was used to fill the lower half of pits before planting. The rest of the dug-out soil was used at the time of planting while the plants were kept erect in the centre of the pits. The plantation was irrigated immediately after planting and thereafter fortnightly irrigation schedule was followed during the summer months from April to September.

The saplings in the studies tended to give rise to low, crooked trunks and deformed crowns probably because of unproportionate ratio in the root and shoot portions. These were cut off at the ground level in February, 1991. The new coppice plants from all the species and sources but *P. fargasii* produced stems and crowns of good form.

### Data Collection and Analysis

The data on diameter (breast height) and height of trees of various Paulownia species/sources were recorded for the PFI, field trial after 5 years of planting (tables 2 and 3) and subjected to the analysis of variance. The results of this analysis are presented in tables 4 and 5.

Table 2. Mean diameter breast height (cm) of Paulownia species and sources: at age 5 years.

Reps.	P. fortunei	P. catalpifolia	P. tomentosa		P. elongata	P. fargesii
			China-N	China-O		
I	23.8	17.2	20.8	15.4	21.0	11.1
II	21.2	25.6	13.4	19.8	18.7	15.4
III	25.6	27.6	13.7	23.9	21.9	14.0
IV	27.0	25.6	16.3	23.7	20.8	14.6
Total	97.6	95.9	64.2	82.8	82.4	55.1
*Average	24.4a	24.0a	16.0c	20.7ab	20.6ab	13.8c

Table 3. Mean Height (m) of 6 Paulownia species and sources at age 5 years.

Reps.	P. fortunei	P. catalpifolia	P. tomentosa		P. elongata	P. fargesii
			China-N	China-O		
I	10.0	9.6	9.1	7.1	4.8	6.1
II	9.7	10.5	6.7	8.4	8.1	7.5
III	10.9	12.2	7.9	10.6	10.4	7.7
IV	10.8	11.0	7.7	9.5	10.7	7.8
Total	41.4	43.3	31.4	35.6	34.0	29.1
*Average	10.35b	10.82a	7.85d	8.9c	9.4c	7.3e

Table 4. ANOVA for dbh of six Paulownia species at 5 years age

Source of variation	Degree of Freedom	Sum of Squares	Mean squares	'F' Ratio
Replications	3	42.507	14.169	1.506
Species/Sources	5	361.285	72.257	7.683**
Error	15	141.078	9.405	

\*\* F value for 5 and 15 df at 0.01 probability level = 4.56

Table 5. ANOVA for height data of Paulownia species/sources at 5 years age

Source of variation	Degree of Freedom	Sum of Squares	Mean squares	'F' Ratio
Replications	3	17.88	5.96	4.354
Species/Sources	5	38.785	7.757	5.667**
Error	15	20.535	1.369	

\*\* F value for 5 and 15 df at 0.01 probability level = 4.56

## Results and Discussion

### PFI, Peshawar Field Trial

The analysis of variance indicated significant differences at 0.01 probability level among Paulownia species and sources both in diameter and height growth of trees at 5 years age.

The least significant difference (LSD) test was applied for ranking the Paulownia species and sources in diameter and height growth of trees. For ranking of Paulownia species in diameter growth, the standard error of the mean difference was worked out as 2.168. The least significant difference between means of Paulownia species/sources for 15 degrees of freedom at 0.05 and 0.01 probability levels were computed as 4.62 and 6.389 respectively. On the basis of these LSD values the species are ranked in diameter growth as follows:

Rank -a = *Paulownia fortunei* and *P. catalpifolia*

Ran -ab = *P. tomentosa* (China - O) and *P. elongata*

Rank -c = *P. tomentosa* (China -N) and *P. fargesii*

Similarly, the value of the standard error of the mean difference for height data of tree species/sources was computed as 0.827, and the LSD between mean values of height of Paulownia species were worked out as 1.76 and 2.437 at 0.05 and 0.01

probability levels. Using these values of LSD, the following ranks were allotted to various Paulownia species/sources in height growth.

- Rank –a = *Paulownia catalpifolia*
- Ran –b = *P. fortunei*
- Rank –c = *P. elongata* and *P. tomentosa* (China-O)
- Rank –d = *P. tomentosa* (China-N)
- Rank –e = *P. fargesii*

## ii) Other Field Trials

The results of the other two studies carried out in Changa Manga irrigated plantation (Punjab) and on farmland at Garhi Saeed (Peshawar district) also confirmed the findings of the PFI trial. The results of these trials are presented in the following tables (Table 6 and 7).

Table 6. Diameter and height growth of 5 Paulownia species at Changa Manga after 5 years of planting

Species	Diameter (cm)	Height (m)*
<i>Paulownia elongata</i>	17.4b	7.1b
<i>P. catalpifolia</i>	21.2a	9.5a
<i>P. fortunei</i>	21.0a	9.2a
<i>P. tomentosa</i>	16.2bc	6.3b
<i>P. fargesii</i>	14.5bc	6.0b

Table 7. Mean diameter and height of *Paulownia catalpifolia*, *P. fortunei* and *P. tomentosa* on farmland at Garhi Saeed Village at 5 years age.

Species	Mean Diameter (cm)	Mean Height (m)
<i>Paulownia catalpifolia</i>	24.8	9.3
<i>P. fortunei</i>	22.9	8.3
<i>P. tomentosa</i> (China-O)	22.1	8.2

## Conclusion

The results of Paulownia species trials carried out at PFI, Peshawar, in Changa Manga irrigated plantation (Punjab) and on farmland at village Garhi Saeed (Peshawar District) indicated high potentials for *Paulownia catalpifolia*, *P. fortunei* and *P. elongata* for planting under irrigated conditions. Because of fast growth rate, sparse crowns and deep root system, these species can be successfully incorporated into the present agroforestry systems on irrigated farmlands of Pakistan.

## References

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