Pakistan J. Agric. Res. Vol 23 No. 3-4, 2010.

RESEARCH NOTE

EFFECT OF INDOLE BUTYRIC ACID (IBA) ON ROOTING OF OLIVE STEM CUTTINGS

Ahmed Aziz Kurd, Amanullah, Saifullah Khan, Basharat Hussain Shah and Munir Ahmed Khetran*

ABSTRACT: Semi-hardwood cuttings of olive *(Olea europea)* variety Coratina with 2–4 leaves and 15–18 cm in length were obtained from existing progeny in an orchard of Arid Zone Research Centre (AZRC), Quetta, Pakistan. The basal portion of these cuttings were treated with 3000, 4000 and 5000 ppm IBA solution for 3-4 seconds. The treated cuttings were immediately planted in polyethylene tubes (10 cm x 20 cm) filled with a sandy loam soil. In the control, the cuttings were planted directly in polyethylene bags without IBA application. Plants were kept in a shade house and humidity was increased manually by hand sprinkling (four times in a day). Highest rooting percentage (60%) was obtained in the cuttings treated with 3000 ppm. The maximum average number of roots per cutting (4.443) and average root length (5.687 cm) were recorded with 4000 ppm IBA treatment. Percentage of rooted cuttings decreased with increased IBA concentration, whereas, number of roots and root length increased with increased IBA concentration. It was concluded that to obtain the most roots per cutting and the longest root length, application of 4000 ppm IBA was the best and to obtain the most number of rooted cuttings, application of 3000 ppm IBA was the best.

Key Words: Olea europea; Variety; Indole Butyric Acid; Growth Hormone; Stem Cuttings; Pakistan.

INTRODUCTION

In Balochistan, commercial olive cultivation is a new farming practice, and development of this method of farming is in its initial stages but increasing with time. The province is endowed with a unique environment for the production of a variety of quality fruits. Wild olives are found in Zhob, Barkan, Musakhail, Khuzdar, Loralai and Bolan districts. They are also found in parts of Kharan, Noshki, and Panjgoor districts. Commercial oil and table varieties have been introduced from exotic germplasm, which have been successfully grown in Loralai, Khuzdar, and Quetta districts. Balochistan has vast cultivable land with favorable climatic conditions, which can be brought under olive cultivation. To extend olive farming on farmers' fields, commercial (exotic) varieties need to be propagated through cuttings to produce true-to-type nursery plants.

The propagation of olive (*Olea europea* L.) cultivars requires grafting or budding on seedling rootstocks or propagation of self-rooted cultivars from 1 or 2 year old woody cuttings (Hartmann et al., 1990). Although self-rooted cultivars can be established in new olive orchards, but low rooting ability, the unsatisfactory viability, and the low rooting quality of cuttings in some cultivars represent limiting factors (Wiesman and Lavee, 1995).

Studies are being carried out to produce high value, true-to-type, and disease-free nursery plants, but olive stem cuttings are hard to root under ordinary conditions. Plant growth regulators can play a vital role to enhance rooting of olive cuttings. Indole butyric acid is an auxin which is commonly used to promote the formation of roots in plants and to generate new roots in the cloning of plants through cuttings, as reported by Wiesman and Lavee (1994) Indole-3-butyric acid (IBA) treatment improves rooting of easy-to-root and moder-

*PARC-Arid Zone Research Centre, Brewery Road, Quetta, Pakistan.

ately-hard-to root olive cultivars, but has less effect to stimulate root formation in hard-to-root cultivars. The study was, therefore, carried out to investigate the effect of different IBA treatments on rooting of olive cuttings to get more specific results of IBA application.

MATERIALS AND METHODS

The present study was performed to check the effect of different IBA treatments on rooting of olive stem cuttings at the Arid Zone Research Centre (AZRC), Quetta, Pakistan during 2010. Semi-hardwood cuttings of olive (Coratina variety) with 2-4 leaves and 15-18 cm in length were obtained from existing progeny in an orchard of AZRC, Quetta. Indole-3-butyric acid solution at 0, 3000, 4000 and 5000 ppm were used for propagation studies. Cuttings were dipped in IBA solutions for 3-4 seconds wetting only 2-3 cm of their basal portion. Afterward semi-hardwood cuttings were immediately planted in polyethylene tubes (10 cm x 20 cm) filled with a sandy loam soil. In the control, the cuttings were planted directly in polyethylene tubes without IBA application. Plants were kept in a shade house, and humidity was increased manually (by hand sprinkling, four times in a day). Cuttings were arranged in a completely randomized block design with three replications. Forty cuttings were planted in each replication and a total of 120 cuttings were planted in all three replications. Cuttings were removed from soil 90 days after treatment, and data were recorded on percentage of rooted cuttings, number of roots per cutting and root length cutting (cm). Data were statistically analyzed using a single factor analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Percentage of Rooted Cuttings

Data showed the mean values of percentage of rooted cuttings (Table 1). Cuttings treated with 3000 ppm IBA had a higher rooting percentage (60.00 %) as compared to 4000 and 5000 ppm IBA. Moreover, rooting percentage decreased as the IBA concentration increased. The control treatment (0 ppm IBA) produced a poor rooting percentage (6.67 %). This study proved that olive rooting in nursery propagation cycles can be significantly improved by this simple and inexpensive treatment. A positive effect of IBA treatment on rooting of olive also was shown in the study of Mukhtar et al. (2001). They reported results of semi-hard wood cuttings that were treated with talc powder containing 0, 0.3, 0.4, and 0.5 percent indole butyric acid. They found that the maximum number of roots of the cultivars 'Coratina' (74%) and 'Frantoio' (65.33%) was obtained with 0.3% IBA.

The positive effect of IBA on root formation was due to the hormonal balance in the cuttings. John (2004) reported that rooting compounds can be used to promote the growth of a root callus at a damaged end of stem cuttings. Healing will happen and roots will grow naturally, albeit more slowly, because of the auxins present within the cutting. The delay caused by the plant having to transport auxins from its top to the cut stem can thus be avoided. It is important to note that the smallest amount of synthetic rooting compound should be used to avoid slowing root growth and delaying the rooting process. A delicate balance exists between auxins, which regulate root production and growth, and

Table 1. Effect of different IBA treatments on olive stem cuttings

IBA (ppm)	Rooted cuttings (%)	Avg. no. of roots / cutting	Avg. roots length (cm)
0	6.67 b	0.667	1.350 c
3000	60.00 a	4.163	4.883 ab
4000	23.33 b	4.443	5.687 a
5000	20.00 b	3.083	2.587 bc
LSD	27.46	N.S	3.029

Means followed by the same letters do not differ significant at P<5%.

cytokinins, which regulate shoot development and growth. The interaction of these two hormones leads to root callus formation. If this hormonal balance is upset, the consequences will be dire indeed. Rafael (2005) and Adelson (2009) also reported that the concentration of 3000 ppm IBA in cuttings with two pairs of leaves promoted best results for number of roots in olive.

Average Number of Roots per Cutting

The highest number of roots per cutting (4.443 per cutting) was found with the 4000 ppm IBA treatment, and the lowest number (0.667) was found in the control treatment. The results showed that IBA treatment increased the average number of roots per olive stem cutting. A higher number of roots per cutting with 4000 ppm IBA was due to the physiological interaction of IBA and carbohydrates, as reported by Wiesman and Lavee (1995). They reported that during rooting, photosynthesis in the cuttings is low and has almost no effect on the carbohydrate content, so that starch appears to be the major source of carbohydrates. Amyloplast levels decline during rooting and IBA increases the rate of their disappearance. The data suggest that carbohydrates have an important role in root formation and improve the stimulatory effect of IBA in this process. These results are similar with the findings of Daoud et al. (1989). Gautum and Chauhan (1990) also reported that higher concentrations of IBA increased root numbers in olive.

Average Root Length

Differences were found in root length among the different IBA treatments. Maximum root length (5.687 cm) was recorded with 4000 ppm IBA, and root length decreased as IBA concentration decreased. However, the smallest root length (1.35 cm) was observed in the control treatment. This study has proved that higher concentrations of IBA increased root number and stimulated root growth. Mir et al. (2001) also showed that IBA at 4000 ppm resulted in maximum root length and the highest rate of survival.

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