

To Study the Effect of Willow Extract on Apple Cuttings for Different Time Duration

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Abstract

An experiment on “To study the effect of Willow extract on Apple cuttings for different time duration” was conducted in Agricultural Research Station Baffa, Mansehra during the growing season 2017. The experimental design was RCBD with three replication. There were 4 treatment consisting of control (To treatment) T₁ (dipping of Apple cutting in extract for 4 hours), T₂ (dipping of Apple cutting in extract for 6 hours) and T₃ (dipping of Apple cutting in extract for 8 hours). Each treatment consists of 30 cuttings. The experimental results revealed that there is a significant effect on apple cutting after treatment with the willow extract. The data showed that the maximum sprouting percentage (97.183) was noted for the T₁(04 hours) which is at par with (96.407) for T₂ (06 hours) and (95.850) T₃ (08 hours), maximum plant height (20.567 cm) was noted for T₃ (08 hours), maximum number of roots per plant (14.093) were noted for the T₃ (08 hours), maximum root length (14.093 cm) were observed in the T₃ (08 hours) which is at par with (11.810 cm) noted in the T₂ (06 hours), maximum plant diameter (1.3700 cm) was noted for T₃ (08 hours), maximum number of branches per plant (5.1633) were recorded for the T₃ (08 hours) which is at par with (4.6167) noted for T₂ (06 hours), while the minimum sprouting percentage was observed in the T₀ (control treatment) 91.707, minimum plant height (10.440 cm) was recorded for the T₀ (control), minimum number of roots per plant (5.620) were noted in the T₀ (control treatment), minimum root length (6.623 cm) was noted for T₀ (control treatment) closely followed by (8.877 cm) for the T₁ (4 hours), minimum plant diameter (0.1667cm) was recorded for the T₀ (control treatment) which is at par with (0.2533 cm) noted for the T₂ (04 hours), minimum number of branches (2.1533) were recorded for the T₀ (control treatment).

Keywords: apple, cuttings, auxin, willow, plant height, plant diameter, root length, number of roots and number of branches etc

Introduction

Apple (*Pyrus malus* L.) is one of the most important fruit crops of the world, which was originated in the Central and South-Western Asia and belongs to the family *Rosaceae* and sub-family *Pomoideae*. In Pakistan, apples are grown in temperate parts (hilly tracts) of Punjab, Khyber Pakhtunkhwa region and Quetta region of Baluchistan (Chaudhary, 1994).

Weeping Willow (*Salix babylonica*) is an amazing tree that have captivated humanity since time immemorial. They appear in the ancient legends, tales, folklore and customs of the Chinese, Egyptians, Greeks, Brits, Celts and American Indians. Willow Water is a homebrew plant rooting hormone that is easily made and can be used to increase the strike rate (growth of roots) of cuttings that you're trying to propagate. The way that it works can be attributed to two substances that can be found within the *Salix* (Willow) species, namely, indolebutyric acid (IBA) and Salicylic acid (SA).

Indolebutyric acid (IBA) is a plant hormone that stimulates root growth. It is present in high concentrations in the growing tips of willow branches. By using the actively growing parts of a willow branch, cutting them, and soaking them in water, you can get significant quantities of IBA to leach out into the water. Willow cuttings can even grow if put in upside-down. This property of willows is due to the naturally occurring plant rooting hormones that they contain. We can take advantage of this naturally occurring hormone, and make extracts that we can use to induce rooting on cuttings of other plants. (deep green permaculture, 2011).

A callus is commonly formed on the basal end of cuttings placed for rooting. It is an irregular mass of parenchyma cells that commonly develops at the basal end of a cutting placed under environmental conditions favorable for rooting (Hartmann et al., 2002). Its occurrence is the result of its dependence on internal and environmental conditions. Roots frequently emerge through the callus so that callus formation is essential for rooting in some species. In the mid-1930s, auxins were found to stimulate root growth (Thimann and Went, 1934). Zimmerman and Wilcoxon (1935) demonstrated that the most reliable plant growth regulators in stimulating root production in cuttings were indole-3-butyric acid (IBA) and α -naphthaleneacetic acid compared with indole-3-acetic acid (IAA), the most abundant endogenous auxin in plants. IBA is considered the best synthetic auxin because it is nontoxic to plants over a wide concentration range. Furthermore, it is a relatively stable compound whose shelf life can be extended by darkness and refrigeration. This well-known plant growth regulator, which acts on cell division and elongation, is used to stimulate root formation in cuttings of herbaceous and woody plants. In olive propagation from cuttings, IBA has been found to be the best root-

promoting compound (Hartmann et al, 2002). However, as a synthetic product, IBA is not permitted in organic agriculture. Organic or biological agriculture defines an agrarian system whose main objective is to obtain high-quality products while preserving the environment and land fertility. European regulation CE 1452/2003 and the U.S. regulation, The Organic Foods Production Act of 1990, as amended, 7 U.S.C. 6501 et seq., allow the use of nonorganic vegetative propagation materials during a transitory period if producers are unable to obtain organic vegetative propagation materials from nurseries. However, there are natural auxin sources such as germinating seeds, fungi, and algae extract, which could be used to obtain organic plants. As far back as the Middle Ages, cuttings were enclosed with germinating seeds to stimulate root formation. Auxins were assessed for the first time by Went (1928) in oat stem development from experiments initiated in 1880. (Ana Centeno and Maria Gomez-del-Campo, 2013).

Propagation through cuttings is another option for getting true to type plants. The use of hardwood cuttings is one of the least expensive and easiest methods of vegetative propagation. Endogenous factors such as growth substances, anatomical structure of cutting (Hartmann *et al.*, 2002) and exogenous factors such as, humidity, air, light condition and date of cutting are always required to obtain a satisfactory propagation success (Ercisli *et al.*, 2003). Planting of loquat cuttings in sand and peat moss mixture after the application of IBA under mist propagation unit have been reported to give 50% rooting in green house (El-Shazly *et al.*, 1994).

Objectives

- To find out an economical way of apple's vegetative reproduction
- To find out optimum time for dipping apple cuttings in the root initiating medium.
- To study the effect of root initiating medium on apple cuttings

Material and method

The experiment on "To study the effect of Willow extract on Apple cuttings for different time duration" was conducted in Agricultural Research Station Baffa, Mansehra during the growing season 2017. The experimental design was RCBD with three replication. There were 4 treatment consisting of control (No treatment) T1 (dipping of Apple cutting in extract for 4 hours), T2 (dipping of Apple cutting in extract for 6 hours) and T3 (dipping of Apple cutting in extract for 8 hours). Each treatment consists of 30 cuttings. Average data obtained were then analyzed by the Statistix 8.1 software for the mean value.

Treatment procedure

1. The young first-year twigs and stems from willow tree were collected.
2. All the leaves were removed, and then the twigs were cut down in the small pieces (2.5cm) long.
3. Chopped the twigs of willow.
4. Placed in the container poured boiled water on it. Leaved it overnight.
5. The twigs were removed from the container and the water was passed through the sieves.
6. According to the experiment treatments the Apple cutting were placed in the extract for treating purpose for 4, 6 and 8 hours.

RESULTS AND DISCUSSION:

The average data of the experiment was analyzed statistically by the software Statistix 8.1 for the following parameters.

Sprouting percentage:

The mean data revealed that there is a significant effect on apple cutting after treatment with the willow extract. The data showed that the maximum sprouting percentage (97.183) was noted for the T1(04 hours) which is at par with (96.407) for T2(06 hours) and (95.850) T3(08 hours), while the minimum sprouting percentage was observed in the T0 (control treatment) 91.707. It might be due to the fact that the sprouting percentage is mostly correlated with the preserved food material within the cutting, environmental factors and cutting health.

Plant height:

The mean data presented in table 1 showed that the maximum plant height (20.567 cm) was noted for T3 (08 hours), whereas the minimum plant height (10.440 cm) was recorded for the T0 (control). It might be due to fact that the cutting placed in the willow extract for the 8 hours duration, allow it to adsorb more IBA, which ultimately faster the adventitious root formation, the more and healthy root formation will maximize the nutrient transport to the leaves for food production and the maximum food production will results in vigorous plant growth.

Number of roots plant⁻¹

The mean data regarding the number of roots per plant showed that the treatment of willow extract has a significant effect on the number of root per plant. The maximum number of roots per plant (14.093) were noted for the T3 (08 hours), while the minimum number of roots per plant (5.620) were noted in the T0 (control treatment). The reason may be that most reliable plant growth regulators in stimulating root production in cuttings were indole-3-butyric acid (IBA) and α -naphthaleneacetic acid compared with indole-3-acetic acid (IAA), the most abundant endogenous auxin in plants. IBA is considered the best synthetic auxin because it is

nontoxic to plants over a wide concentration range. This well-known plant growth regulator, which acts on cell division and elongation, is used to stimulate root formation in cuttings of herbaceous and woody plants. Zimmerman and Wilcoxon 1935 and Hartmann *et al.*, 2002

Indolebutyric acid (IBA) is a plant hormone that stimulates root growth. It is present in high concentrations in the growing tips of willow branches.

Our findings are in accordance with the results of Wiesman & Lavee (1995) who found that IBA enhanced root number in comparison with untreated cuttings. It was well documented that a delicate balance between endogenous stimulatory and inhibitory factors control the rooting (Eliason, 1981), while auxin stimulates rooting, cytokinins and gibberellins inhibit it (Hartmann *et al.*, 2002) these results are showing disparity with Mukhtar *et al.*, (1998) where he found maximum number of roots per plants (136) with 100 ppm PBZ in guava while Hafeez *et al.*, (1988) got 30.19 roots with 3 ppm PBZ treatment of softwood cuttings of guava. Singh (1998) got 48.3 primary roots and 138.54 secondary roots by stooling with the aid of 2500 ppm paclobutrazol. Increase in concentration and dipping time of growth regulators induced high number of roots as compared with low concentration. It was also recorded by Mukhtar *et al.*, (1998) that the number of roots with high concentration of root promoting growth regulator and longer dipping period may have allowed the cutting to absorb it well.

Root length

The experimental result revealed that the root length was significantly effected by the treatment of cuttings with the willow extract. The data showed that the maximum root length (14.093 cm) were observed in the T3 (08 hours) which is at par with (11.810 cm) noted in the T2 (06 hours), whereas the minimum root length (6.623 cm) was noted for T0 (control treatment) closely followed by (8.877 cm) for the T1 (4 hours). It might be due to fact that the maximum adsorption of the IBA by putting the cutting in the willow extract for the 8 hours duration, induced adventitious root formation, the roots adsorbed the available nutrients (macro and micro) which increased the production of leaves, ultimately increased the process of photosynthesis, higher amount of carbohydrates were produced and trans-located to all parts of the plant for better growth and development. The results of the study are in consonance with those of Darwesh *et al.*, (2013) who reported that growth regulators help in stimulating the roots in cuttings when the endogenous and climatic factors are favorable. With regard to treatments with and without PBZ, no significant differences were observed, i.e., they did not contribute towards the root regeneration process. Thus plant growth retardant has effects on the partition of photo assimilates, on the water status of the cuttings, and has been described as a promoter of adventitious roots in many species (Steffens & Wang, 1986)

Plant diameter

The data regarding the plant diameter indicated that a significant effect of willow extract treatment was found on the plant diameter. The data showed that the maximum plant diameter (1.3700 cm) was noted for T3 (08 hours), while the minimum plant diameter (0.1667cm) was recorded for the T0 (control treatment) which is at par with (0.2533 cm) noted for the T2 (04 hours). It might be due to the fact that the cutting placed in the willow extract for the 8 hours duration, allow it to adsorbed more IBA, which ultimately faster the adventitious root formation, the more and health root formation will maximize the nutrient transport to the leaves for food production and the maximum food production will results in vigorous plant growth.

Number of primary branches plant⁻¹

The experimental results showed that the number of branches per plant was significantly effected by the treatment of cuttings with the willow extract. The mean data showed that the maximum number of branches per plant (5.1633) were recorded for the T3 (08 hours) which is at par with (4.6167) noted for T2 (06 hours), whereas the minimum number of branches (2.1533) were recorded for the T0 (control treatment). High concentration of root promoting growth regulator and longer dipping period may have allowed the cutting to absorb it well. Mukhtar *et al.*, (1998). Which lead to the better and healthy root formation. Healthy root formation will maximize the nutrient transport to the leaves where the food production occurs for the all the parts of plant. Abou-Rayya *et al.*, (2009) review that the accumulation of carbohydrates and seasonal variation contributes and helpful in production of lateral shoots.

Recommendations

From the results of the experiment, it is recommended that the willow extract is most suitable medium for the root initiation and

The apple cutting placed in the willow extract for 8 hours of duration of time results in plant vigorous growth and root production.

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Table :1. Effect of willow extract on sprouting percentage, plant height, number of roots, root length, plant diameter and number of primary branches of apple cutting after treatment with willow extract for different time duration.

Treatment	Sprouting percentage	Plant height	No. of root	Root length	Plant diameter	No of primary branches
T0 (control)	91.707 B	10.440 D	5.620 D	6.623 B	0.1667 C	2.1533 B
T1(02 hours)	97.183 A	12.843 C	9.237 C	8.877 B	0.2533 C	4.0133 AB
T2(04 hours)	96.407 A	16.427 B	12.700 B	11.810 A	0.7900 B	4.6167 A
T3(06 hours)	95.850 A	20.567 A	15.410 A	14.093 A	1.3700 A	5.1633 A
LSD value at 0.05	2.6368	2.3895	2.3954	2.6020	0.4527	1.9290