

Effect of growth hormones on *Jatropha curcas* L. stem cuttings.

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Abstract

This study was conducted to assess the effect of growth hormones on rooting percentage and number of leaves. Stem cuttings of *Jatropha curcas* were treated with different growth hormones. It was observed that the stem cuttings treated with IBA proved significantly effective for rooting percentage and number of leaves. While comparing with different hormones treatments maximum rooting and leaves were observed for IBA at 200 ppm.

keywords: Growth Hormones, Stem cuttings, *Jatropha curcas*.

Introduction

Jatropha curcas L., is a drought resistant perennial plant belonging to family Euphorbiaceae [1]. *Jatropha* were found to be used in traditional medicines and its effects for the cure of many diseases such as arthritis, gout and jaundice [2]. Dental complaints (Toothache, gum inflammation, gum bleeding, pyorrhea [3]; *Jatropha curcas* oil cake has been recognized as a valuable fertilizer. It contains high amount of nitrogen 4.44 %, phosphorus-2.0g % and potassium 1.68 % in oil cake. [4] The energy challenges of India can be met by tree-borne oilseeds focused primarily on *Jatropha curcas* L. (Ratanjot) for usage as renewable alternate fuel to petrodiesel [5]. Hence the contribution of non-edible oils such as *Jatropha* will be significant as a non-edible plant oil source for bio-diesel production. *Jatropha* is considered as one of the mainstream alternatives for biofuel development [6].

J. curcas is a multipurpose species with many attributes and considerable potential and reported that oil is a strong alternative for diesel replacement [7]. It is truly a multipurpose tree species fit for agroforestry and other afforestation programme[4]. It has a long history of cultivation in tropical and subtropical regions of the world. *Jatropha curcas* is a succulent that sheds its leaves during the dry season and well adapted to arid and semi-arid condition and often used for erosion control, *Jatropha curcas* has been identified as a potential biodiesel crop, National and State Governments have drawn ambitious programmes for its large scale cultivation [8-10]. *J. curcas* is usually propagated by seeds which results in lots of genetic variability in terms of growth, biomass and seed yield. However, vegetative propagation of *Jatropha curcas* has shown an advantage of disease free plant of great importance both economically and commercially [11]. However, in most vegetatively propagated plant species, there may be need for preplanting practices to ensure rapid development of the crop. Among such practice is the pre-treatment of stem cuttings with growth hormones like Indole-3- Butyric Acid (IBA), Indole-3-Acetic Acid (IAA) and Naphtalene Acetic Acid (NAA) [12]. These growth hormones have been found to affect different aspects of plant growth and development [13]. Cline [14] noted that the significant effect of IBA and IAA in breaking root apical dominance induced by cytokinins in plants. The use of plant growth regulators particularly auxins for enhancing rooting of cutting as reported by many scientists [15-18]. Narin and Watna[19] found that stem cutting of uniform size of 15 cm length and 1.5-2.0 cm diameter, by quick dip method with IBA showed highest percent sprouting of the buds in *J. curcas*. Gaikwad [20] concluded that the stem cuttings of *J. curcas* were treated with IAA+IBA at 300 ppm was proved significantly effective for percent rooting and more number of leaves as compared with *J.gossypifolia*.

Ali *et.al.*, [21] studied vegetative propagation in *Jatropha curcas*. With different concentration of IBA and NAA. They concluded that IBA 200 ppm, 400 ppm and NAA 100 ppm, 400 ppm showed the best result as compared to other treatment. Among various bio-diesel plants

listed above the species of *Jatropha* in general and *J. curcas*. in particular have become popular for the cultivation in the region of Maharashtra. Keeping this in view, the aim of this study was to investigate the effects of different growth hormone treatments on rooting of stem cuttings in *Jatropha curcas*.

Methodology

PROPAGATION OF STEM CUTTING

Selection of cuttings

In the present study healthy semi hard wood cuttings from five years old mature thick terminal branches of *Jatropha curcas* and three years of old *Jatropha gossypifolia* mature branches were selected from Botanical Research garden at Department of Botany, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S).20-30 cm length and 3 to 4 cm thick stem cutting from the basal portion of branches with short internode of *Jatropha curcas* and *Jatropha gossypifolia* were selected [1,22-24].

Method of planting

The cuttings were planted in right season. Polybags having size of 22.5 x 12.5 cm were used for planting [24]. The drainage holes were provided at the bottom of the polybags. The treated as well as untreated cuttings were planted to a depth about 6 to 8 cm.

Application of growth regulators to cuttings

Various concentrations of growth regulators were prepared. Basal slanting was done bellow the buds. The cutting were washed in tap water and tied in bundles of 10 each. Cutting bundles were treated with 0.3 % Benomyl for 15 minutes. These cutting bundles were treated with 50–400 ppm concentrations of growth regulators for 12 hours by dilute solution soaking method described by Hartmann and Kester [25], one lot served as control. The cuttings were dipped with basal 4–6 cm portion in solution. The experiment was laid out in randomized block design with replications. The cuttings were planted in polybags. After 90 days of planting observations were recorded.

Identification of fungi

The fungi occurring on each and every diseased tissue portion in the plates were identified preliminary on the basis of sporulation characters like asexual or sexual spores and fruiting structures with the help of binocular microscope.

The identification and further confirmation of the fungi was made by preparing slides of the fungal growth and observing them under compound microscope. Pure cultures of these fungi prepared and maintained on potato dextrose agar slants.

Results and Discussions

Jatropha curcas stem cuttings were treated with growth hormones viz. IAA, IBA, NAA, 2,4-D and GA for different concentrations. It is clear from result

mentioned in table 1 and 2 that stem cuttings were treated with IBA proved significantly effective for rooting percentage and number of leaves. while comparing with different hormonal treatments maximum rooting and leaves were observed for IBA at 200 ppm and minimum for IAA at 400 ppm. It is noticed that all above five hormones at 100, 200, 300 ppm concentrations showed rooting and more or less per cuttings. Kochhar *et.al.* [26] studied the effect of IBA and NAA on rooting and sprouting behaviour of two *Jatropha species*. The result observed that application of IBA and NAA increased survival percentage. IBA being more effective in case of *Jatropha curcas* and NAA in case of *Jatropha glandulifera*. The number of roots per-cutting also increased with both IBA and NAA at 100 mg/l. Kaushik and Kumar [4] studied and concluded that the length may be 30 to 40 cm. cutting must be prepared in the right season i.e. March. The longer and thicker cutting showed better results.

Table 1: Effect of different growth hormones on rooting of stem cuttings in *Jatropha curcas*.

| Concentration (ppm) | <i>Jatropha curcas</i> | | | | | |
|---------------------|------------------------|------------------------|-----------------|------------------------|-----------------|------------------------|
| | IAA | | IBA | | NAA | |
| | Percent rooting | of leaves per cuttings | Percent rooting | of leaves per cuttings | Percent rooting | of leaves per cuttings |
| 50 | 100 | 14.6 | 90 | 12.7 | 80 | 12.4 |
| 100 | 80 | 13.4 | 100 | 14.8 | 80 | 12.0 |
| 200 | 60 | 13.2 | 100 | 15.6 | 90 | 13.8 |
| 300 | 60 | 11.8 | 80 | 11.4 | 100 | 14.0 |
| 400 | 20 | 9.7 | 70 | 11.0 | 60 | 10.6 |
| S.D | 37.24 | 5.39 | 37.77 | 5.65 | 36.01 | 5.28 |
| S.E± | 15.20 | 2.20 | 15.42 | 2.31 | 14.70 | 2.15 |
| C.D(P=0.05) | 39.07 | 5.65 | 39.63 | 5.93 | 37.78 | 5.54 |

Table 2: Effect of different growth hormones on rooting of stem cuttings in *Jatropha curcas*.

| Concentration (PPM) | <i>Jatropha curcas</i> | | | |
|---------------------|------------------------|-------------------------------|--------------------|-------------------------------|
| | 2,4-D | | GA | |
| | Percent of rooting | Number of leaves per cuttings | Percent of rooting | Number of leaves per cuttings |
| 50 | 40 | 13.5 | -- | -- |
| 100 | 50 | 14.6 | 50 | 12.6 |
| 200 | 80 | 14.2 | 60 | 13.4 |
| 300 | 40 | 16.4 | 80 | 14.6 |
| 400 | -- | -- | 50 | 14.3 |
| S.D | 30.82 | 7.64 | 32.86 | 7.12 |
| S.E± | 12.58 | 3.12 | 13.42 | 2.91 |
| C.D(P=0.05) | 32.34 | 8.01 | 34.48 | 7.47 |

Table 3: Incidence of fungi on infected cuttings of *Jatropha curcas*.

| Fungi | <i>Jatropha curcas</i> |
|------------------------------|------------------------------|
| | % infection on stem cuttings |
| <i>Alternaria alternata</i> | 20 |
| <i>Aspergillus flavus</i> | 50 |
| <i>Aspergillus fumigatus</i> | 30 |
| <i>Aspergillus niger</i> | 80 |
| <i>Fusarium oxysporum</i> | 50 |
| <i>Mucor spp</i> | 30 |
| <i>Penicillium spp.</i> | 10 |

Vegetative propagation by stem cuttings have been reported to be failure due to soil borne infections caused by fungi and resulting into decay and rot of the cutting in the nursery beds. The incidence of infection of fungi on infected cuttings of *J. curcas*, the experiment was conducted. It is clear from table 3 that the cuttings of *J. curcas* showed 07 different types of fungi namely *Alternaria alternata*, *Aspergillus flavus*, *Aspergillus niger*, *A. fumigatus*, *A. flavus*, *F. oxysporum*, *Mucor spp*, *Penicillium spp*, Roy[27] observed white root rot disease of *chlorophytum borivilianum* due to *Sclerotium rolfsii*.

Similarly Malvia and Jain [28] isolated *Macrophomina phaseolina* from root rot of *Rauwolfia serpentina* while Roy *et.al.*, [29] isolated. *Aspergillus flavus*, *A. niger*, *A. candidus*, *A. luchuensis*, *A. ochraceus*, *Fusarium moniliforme* and *Penicillium spp* from infected roots of *Rauwolfia serpentina* similar to other crops to *Jatropha* it is reported that fungi also cause similar type of damage. Heller [24] isolated *Phytophthora spp.*, *Pythium spp.*, *Fusarium oxysporum* from damping off root rot of *Jatropha curcas*. Sharma *et.al.*, [30] observed root rot of *Jatropha curcas* due to *Fusarium moniliforme*.

Conclusion

The stem cuttings treated with IBA proved significantly effective for rooting percentage and number of leaves. While comparing with different hormones treatments, maximum rooting and leaves were observed for IBA at 200 ppm. Therefore, IBA at 200 ppm may be recommended for plantation programme.

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