Indian Journal of Plant Sciences ISSN: 2319–3824
An Open Access, Online International Journal Available at http://www.cibtech.org/jps.htm
2020 Vol. 9, pp.31-35/Tomar and Srivastav
Research Article

EARLY GROWTH PERFORMANCE OF *POPULUS DELTOIDES* CLONES IN PRAYAGRAJ

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ABSTRACT
To assess suitability of poplar clones, specifically for eastern Uttar Pradesh region twenty poplar clones viz . G- 48, AM -48, AM- 49, AM -41, BR -510, AM -50, FS -18, FS -190, FS -155, L -90, L -87, L -89, S_7 C_1, S_7 C_{15}, S_7 C_{20}, S_7 C_4 , L-200-84 Udai, Kranti, Bahar were tested in Prayagraj. This paper, analyzed early first two year growth of poplar clones. The trial was established in February 2018 by the clones procured from Forest Research Institute (FRI), Dehradun and Wimco seedlings ltd. The performance of twenty clones were tested on the basis of height and dbh. The highest height was recorded in poplar clone L-200-84 (9.98 m) followed by Udai (9.57 m). The clone Udai recorded maximum gbh (9.74 cm) followed by L-200-84 (9.16 cm). The clones viz. L-200-84, Udai and Kranti are doing quite well whereas AM and BR series clones showed poor performance. The performance of G-48 was inferior for growth increments as compared to other clones. The results of early growth performance indicated that out of twenty clones, Wimco seedlings ltd. clones gave superior results for growth indicators as compared to others clone tested.

Keywords: *Poplar, Performance, Trial, Clones*

INTRODUCTION
In India, the term 'poplar' is used synonymously with *Populus deltoides*, an exotic species introduced from North America during the early 1950s (Kumar *et al.*, 2017). It has gained much popularity as commercial timber tree, due to multifarious uses, market potential and fast rate of growth. Its wood is of good quality with white colour, lack of smell, good workability, even grained, light weight and resistance to splintering. Its wood is used in preparation of packing cases, matches, plywood, particle board, pulp and paper, ice cream sticks tooth picks, sports goods, artificial limbs, furniture, 'khas' of desert coolers, shuttering material, fuel and fodder (Siddiqui, *et al.*, 1986; Sheikh, 1993). Poplar is the major species behind the development of a vibrant plywood industry in north-west India. It is also used to a significant extent in match industry. The waste wood is used for making paper or as fuel. Every year poplar in non-forest area produces 1.20 million m^3 wood for making plywood. It is thus saving 43,000 ha natural forests or 13,500 ha forest plantations from felling every year to produce the same quantity of wood. Farmers are earning handsome profits from nursery as well as plantation activities. Profits to the tune of 38.8 per cent to 100.9 per cent of investments, depending upon scale of operation, are reported from raising of nursery stock within one year. In plantations, benefit: cost ratio of 1.92:1 and 2.13:1 are reported with pure poplar and with poplar + intercropping in a period of 7 years. Under world trade organization (WTO) poplar wood has been recommended as packing material. After the implementation of WTO its wood demand and market potential will enhance manifolds (Khan and Chaudhry, 2007). Poplar is deciduous, remains leafless during winter months and combines very well with most of the winter season agricultural crops (Jain, *et al.*, 1999). Owing to the higher market price that poplar wood fetches (about 3-4 times that of Eucalyptus wood) and certain other factors, the farmers cultivate poplar within agricultural fields with arable crops like wheat, sugarcane, turmeric, potatoes, tomatoes, vegetables, berseem, maize fodder, etc. It gives good returns in short rotation of 6-8 year (Sharma, 1996). Its fast rate of growth, ease of establishment, easy marketing, no fruiting and multifarious uses make poplar the most popular tree species for agroforestry systems. Usually farmers grow poplar trees on their farmlands in linear or block

fashion. In block form mostly intercropping is done for initial 2-3 years only. Afterwards crop yields start declining and farmers stop growing crops in poplar blocks (Hussain *et al.,* 1999). Due to this inability of growing agricultural crops farmers feel that their land has become unproductive and they do not pay proper attention to their tree crop. As a result the tree-growth slows down, area becomes infested with weeds, wood quality reduces and trees take more time to gain required dimensions.

This species has ushered in revolution in production forestry in the country and contributes substantially to rural economy and sustainable forestry. Poplar trees are planted in various spatial arrangements with agricultural crops and they add up to about 60,000 ha equivalent of pure plantations of this species. Although loss in crop yield is noticed close to the trees, yet the overall productivity in the entire fields is increased. Poplar grows fast attaining about 25 m height and 30 cm dbh in 6 to 8 years. The average m.a.i. of poplar plantations is 20 to 25 m^3 /ha/year.

In view of the economic and social importance of poplar in India, R&D work for increasing the productivity of poplar plantations is underway in different institutions in the country. The Forest Research Centre for Eco-rehabilitation (FRC-ER) at Prayagraj also took an initiative with the help of financial support from Council of Science and Technology, Lucknow to select some promising clones of poplar suitable for eastern U.P.

MATERIALS AND METHODS

The trail in Prayagraj was carried out in the experimental field of Forest Research Centre research nursery situated at latitude $25^0$07' to $25^0$10'N and longitude $81^0$54' to $81^0$58' E and at 98 m elevation The experimental site was prepared by ploughing 4-5 times with tractor mounted cultivator, followed by planking and leveling. Trial was established by poplar cuttings in the first week of February in 2018 taken from stems of one-year-old plants grown in nursery.Clones AM-48, AM-49, AM-41, BR-510, AM-50, FS-18, FS-190, FS-155, L-90, L-87, L-89, S_7C_1, S_7C_{15}, S_7C_{20}, S_7C_4 and L-200-84 were collected from Silviculture division of Forest Research Institute, (FRI) Dehradun and three clones procured from WIMCO seedlings ltd. Bareilly viz. Bahar, Udai, Kranti. G48 was taken as control and collected from local nursery. Cuttings of size 22 cm length and 2 to 3.5 cm diameter were planted in pits. Cuttings were Pre-treated with fungicide & insecticide. The study was laid out using RCB design and replicated three times. Ten plants per row was planted with a spacing of 3 m X 3 m. Good compaction and ramming of the plants was done after planting. First irrigation with canal water was given immediately after planting. After 24 hours of irrigation the leaning and wind fallen plants were straightened by adding and compacting more soil. The orientation of rows was south-east to northwest. Urea was applied at the time of first and third irrigation in equal doses. The data regarding tree diameter (cm), tree height (m) were recorded in the month of April during the year 2019 and 2020 at the age of one and two years.

P. deltoides grows better on well-drained fertile soils with a neutral soil pH (Kumar *et al.,* 2017) The soil analysis was done for pH, EC, organic carbon and NPK contents using standard procedures (Jackson, 1985). The annual increment of each clone was calculated using all the growth parameters for diameter at breast height (dbh) and height for two year of planting to assess early growth performance of planted poplar twenty clones.

RESULTS AND DISCUSSION

Tree growth is function of age, spacing and site quality (Nissen, *et al.,* 2001). The growth of poplar tree is reflection of many factors, viz. genotype, climate, soil conditions, care of trees, use of fertilizers, frequency of cultural operations and irrigation schedule. The results of early growth performance evaluation of these clones after two year of planting were carried out for mean annual measurements of total height and dbh (Figs.1 & 2).

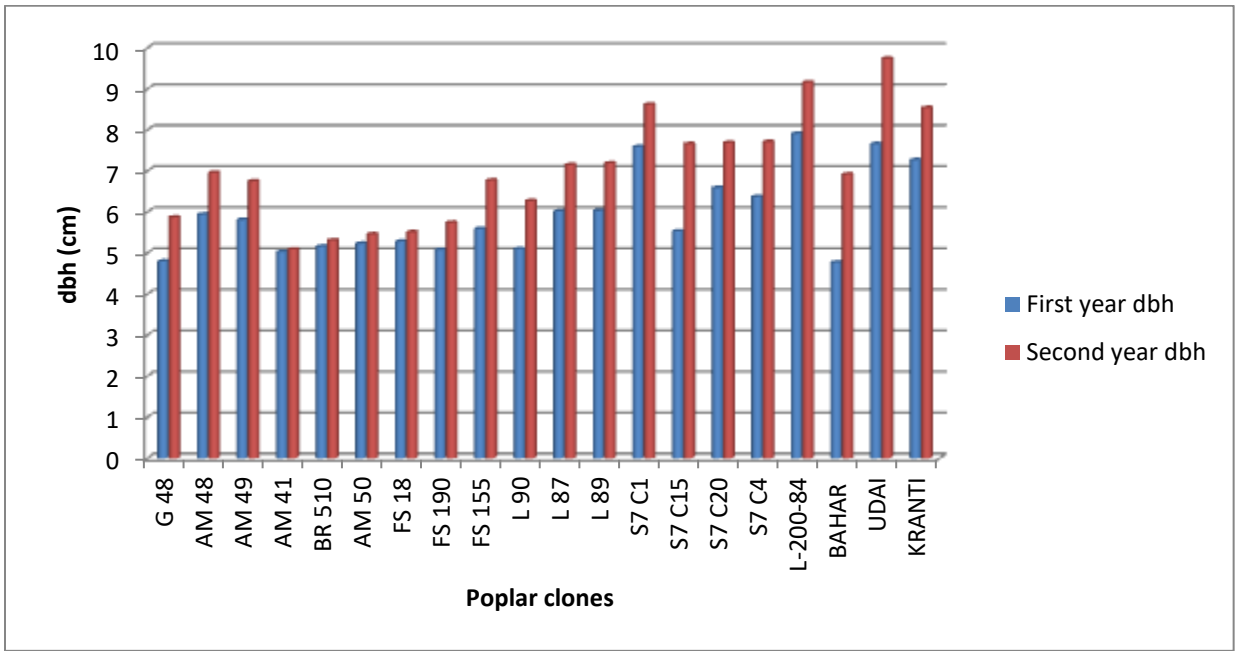

Figure1: Annual increment in dbh (cm)

The highest value of annual increment in dbh belonged to clone Udai (9.74 cm) followed by L-200-84 (9.16 cm), S_7C_1 (8.62 cm), Kranti (8.54 cm) and S_7C_4 (7.71 cm) whereas FRI clones (AM & BR) performed poor. The lowest values belonged to clone AM 41 and BR 510 with 5.09 cm and 5.31 cm respectively. These differences in dbh between clones within a site may be attributed to genetic difference (Wamalwa *et al.*, 2007). The soil analysis of the field trial indicated pH 7.5, EC 0.68 mm/cm, organic carbon 0.40%, Nitrogen 90 kg/ha, Phosphorus 18 kg/ha and Potassium 268.8 kg/ha.

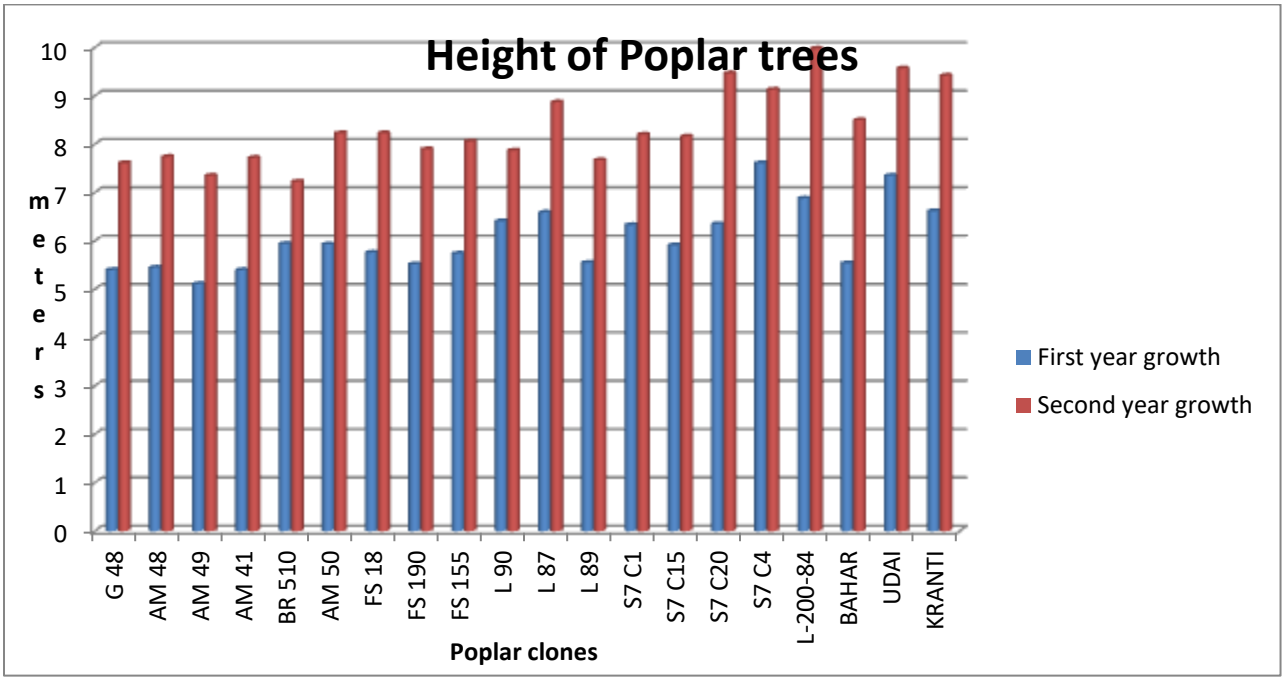

Figure 2: Annual increments in height (m)

The clones with good annual increment in height were L200-84 (9.98 m) followed by Udai (9.57 m), S_7C_{20} (9.47 m), Kranti (9.42 m) whereas in FRI series, AM 50 and FS 18 (8.23 m) performed superior over other FRI clones. The survival of plants was in range of 96-100%. Survival in general is influenced by several factors, which include site management, especially the weeding frequency and the protection of the seedlings from pests and diseases, drought and handling during planting period (Kahunyo, 2008). The performance of G48 was inferior for growth increments as compared to other clones. The remaining clones had different ranks of dbh and height increments as compared to the G48**.** The results of early growth performance indicated that out of twenty clones, L200-84, Udai, Kranti gave superior results for growth indicators as compared to others clone tested. Kumar *et al*., (2017) also reported same results in different clones through nursery performance. They observed that clone Udai overtook all other clones and showed maximum height growth, collar diameter and number of branches after six months and after one year. Other clones viz., S_7C_1, Bahar, S_7C_8 were considered significantly promising clones. Clones FRI-AM-81, FRI-AM-37 had poor performance as compared to other clones. The poor performance in all the clones has been due to non-application of any fertilizer to the soil or due to their genetic make-up. Kumar *et al*., 2017 also observed that all three Wimco seedlings ltd. clones showed significantly better growth performance in the nursery over other clones. Various workers had also studied the performance of *Populus deltoides* clones under nursery conditions and reported similar results. Verma and Bangarwa (2003) suggested that WIMCO seedlings ltd. clones had better growth characters than Lal Kuan clones of Uttarakhand. Toky *et al*., (1996) also studied the performance of various clones and observed a lot of variation in the growth parameters of different *Populus deltoides* clones. Rawat *et al.,* (2001) earmarked eleven clones as best and twelve as potential clones on the basis of nursery screening. Similar results was also reported by Karnatka and Chandra (1995) that growth performance of five clones, viz., Udai, Kranti, Bahar, 72/58 and ST-74 had come close to clone G-48 and clone Udai and Kranti performed better than Bahar.

CONCLUSION

The results of study confirm that three clones of Poplar, out of which two belongs to Wimco (Udai and Kranti) were better suited to growth at early stage in Prayagraj region. However, these were early growth results, with expected low juvenile mature correlations and growth monitoring will continue in this trial series for confirm assessment of promising clones for the region. The identification of promising clones for the region will open a new path for farmers to adopt this species more widely in agro forestry as suitable planting material of Poplar will be a boon for local farmers for strengthening their economic level through agro forestry. Assessment of performance of poplar clones in future years will be helpful for identification of promising clones for the specific region, thus, planting stock of desired clones may be raised for their further cultivation in field. The expansion of plantations of poplar in agro forestry will be helpful in reducing pressure of forests and increasing trees outside forests.

ACKNOWLEDGEMENTS

This work was financially supported by Council of Science and Technology, Lucknow. Uttar Pradesh

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