Effect of Growth Regulators and Potting Media on Morphological and Biomass Traits on G_{48} Clone of Poplar

Abdul Nasir[1] and Afaq Majid Wani[2]

[1]College of Forestry & Environment,
Allahabad Agricultural Institute-Deemed University, India

[2]Corresponding Author: College of Forestry & Environment,
Allahabad Agricultural Institute-Deemed University, India

ABSTRACT--- ***The study was conducted on "Effect of Different Growth Regulators and potting media on morphological and biomass traits on G_{48} clone of poplar" in the forest Nursery and Research Centre (School of Forestry and Environment) of Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad. The cuttings were obtained from the forest Nursery, School of Forestry and Environment with 15 cm length and without any branches and flowers. The experiment was laid out in Completely Randomized Design (CRD). There were six treatments including control replicated four times in which several growth regulator control (distilled water), IBA(100 ppm), IAA (100 ppm), NAA (100 ppm), GA_3 (100 ppm), 2,4-D (100 ppm) were used with 10 cuttings per replication. Among the different treatments the most effective growth regulator was T_1 (IBA 100 ppm) which gave better results with diameter, leaf area. number of root, shoot length, root length, shoot fresh weight, root fresh weight, root dry weight, total biomass compared to control and other treatments, so it can be recommended that IBA as a most effective growth regulator among the all treatments.. In potting media there were seven treatments with three replications and the combinations were control Soil: Soil: FYM: Sand 1:1:1, Soil: FYM: Neem cake 1:1:1, Soil: FYM: Vermicompost 1:1:1, Neem cake: sand: Vermicompost 1:1:1, Neem Cake: Soil: Vermicompost 1:1:1, Neem cake: FYM: Vermicompost 1:1:1. Among all potting media combinations most effective treatment was T_1 (Soil: Sand: FYM 1:1:1) which shows better results in sprouts/cutting, survival percentage, diameter, leaf area, shoot dry weight, root fresh weight, compared to control or other treatments so it can be recommended that the combination of (Soil: Sand: FYM 1:1:1) as effective treatment for the growth of poplar cuttings. Hence it has been concluded that IBA with 100 ppm and combination of Soil: Sand: FYM (1:1:1) can be recommended to obtain best growth and development for poplar cuttings.***

Keywords-- Vermicompost, potting media, growth regulators, clone, poplar

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1. INTRODUCTION

The use of vegetative propagation of trees is a tool and their domestication has a long history. In order to meet the huge annual targets there is a need to raise a large amount of seedlings in the nurseries. Therefore quality of planting material is most important for establishment of successful plantation. The production of quality nursery stock constitutes one of the major factors for the success of any tree planting programme.

Poplar (*Populus deltoides*) belongs to the family Salicaceae. It is a very important taxonomical group of tree species in plantation forestry because it is a deciduous fast growing. The tree crown intercept rains, acts as wind breaks and thus checks soil erosion and minimizes the effects of wind on associated crops. Poplar is a large tree reaching well over 25 m height and 100 -130 cm. in girth (at breast height) in a period of 10 -12 years. It possesses shallow rooted and the root system spreads widely. Poplar species are light demanding plants and are susceptible to drought. Though they grow well on sites with higher water table, but cannot withstand water logging. The growth is optimal under irrigated conditions. They prefer deep well drained, workable and nutrient rich soils. The pH should be range 5.5 to 7.0 and do not tolerate acidic soils, they are fire tenders and susceptible even to light fire. Poplar favors inter-cultivation of agricultural crops throughout the rotation. Poplar can produce biomass in a short rotation intensive culture and other deciduous or evergreen species (Dickmann and Stuart, 1983).

It is planted in the plains of North West India i.e; Western Uttar Pradesh, Punjab and Haryana and to some extent in outer plains/valleys of Jammu and Kashmir, Uttaranchal and Himachal Pradesh, It has been successfully cultivated as a forest crop or agro-forestry crop in Punjab plains and in Terai region of U.P. Poplars have been raised at slightly lower latitudes also, but it is only above 29°N that they had fair success in experimental plantations and on farms.

In India poplar occupies an important place amongst fast growing tree species due to its multiple uses and its cultivation has specifically gained importance in social forestry and agro forestry practices.

The species is suitable for making general purpose plywood, marine plywood, concrete shuttering plywood. The timber is used principally for lumber, veneer, pulpwood, excelsior, and fuel (Laver, 1981). Poplar is widely used for shelterbelt, windbreak and amenity plantings. Recently, it has been championed as one of the leading potential species for silviculture biomass production. Salicylic acid, derivable from this species, is used as a coupling agent in dye intermediates (Behan, 1981).

Plant growth regulators have been exploited profitably to alter plant archetype to achieve higher yields and quality in intended species. These are the chemical substances which are needed in small quantity for fine tuning of various physiological processes. It has been widely demonstrated that extremely minute concentrations of plant growth substances have the potential to regulate several phases of plant growth and development spanning from seed germination, plant growth, flowering, fruiting, seed formation through senescence and development. The present study was initiated to know the effect of different growth regulators (IBA, NAA, IAA, GA_3, 2,4-D) on cuttings of poplar.

2. METHODS AND MATERIALS

The field experiment was conducted at Forest Nursery, School of Forestry and Environment, Allahabad, Sam Higginbottom Institute of Agriculture, Technology and Sciences Allahabad during the period of 2012-13. The potting media was *viz*, neem cake vermicompost and farm yard manure. The growth hormones used for stem cutting were IBA, NAA and GA_3. Solution of auxins was made and cutting of G_{48} clone of poplar were soaked in growth regulators for 24 hours before planting. The cuttings of G_{48} clone of poplar were treated with test compounds by dipping their basal 3.5 cm portions in various rooting regulators solutions for 24 hours at room temperature (20±1 ^{0}C). The solutions included Indol-3-Butyric Acid (IBA; 100, ppm), and α- Naphthalene acetic acid (NAA; 100, ppm) Gibberellic acid (GA_3; 100, ppm) and the basal portion of the cutting was cut off and dips into the distilled water for 24 hour (Hartman and Kester, 1960). The potting media were prepared according to different treatments of potting media. *viz.* Neem cake, vermicompost, Soil, Sand and FYM. at the ratio of 1:1:1. The Observations which are recorded on the following morphological and biomass traits are a) survival percentage, b) number of roots, c) root length, d)root shoot ratio, e) total biomass, f) sturdiness quotients and g) dickson quality index.

The experiment was laid out by Completely Randomized Design (CRD) replicated 4 times. In each replication, 10 cuttings were raised accordingly and data are recorded immediately after the cuttings emerged. The data were recorded during the course of investigations and subjected to statistical analysis of variance as suggested by Fisher and Yates (1963).

3. RESULTS AND DISCUSSION

The maximum survival percentage was shown by T_2 (92.50%) followed by T_1 (90%), and the minimum by T_4 (47.50%). Number of roots showed maximum result of (23.45) in T_1 followed by T_3 (23.35) however minimum was observed in T_5 (17.85) .Maximum root length was recorded in T_5 (51.77cm) followed by T_3 (50.90cm) and minimum was observed in T_0 (40.85cm).Total biomass showed maximum result of (52.11g) in T_1 followed by T_2 (41.37g) however minimum was observed in T_4 (19.41g). and showed that maximum value was recorded for sturdiness quotient (14.25) in T_4 followed by T_1 (11.05), and minimum sturdiness quotient (7.71) was observed in T_2. Dickson quality index showed maximum result of (5.40) in T_1 followed by T_2 (5.26) however minimum was observed in T_4 (1.83).

Table 1. Effect of different growth regulators on different traits of G_{48} clone of poplar

Treatments	Survival percentage	Number of roots	Root length	Root/ Shoot Ratio	Total Biomass	Sturdiness quotients	Dickson Quality Index
T_0 -Control	80.00	19.50	40.85	0.71	36.07	10.12	3.34
T_1 – IBA	90.00	23.45	50.00	0.52	52.11	11.05	5.40
T_2 - IAA	92.50	22.85	46.40	0.49	41.37	7.71	5.26
T_3- NAA	82.50	23.35	50.90	0.85	26.36	8.63	3.74
T_4 -GA_3	47.50	18.56	43.94	0.74	19.41	14.25	1.83
T_5 -2, 4, D	87.50	17.85	51.77	0.89	33.38	8.52	3.95
F- test	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Ed. (±)	**7.64**	**1.52**	**5.32**	**0.23**	**8.06**	**1.61**	**1.22**
C.D. at 5%	**16.04**	**3.20**	**10.84**	**0.48**	**16.93**	**3.39**	**2.57**

The maximum value was recorded for survival percentage (70%) in T_1 followed by T_3 (66.67%),) and minimum survival percentage (10.00%) was observed in T_4 and T_5. Number of roots showed maximum result of (24.53) in T_3 followed by T_6 (18.37) however minimum was observed in T_5 (4.00) .Maximum root length was recorded in T_3 (35.00cm) followed by T_1 (27.93cm) and minimum was observed in T_2 (6.87cm). However, maximum value was recorded for root/shoot ratio (0.85) in T_4 followed by T_1 (0.80), and minimum root shoot ratio (0.31) was observed in T_6.Total biomass showed maximum result of (21.63g) in T_1 followed by T_3 (19.83g) however minimum was observed in T_5 (3.70g). Maximum value (17.77) for Sturdiness quotient was recorded in T_2 followed by T_4 (13.74), and minimum (6.97) was observed in T_0. . Dickson quality index showed maximum result of (2.34) in T_1 followed by T_6 (1.98) however minimum was observed in T_2 (0.24). The best performance of the rooted cuttings in the medium may be due to nutritionally better medium, containing organic material that resulted in maximum survival, length of root (Table 2). Mathad and Nalwadi (1989) reported that decomposed organic material improve soil fertility by increasing soil aeration, water holding capacity and water infiltration and lower surface crusting. Similarly the poorest performance of rooted cuttings in control may be due to nutritionally poor medium, lacking in organic material that resulted in minimum survival, thereby reducing the plant survival and growth. Ahmad and Qasim (2003) found that potting media containing FYM, poultry manure as main source of organic matter with sand, silt and saw dust were better than sole factor of soil itself as these combinations presented more growth and vigor of the plants improving total available nitrogen and phosphorus. Similar findings have been reported previously by Rahman and Ishtiaq (1996).

Table 2. Effect of different potting media on the different traits of G_{48} clone of poplar

Treatments	Survival percentage	Number of Roots	Root Length	Root/Shoot Ratio	Total Biomass	Sturdiness Quotient	Dickson Quality Index
T_0	60.00	15.93	24.20	0.60	13.61	6.97	1.82
T_1	70.00	17.33	27.93	0.80	21.63	8.17	2.34
T_2	11.67	4.97	6.87	0.74	4.37	17.77	0.24
T_3	66.67	24.53	35.00	0.50	19.83	10.34	1.81
T_4	10.00	4.97	8.13	0.85	4.37	13.74	0.47
T_5	10.00	4.00	9.30	0.76	3.70	12.77	0.28
T_6	53.33	18.37	25.33	0.31	15.34	8.49	1.98
F- test	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Ed. (±)	**11.02**	**1.96**	**2.80**	**0.11**	**5.42**	**2.03**	**0.50**
C.D. at 5%	**23.14**	**4.12**	**5.88**	**0.23**	**11.39**	**4.26**	**1.04**

T_0 – CONTROL T_1 - SOIL:SAND:FYM T_2 - SOIL:SAND:NEEM CAKE T_3 - OIL:SAND:VERMICOMPOST
T_4 - VERMICOMPOST:SAND:NEEMCAKE T_5 - VERMICOMPOST:SOIL:NEEMCAKE T_6- VERMICOMPOST:FYM:NEEMCAKE

4. CONCLUSION

From this study it was concluded that the most effective growth regulator was T_1 (IBA 100 ppm) which gave better results for number of root, root length, total biomass as compared to control T_0, so it can be recommended that IBA (IBA 100ppm) was most effective growth regulator among the all treatments. Whereas in case of survival percent T_2 (IAA 100ppm) was the most effective treatment for poplar G_{48} clones at Allahabad condition. Among all potting media combinations most effective treatment was T_1 (Soil: Sand: FYM in the ratio of 1:1:1) which shows better results for survival percentage, as compared to control T_0, so it can be recommended that the combination of (Soil: Sand: FYM in ratio , 1:1:1) as most effective treatment for the growth of G_{48} poplar clones. However, in case of number of root, root length the most effective treatment in potting media was T_3 (soil: sand: Vermi-compost in the ratio of 1:1:1).

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