

# Suitability of casuarina clone (CH-I) in Punjab: a path breaking solution for paper industries for their fibre demand & security

## Abstract

The Casuarina clones are widely used in the Southern part of India, but it is yet not well known to the farmers in North. The paper industries are using it as its raw material due to its properties that are well suited for pulping. The current study was carried out on the growth parameters of Casuarina clone CH-1 planted in the mill campus of Kuantum Papers Limited, Hoshiarpur, Punjab and apart from experimental plot at the mill there are 4 other such model plots maintained in different districts of Punjab and the character studied included its height, girth and volume at different age intervals. The carbon sequestration was also estimated after completion of two year age of the experimental trial plot. The results showed that the average height of the trees was estimated to be 2.59m, 4.36m, 5.85m and 9.81m at different age intervals i.e. 6months, 12 months, 18 months and 24 months respectively. The average girth of the plantation at different intervals was found to be 0.085m after 6 months, 0.124m after 12 months, 0.155m after 18 months and 0.238m after 24 months. The volume was found to increase over time and after completion of 2 years it was found to be 0.035 m<sup>3</sup>. The carbon and carbon sequestration estimated after two years was found to be 31 lbs (0.014 tons) and 112.44 lbs (0.051 tons) respectively. The clone displayed commendable growth making it suitable for industrial raw material purposes.

**Keywords:** casuarina, paper industry, kuantum papers limited, carbon content

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## Introduction

### Wood as raw material for paper industry

Forests not only play pivotal role in meeting the needs of increasing population for food, fodder, fuel etc. but also they are equally significant in meeting demands of industries that use wood as raw material, such as paper, ply board, veneer, packaging etc.<sup>1</sup> Pulp and Paper industry is one of the major industry that consumes wood as its raw material. The global demand of paper which was 242.79 Million Tonnes in 1990 grew to 402 Million Tonnes in 2011 i.e. it doubled in 20 years, and India is producing 10.11 Million Tonnes paper annually.<sup>2</sup> In the year 2020 the industrial demand of wood was 153 million cum on the contrary the internal market supply was 60 million cum. The demand of wood is tremendously increasing, and the supply is comparatively very low. i.e. 0.7 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup> there is a need to bridge the gap.<sup>3</sup> Species that are having short rotation period are introduced by paper industries like Eucalyptus, Poplar, Leucaena, Casuarina, Melia etc. along with Bamboo.

### About casuarinas

Casuarina is also known as Australian Pine, Beach She Oak, Whistling Pine belonging to the family Casuarinaceae, is an evergreen tree a native to Southeast Asia, Australia and Pacific Islands is gaining popularity due to characteristics such as fast growth, with short rotation period of 3-4 years both in coastal and inland areas, and also due to drought tolerance and good coppicing ability.<sup>4</sup> Casuarina spp. thrive in barren lands and make the land productive, where majority of other plant species do not grow.<sup>5</sup> It has straight and cylindrical, the bark is light greyish – brown, smooth on young trunk and rough, thick and grooved on older trees.<sup>6</sup> The major Casuarina planting states in India are Andhra Pradesh, Orissa, Tamil Nadu, Gujarat, Maharashtra,

whereas, in North India it hasn't yet gained such popularity. Punjab, a North Indian state is majorly an agrarian state, wheat and Paddy are the major crops that are cultivated here and trees like Eucalyptus and Poplar are also quite popular among the farmers of this region, still Casuarina are not adopted by them as commercial crop, this may be due to lack of knowledge. Casuarina have great potential and viable raw material to meet demands of Pulp and Paper Industries, but yet enough work hasn't been done.

### About kuantum papers limited

Kuantum Papers Limited is one of the leading paper industry in the North India with a remarkable presence of over four decades, is located in Village Saila Khurd, District Hoshiarpur of Punjab. The company has maintained its own state of art Clonal Hi-Tech Nursey with latest technology & infrastructure for production of Clonal plants of Species including Eucalyptus, Casuarina, Subabul, *Melia dubia* and Poplar to maintain a sustainable supply of raw material and for the socio- economic growth of the farmers of the region. It is the pioneer paper industry in the Northern region to introduce Casuarina in its nursery for distributing it to progressive farmers, as this species is highly suitable for pulp and paper production. KPL is currently, capable of producing 40 Lacs Clonal plants every year but the vision of the company is to increase the production to 1 crore per annum in order to meet the rising demand and to meet its key objective that is to become wood positive.

Experimental trial plot at Mill Campus and additional demonstration plots of Casuarina have been maintained in different localities to check its suitability in different regions of Punjab. Not much work has been done and very less literature is available on this aspect of this Plant. Therefore, the present study was done to check the suitability of the Casuarina Clone in the Punjab region.

## Material and methods

### Experimental site

Experimental area *i.e.* trial plot was set up in the Mill's campus, Saila Khurd, Punjab. The trial area lies in the Bist Doab region of Punjab reason being this region is semi-arid to sub-humid (Table 1).

**Table 1** Agro-Climatic Data of Experimental Site, KPL, Campus Saila

S.no.	Particulars	Values
1	Soil type	Sandy loam
2	Soil pH	7.2-7.8
3	Temperature	30°C-45°C
4	Average rainfall	55-60cm

### Germplasm material

600 Rooted cuttings of Casuarina clone IFGTB CH-1 were procured from Vapi, Gujarat. The plants were 5 month old and 10-12 inches in height (Table 2).

**Table 2** Clonal Detail – Casuarina CH-1

Clone ID	Taxa	Pedigree
CH-1	Interspecific hybrid <i>C. equisetifolia</i> x <i>C. junghuhiana</i>	Selection from fullsib family produced by control pollination between first-generation parent clones

### Treatment details

The 600 plants were planted in the month of February 2022. Now they are two years old, planted at uniform spacing of 1.5x3m.

### Collection of data

Growth parameters including height (m), girth (cm) and Volume from three replications sample plots of 10 meter each plot consisting of 28 trees for each treatment were estimated from entire experimental trial plot. The girth of the trees were measured at breast height *i.e.* 1.37 m with the help of a measuring tape.

### Management activities

The experimental trial plot was managed properly and timely pruning of lateral branches, soil working and insect pest disease management was done during growth period. At periodic intervals weeding and irrigation were done or as and when required.

### Estimation of volume

The volume was estimated using the Quarter Girth Formula as follows:

$$V = \left(\frac{g}{4}\right)^2 \times h$$

Where, V is the Volume (m<sup>3</sup>), g the GBH (m) and h is the height of the tree (m).

### Carbon & carbon sequestration

The average carbon in the tree is 50 per cent of the tree volume and the carbon sequestration rate depends upon the growth characteristics of the tree species, the conditions in which it is planted and the plant phase.

### Total green weight

According to Alexander Clark III et al.,<sup>7</sup> the algorithm used to calculate the weight of a tree is as follows:

For trees with D < 11 inches  $W = 0.25 D^2 H$ ;

For trees with D ≥ 11 inches  $W = 0.15 D^2 H$

W = Above-ground weight of the tree in pounds;

D = Diameter of the trunk in inches;

H = Height of the tree in feet. Depending on the species,

The coefficient (e.g. 0.25) could change, and the variables D<sup>2</sup> and H could be raised to exponents just above or below. However, these two equations could be considered as an “average” of all the species equations. Tree root system weighs about 20% as much as the above-ground weight of the tree. Therefore, to determine the total green weight of the tree, multiply the above-ground weight of the tree by 120%.

### Tree dry weight

To determine the dry weight of the tree, multiply the weight of the tree by 72.5%.

### Determination of tree carbon content

The average carbon content is generally 50% of the tree's total volume. Therefore, to determine the weight of carbon in a tree, multiply the dry weight of the tree by 50%.<sup>8</sup>

### Determination of CO<sub>2</sub> sequestration

CO<sub>2</sub> is composed of one molecule of carbon and 2 molecules of oxygen. Atomic weight of carbon is 12.001115, atomic weight of oxygen is 15.9994, and weight of CO<sub>2</sub> is C+2 x O= 43.99. The ratio of CO<sub>2</sub> to C is 43.99/12.001115= 3.6663. Therefore, to determine the weight of carbon dioxide sequestered in a tree, multiply the weight of carbon in the tree by 3.6663.<sup>8</sup>

## Result and discussion

This study presents the result on girth, height and volume (Table 3) at different age intervals *i.e.* 6 months (Figure 1), 12 months (Figure 2), 18 months (Figure 3) and 24 months (Figure 4). It was made sure that the plantation is regularly watered and is free from weeds. The trees were pruned as they grew.

**Table 3** Mean values of Casuarina hybrid clones (CH-1) at different age intervals

Age	Height (m) (Mean)	Girth (m) (Mean)	Volume (m <sup>3</sup> ) (Mean)
6 Months	2.594	0.085	0.001
12 Months	4.365	0.124	0.004
18 Months	5.857	0.155	0.008
24 Months	9.816	0.239	0.035
C.D.	0.176	0.003	0.001
SE(m)	0.050	0.001	0.000
SE(d)	0.071	0.001	0.000
C.V.	1.526	0.912	2.44



Figure 1 Height of (CH-I) clones after 6 Months.

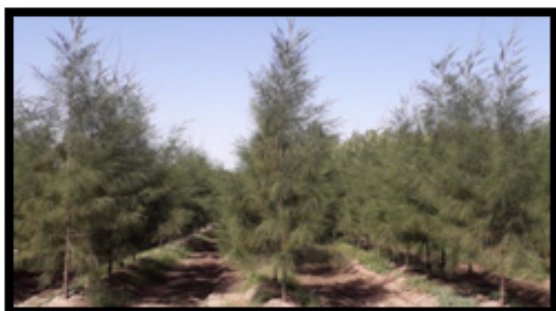


Figure 2 Height of (CH-I) clones after 12 Months.



Figure 3 Height of (CH-I) clones after 18 Months.



Figure 4 Height of (CH-I) clones after 24 Months.

The average height of the trees was estimated to be 2.59m, 4.36m, 5.85m and 9.81m at different age intervals i.e. 6 months, 12 months, 18 months and 24 months respectively (Figure 5).

The average girth of the plantation at different intervals was found to be 8.5cm after 6 months, 12.4cm after 12 months, 15.5cm after 18 months and 23.8cm after 24 months (Figure 5). The tree growth characters have shown great variation throughout the two-year period of growth.

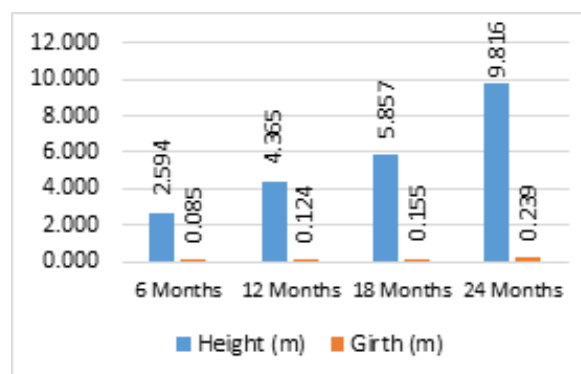


Figure 5 Height and Girth of CH-I clones at different ages.

Volume (Figure 6) of the plantation after two years was estimated to be 0.035 m<sup>3</sup> and the findings are in line with findings of Garg RK *et al.*,<sup>9</sup> The carbon and carbon sequestration estimated after two years was found to be 31 lbs (0.014 tons) and 112.44 lbs (0.051 tons) respectively, and the findings are in line with the results obtained by Berry N and Shukla A.,<sup>10</sup>

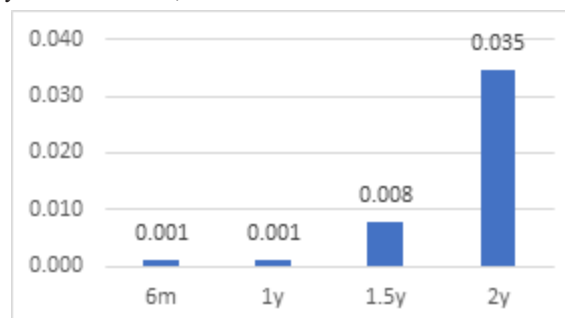


Figure 6 Volume (m<sup>3</sup>) of CH-I clones at different ages.

## Conclusion

The overall growth parameter of Clone CH-I has displayed great results, making it a suitable species for the paper industries and is a potential substitute to other species that are grown by the farmer for same objective. Not only this experimental plot but the company has established multiple other Casuarina trial plots in the various districts of in order to ensure its suitability in the region. The current findings are showing that this tree can be easily cultivates and promises excellent returns as well.

The industrial wood demand has substantially increased over years and it is the need of the hour to focus on plantation so that there is a sustainable supply of raw material throughout and casuarina in this context is a promising species. This will be path breaking species in Punjab where so many paper industries are facing raw material shortage. The farmers of Punjab if adopt Casuarina they will get multi benefits in term of revenue from their wood as well as it will be helpful to improve their soil. Casuarina plantation will not only restore degraded lands but also it would provide solution to prevent soil erosion and stabilize the soil. With properly implemented sustainable planting and harvesting practices monoculture can be prevented, ensuring the health of ecosystem and enhancing biodiversity of the region. In Punjab, still there is a need for developing approaches to integrate casuarina into multifunctional landscapes that support biodiversity and provide economic benefits. Further Industry particularly have to come forward to promote this species on a large scale which can meet their wood requirement. It has no doubt that

at present there is an acute shortage of wood in the country. In such scenario major plantation activities by selecting suitable species like Eucalyptus, Poplar and Casuarina can solve this problem to a great extent in the coming years.

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## Conflicts of interest

The authors declare that there are no conflicts of interest.

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## References

1. Hussnain M, Maheswarappa V, Hegde R, et al. Evaluation of early growth and morphological variation in Casuarina hybrid clones. *International Journal of Current Microbiology and Applied Sciences*. 2020;9(9):950–958.
2. Kulkarni HD. *Pulp and Paper Industry Raw Material Scenario-ITC Plantation Case Study*. ITC Limited Sarapaka, Bhadrachalam, District Khammam. 2013;25(1):79–89.
3. Samy A, Meena RK, Kumari T. Growth of wood based industries through industrial agroforestry in India. *The Agriculture Magazine*. 2022;1(10):131–134.
4. Vairamani T, Rajendran K. Growth performance of Casuarina junghuhniana seedlings inoculated with biofertilizers. *International Journal of Pharmacy and Biological Sciences*. 2021;11(3):139–144.
5. Warriar KCS, Vamadevan T. Assessing the performance and adaptability of international provenances of *Casuarina equisetifolia* grown in India. *International Journal of Plant and Soil Science*. 2023;35(18):1999–2007.
6. Ravi R, Buvaneshwaran C, Venkatesh A, et al. Growth and productivity of *Casuarina equisetifolia* in farmlands. *Indian Journal of Agroforestry*. 2013;15(1):36–44.
7. Alexander Clark III, Joseph Saucier R, McNab WH. *Total-Tree Weight, Stem Weight, and Volume Tables for Hardwood Species in the Southeast*. Research Division; Georgia Forestry. 1986.
8. Tooche EC. Carbon sequestration: how much can forestry sequester CO<sub>2</sub>? *Forest Res Eng Int J*. 2018;2(3):148–150.
9. Garg RK, Sra MS, Nicodemus A, et al. Evaluation of interspecific hybrid clones of Casuarina for adaptability and growth in arid and semi-arid regions of North- West India. *Journal of Environmental Biology*. 2022;43(2):317–325.
10. Berry N, Shukla A. Assessment of growth performance of *Casuarina equisetifolia* clones in tropical region of Jabalpur district of Madhya Pradesh, India. *International Journal of Environment and Climate Change*. 2023;13(11):266–271.