INTERACTION OF GIBBERELIC ACID (GA_3) AND NAPHTALENE ACETIC ACID (NAA) ON ROOT INDUCTION IN *OLEA EUROPEA L.*

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Abstract

Leafy stem cuttings of olive cv. "Kokër Bardhi i Tiranës" were obtained from 1-year-old olive shoots sampled on 10 February and 30 March during the 2010 growing season. To improve the rooting of olive cuttings, different concentrations of GA_3 (50 ppm, 100 ppm, and 150 ppm) were tested in combination with NAA 4000 ppm. After treatments the stem cuttings were planted in greenhouse equipped with an automatic mist system. At 50 days after the beginning of rooting treatments, cuttings were scored for the presence of callus, percentage of rooted cuttings, root number per cutting and root length. GA_3 inhibits adventitious root formation, but adding it to NAA in a small ratio (1:40) improved the rooting. In both seasons NAA 4000 ppm + 100 ppm GA_3 (40:1) combination modified significantly higher rooting of cuttings. This combination of growth stimulators induces also a higher number of roots per cutting in comparison with those treated with NAA alone. The percentage of rooted cuttings sampled on 30 March was markedly greater than those sampled on 10 February. The mean root length was not significantly different between NAA alone and NAA combined with GA_3.

Key words: stem, cutting, olive, Gibberelic acid, Naphtalen acetic acid, rooting, percentage.

1. Introduction

According to government's program, twenty million olive trees should be planted in Albania during the years 2008-2013. The domestic varieties should constitute the main percentage of varieties to be planted. The propagation of these varieties is very important in achieving this objective.

That`s why this experiment aimed at increasing the rooting ability of olive cuttings cv. "Kokërr Bardhi i Tiranës" using NAA with different concentrations of GA_3.

In order to stimulate the root formation of olive cuttings IBA or NAA are usually used. GA_3 inhibits adventitious root formation, but in some cases, it stimulates root formation [1, 3, 5].

High concentration of gibberelic acid (GA_3) inhibited rooting in cuttings of *Pisum Sativum* L, while low concentration (10^{-9} to 10^{-6} mol) promoted rooting [6].

Some early workers [4], reported that indol-3 acetic acid (IAA) and gibberelic acid (GA_3) enhanced the formation of roots on the stem cuttings of *Abelmoschus esculentus* Moench. The effect considerably increased, when both IAA and GA_3 were applied together [4].

The combination of GA_3 1 ppm + 4 ppm NAA used on rooting of microshoots of olive (cv. Kallamon), promoted the root formation [7].

In the concentration range of 10^{-8} to 10^{-4} mol of GA_3, and in the presence of tryptamine or indol-3 lactic acid (an active indole derivative for root induction) a significant increase of root initiation on tomato leaf discs was observed [2].

The study reported in this paper was carried out to examine any possible interaction between NAA and GA_3, which might influence the rooting activity of stem cuttings in *Qlea europea* , cv. "Kokërr Bardhë i Tiranës".

2. Materials and Methods

Leafy stem cuttings (15-20cm long each) from one year old olive shoots of "Kokërr Bardhë i Tiranës", grown in Pezë-Helmës village (Tirana district) were conducted to examine the influence of the combination NAA with GA_3 on the root initiation.

The shoots were sampled in different dates in early spring (10 February and 30 March) in order to observe the effects of growing season on the rhizogenesis,.

Leafy stem cuttings with four leaves are prepared in the morning and their bases were dipped for 7 sec in solution of 4000 ppm NAA, the appropriate concentration on rooting of olive stems [9], in combination with different treatment of GA_3 as follows:

- 1st treatment 4000 ppm NAA
- 2nd treatment 4000 ppm NAA + 50 ppm GA_3
- 3rd treatment 4000 ppm NAA+100 ppm GA_3
- 4th treatment 4000 ppm NAA + 150 ppm GA_3

After treatments, the stem cuttings were planted in greenhouse equipped with an automatic mist system. The layout of experimental design was completely randomized with 3 replications of 30 cuttings per treatment. Cuttings were evaluated 50 days after planting for percentage of rooted cuttings, primary root number and mean primary root length. Differences between means of each treatment were analyzed by the Duncan multiple range test ($P < 0.05$).

The effect of GA_3 in combination with NAA on root initiation of cuttings has been noticed by the mung bean test [8]. Mung bean cuttings, each 7 to 8 cm long with a 5 cm long hypocotyl, a 2 to 3 cm epicotyl and a pair of primary leaves were obtained from seedlings germinated in perlite and growth in a greenhouse equipped with a mist automatic system. Cuttings were placed in 50 x10 mm glass tubes containing 5ml aqueous solution of 0.1 ppm NAA in combination with 0.01, 0.05, 0.1 and 1 ppm of GA_3, respectively. The rooting results were expressed as mean root number per mung bean cutting. Tests were arranged in a randomized complete block design with five replications per

experimental treatment unit (glass tube), each with four cuttings.

3. Results and discussion

Percentage of rooted cuttings, primary root number and mean primary root length of the shoots sampled on 30 March 2010 are summarized in Table 1.

In determining the optimum gibberellic acid (GA_3) requirements for rooting, the best result was obtained when 4000 ppm NAA (control) was combined with 100 ppm GA_3 (10. 6% higher than the control).

The percentage of rooting was not significantly different between 4000 ppm NAA alone (control) and NAA (control) in combination with 50ppm GA_3, but was decreased considerably by increasing the GA_3 concentration to 150 ppm (11, 6% less than the control).

The mean number of roots per cutting was higher in the treatment of 4000ppm NAA with 100 ppm, but the difference was not significant.

The mean root length was not markedly different between treatments (Table1).

Table 1. Effect of NAA alone and in combination with GA_3 on rooting of "Kokërr Bardhë i Tiranës" olive cuttings

Treatments	*Percentage of rooting*	*The mean number of roots per cutting*	*The mean root length*
4000ppm NAA	51. 2 b*+	3. 96a+	2. 098 a+
4000 ppm NAA + 50 ppm GA_3	51. 4 b	3. 78 a	2. 12 a
4000ppm NAA + 100 ppm GA_3	61. 8 c	4. 42 a	2. 18 a
4000ppm NAA + 150 ppm GA_3	39. 8 a	4. 04 a	2. 076 a

*Separation by Duncan's multiple range test, at P< 0. 05, +Mean of three replications

Table-2. Effect of the season collection in percentage of rooted cuttings

Dates of cutting Collections	***4000ppm NAA***	***4000ppm NAA + 50ppm GA_3***	***4000ppm NAA +100ppm GA_3***	*4000ppm NAA +150 ppm GA3*
10-02-2010	13. 3 a*+	13. 98a+	23. 3 a+	14. 6a+
30-03-2010	51. 2b	51. 4b	61. 8 b	39. 8b

**P<0. 05, +Mean of three replications*

As it can be seen in Table 2, rooting percentage of cuttings propagated on 30 March was statistically higher than those collected on February 10, for all the treatments. This might be due to highest rate of cambium activity that enhances the root formation of cuttings.

Table 2 shows that the synergistic effects of gibberellic acid and naphtalene acetic acid on rooting in stem cutting of olive was significant in both seasons, 10% and 6% greater than control, respectively.

The combination of GA3 with NAA marked differences in root induction in the mung bean test (Table 3). The mean root number per mung bean cutting was higher, 39 roots, at combination NAA 0, 1ppm + 0, 01ppm GA_3 with reduced mean root number

per cutting at higher concentration of GA_3. There was no root formation in combination 0, 1ppm NAA with 1ppm GA_3.

Table-3. Effect of GA_3 in combination with NAA on mean root number per mung bean cutting

The combination NAA+GA_3	***Mean number of root per cutting***
0. 1 ppm NAA	32. 8* a
0. 1ppm NAA+0, 01ppm GA_3	39. 2 b
0. 1 ppm NAA+0. 05ppm GA_3	34. 4 a
0. 1ppm NAA+0, 1ppm GA_3	12. 3 c
0. 1 ppm NAA+ 1ppm GA_3	-

**P<0. 05, +Mean of five replications*

Gibberelic acid (GA_3) application at 100 ppm in combination with 4000 ppm NAA increased root formation of olive cuttings. The promoting effect of GA_3 was due to increased numbers of regenerated roots. GA_3 treatments had no effect on decreased rate of root elongation.

The stimulation of rooting by combination of GA_3 with NAA reported in this paper is in accord with the findings of other researchers [4, 6] which reported that lower concentration of GA_3 enhanced rooting, while higher ones inhibited it.

The concentration of gibberllic acid that enhanced the number of roots on cuttings of mung beans (0, 01 ppm or 3, 46 x 10-7 mol) confirmed in the present experiment, is in accordance with most earlier reports (10^{-9} to 10^{-6}mol) reported by J. Hansen [6], and (10^{-4} to 10^{-8} mol), reported by W. K Coleman [2].

Both NAA and GA_3 enhanced rooting of olive cv. “Kokërr Bardhi i Tiranës”. GA_3 was more effective at the concentration of 100ppm.

Root formation of cuttings was inhibited by GA_3 at concentration of 150 ppm. The promotion of GA_3 on rooting, appears to be due to stimulation of juvenility in tissues of cuttings, or perhaps GA_3 increased the sprouting buds, and consequently, the synthesis of any rooting cofactor.

4. References

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