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Effect of indole butyric acid (IBA), cow urine and growing media on root formation in tomato stem cuttings

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Abstract

An experiment was conducted to study the response of growing media and various concentrations of IBA and cow urine on root parameters viz., number of days to root initiation, number of roots per cutting, root length (cm) and survival percentage of the stem cuttings (%). Root formation was significantly earlier in the cuttings treated with RH1C2G2 (RH1 = IBA, C2 = 100 ppm and G2 = Soil) and CUC1G1 (CU = Cow urine, C1 = 5% and G1 = Soilless) i.e. 4.67 days than the non treated tomato stem cuttings. Maximum number of roots per cutting (27.67) and longer root length (8.73 cm) were obtained from treatment RH1C3G2 (RH1 = IBA, C3 = 150 ppm and G2 = Soil). All treatments showed a significant increase in all the root parameters except survival percentage of the stem cuttings (%).

Key words: IBA, cow urine, tomato, stem cuttings, rooting.

Tomato (*Solanum lycopersicum* L.) is native to Peru-Ecuador-Bolivia area of the Andes (South America) and belongs to family *Solanaceae*. It is commercially an important crop throughout the world, both for fresh fruit market and for processed food industries. In India, tomato has become an important vegetable crop and is grown in tropical, subtropical and mild temperate climate areas. Besides this, tomato is extensively grown under protected conditions and gives higher returns. The major issue related to this crop is the availability of the seed of the desired hybrids or varieties to be grown under protected environment. Public sector hybrids for protected cultivation are scanty and not available to the polyhouse growers, whereas, private sector hybrids are very costly. Growing hybrid tomato through seed is very expensive due to high prices of the hybrid seeds which a poor farmer cannot afford. Therefore, there is a need of exploring an efficient method of vegetative propagation of tomato plant for its cheaper multiplication and cultivation throughout the year.

Bio-regulators affect fundamental processes of plant growth and development. IBA is a plant bio-regulators belonging to the auxin group. IBA regulate growth and influence various developmental processes, including stem elongation, early root formation, callus formation, enhances flowering, enzyme induction and leaf and fruits senescence. IBA is the leading plant hormone used to promote the formation of roots and to generate new roots in the cloning of tomato plants through cuttings (Waheed *et al.* 2015). In addition to synthetic chemicals, other naturally available byproducts of organics are known to contain vital plant growth substances, which enhance the growth and development of plant. Cow urine is considered as an organic fertilizer. Cow urine contains 95 per cent water, 2.5 per cent urea and the remaining 2.5 per cent a mixture of salts, hormones, enzymes and minerals (Jandaik *et al.* 2015). The aim of present study was to explore a suitable technique for early root development in tomato cuttings, minimizing the cost incurred on the purchase of hybrid seeds for each and every time.

Materials and Methods

The present investigation was conducted at Vegetable Research Farm, Department of Vegetable Science and Floriculture, CSKHPKV, Palampur

(Himachal Pradesh). The experimental material comprised of a tomato hybrid Palam Tomato Hybrid-1 which is recommended for cultivation under protected conditions in Himachal Pradesh. The seeds were obtained from Department of Vegetable Science and Floriculture, CSK HPKV, Palampur. IBA and cow urine with different concentration (IBA - 50, 100 and 150 ppm and cow urine – 5% and 10%) and two growing media (soil and soilless) were used in the experiment. Soilless media comprised of Cocopeat:Perlite:Vermiculite in 3:1:1 ratio. The experiment was laid out in a Randomized Block Design (RBD) with three replications.

Prior to the treatment of succulent cuttings, a slant cut was given at the base of the cutting with sharp knife to avoid the damage of cuttings and for better root proliferation. IBA was prepared by dissolving 50-150 mg IBA in 2-5 ml solvent (75% or purer alcohol). Once completely dissolved the final volume was made to 1 litre by adding distilled water. Cow urine was prepared by dissolving 50-100 ml cow urine in 1 litre distilled water a sterile container. The urine was filtered through Whatman filter paper to get rid of debris and precipitated material. Then the urine solution was stored in an airtight container. The cuttings were dipped in the IBA and cow urine solutions and planted in soil and soilless media. The data was recorded for root parameters viz., number of days to root initiation, number of roots per cutting, root length (cm) and survival percentage of the stem cuttings (%). The data analysis was done as per the standard statistical procedures.

Results and Discussion

Number of days to root initiation

It is apparent from the data presented in the table 1 that different treatments used in the study significantly affected days to root initiation. Among various treatments, RH1C2G2 (RH1 = IBA, C2 = 100 ppm and G2 = Soil) and CUC1G1 (CU = Cow urine, C1 = 5% and G1 = Soilless) took minimum days (4.67) for root initiation. Treatment RH1C1G1 (RH1 = IBA, C1 = 50 ppm and G1 = Soilless) took maximum days (6.00) for root initiation. All the treatments were found to be significantly superior to the control. Time taken to root initiation was significantly lowest in the treatment RH1C2G2. This might be due to quick dip in IBA solution which supplemented the endogenous auxin content at the base of cuttings, which accelerated the root initiation and formation of root primordia that resulted in increased rooting in treated cuttings. Cow urine also had a significant effect on early root formation and the effect was more in soilless media. The effect of cow urine on early root formation might be due to the presence of growth promoting substances (auxins) and nutrients in cattle urine. These findings are also supported by Nizam-ud-din *et al.* (2005) and Shinde and Malshe (2015).

Number of roots per cutting

An examination of data presented in table 1 indicated that different treatments used in study significantly influenced the number of roots per cutting in tomato. The maximum number of roots per cutting (27.67) were produced by treatment RH1C3G2 (RH1 = IBA, C3 = 150 ppm and G2 = Soil) followed by RH1C1G2 (RH1 = IBA, C1 = 50 ppm and G2 = Soil) which were significantly superior to the control. Three treatments RH1C1G1 (RH1 = IBA, C1 = 50 ppm and G1 = Soilless), RH1C2G1 (RH1 = IBA, C2 = 100 ppm and G1 = Soilless) and RH1C2G2 (RH1 = IBA, C2 = 100 ppm and G2 = Soil) were found to be statistically at par with RH1C3G2 (RH1 = IBA, C3 = 150 ppm and G2 = Soil). The least number of roots per cutting (20.00) were produced by CUC2G1 (CU = Cow urine, C2 = 10% and G1 = Soilless) which was statistically at par with the control. Maximum number of roots per cutting were found in IBA treatment. IBA increased not only the endogenous IAA but also indole-3-acetyl-aspartic acid (IAAsp) that is required for normal growth of root meristemoids as the root formation proceeded. Similar results were also reported by Javier and Mamicpic (1978), Acha *et al.* (2004), Nizam-ud-din *et al.* (2005), Ali *et al.* (2009), Agele *et al.* (2010) and Waheed *et al.* (2015).

Root length (cm)

Response of growing media and various concentrations of IBA and cow urine are presented in table 1. The longest roots (8.73 cm) were formed from cuttings treated with RH1C3G2 (RH1 = IBA, C3 = 150 ppm and G2 = Soil) followed by RH1C2G2 (RH1 = IBA, C2 = 100 ppm and G2 = Soil) which were significantly superior to the control. All other

Table 1. Effect of IBA, cow urine and growing media on root parameters in tomato stem cuttings

Treatments	Rooting hormone and cow urine	Concentration	Growing media	Number of days to root initiation	Number of roots per cutting	Root length (cm)	Survival percentage of stem cuttings (%)
RH1C1G1	IBA	50 ppm	Soilless	6.00	23.33	7.83	65.00
RH1C1G2	IBA	50 ppm	Soil	5.33	27.00	7.70	70.00
RH1C2G1	IBA	100 ppm	Soilless	5.00	24.33	7.33	65.00
RH1C2G2	IBA	100 ppm	Soil	4.67	23.67	8.57	72.33
RH1C3G1	IBA	150 ppm	Soilless	5.67	22.00	7.43	71.33
RH1C3G2	IBA	150 ppm	Soil	5.00	27.67	8.73	71.00
CUC1G1	Cow urine	5%	Soilless	4.67	22.33	6.90	68.33
CUC1G2	Cow urine	5%	Soil	5.33	21.33	8.33	70.00
CUC2G1	Cow urine	10%	Soilless	5.00	20.00	8.33	72.83
CUC2G2	Cow urine	10%	Soil	5.67	21.67	7.43	71.00
Control				8.67	21.67	6.83	68.33
CD (P 0.05)				1.30	4.46	1.36	NS

treatments except RH1C2G1 (RH1 = IBA, C2 = 100 ppm and G1 = Soilless) and CUC1G1 (CU = Cow urine, C1 = 5% and G1 = Soilless) were found to be statistically at par with treatment RH1C3G2 (RH1 = IBA, C3 = 150 ppm and G2 = Soil). The shortest roots (6.90 cm) were observed in CUC1G1 (CU = Cow urine, C1 = 5% and G1 = Soilless) which was statistically at par with the control (6.83 cm). IBA clearly enhanced the root length of stem cuttings which might be due to reason that auxins helped in cell division and cell enlargement which resulted in longer roots and more mean length of roots. Cell elongation involves sequential changes in levels or activity of enzymes. The enzymes involved in cell enlargement processes are triggered by auxin. IBA promotes root length by influencing the synthesis of enzymes concerned in cell enlargement. These results are in agreement with those of Javier and Mamicpic (1978), Nizam-ud-din *et al.* (2005), Agele *et al.* (2010), Jasim and Abed (2013) and Waheed *et al.* (2015) who had reported considerable variation for root length.

Survival percentage of the stem cutting (%)

Table 1 showed that the effect of different treatments on survival percentage of the stem cutting was found to be non-significant. Treatment CUC2G1 (CU = Cow urine, C2 = 10% and G1 = Soilless) recorded maximum percentage (72.83%) for survival of stem cuttings while minimum percentage (65.00%) for survival of stem cuttings was recorded in treatment RH1C1G1 (RH1 = IBA, C1 = 50 ppm and G1 = Soilless) and RH1C2G1 (RH1 = IBA, C2 = 100 ppm and G1 = Soilless). Similar results were also observed by Jasim and Abed (2013).

The investigation revealed that various concentrations of IBA and cow urine significantly enhanced all root parameters except survival percentage of the stem cuttings (%). Stem cuttings treated with RH1C2G2 (RH1 = IBA, C2 = 100 ppm and G2 =Soil) and CUC1G1 (CU = Cow urine, C1 = 5% and G1 = Soilless) recorded minimum days (4.67) for root initiation. Treatment RH1C3G2 (RH1 = IBA, C3 = 150 ppm and G2 = Soil) was found to be best as it recorded maximum number of roots per cutting and longest root length (cm).

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