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EFFECT OF BORON AND GIBBERELLIC ACID ON GROWTH AND FRUIT YIELD OF OLIVE CV. "USLU"

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ABSTRACT

A field research was under taken to evaluate the efficiency of Boron (B) and Gibberellic Acid (GA_3) on fruit setting phenomenon in Olive cultivar "Uslu" in Olive fruit orchard at NARC, HRI during 2009. The Olive plants were sprayed with 4 levels of (B) (@ 0, 0.3, 0.06 & 0.09 %) and (GA_3) was also sprayed in 4 levels (0.20ppm, 25ppm and 30ppm) after flower opening. The results showed that the maximum flowering (No.2557) with the application of (B) treatment @ 0.03%, while GA_3 showed maximum flowering (No. 2222) with 30ppm treatment. Maximum fruit setting (34) was recorded with (B) spray @ 0.06% and maximum fruit setting (21) was observed with GA_3 treatment @ 20ppm. Maximum number of fruits, fruit size and fruit weight was observed with 30ppm (25.00, 3.787cm and 3.650 kg) and maximum number of fruits, fruit size and fruit weight was observed with (B) treatment @ 0.09% (No. 63.50, 1.712 and 3.562 kg) on the basis of above results it may be concluded that (B) @ 0.09% and GA_3 @ 30ppm treatment was optimum for improvement in number of flowers & fruits, fruit size and fruit weight in Olive cv "Uslu"

key words: *Olive. Gibberellic acid. Boron. Spray. Fruit setting. Fruit yield.*

INTRODUCTION

Olive is an evergreen plant of Mediterranean climate. Fruit yield quality is greatly affected by environmental conditions. Olive tree (Olea europaea L.) of the family Oleaceae family has a high economic value and many countries such as Iran, Turkey and Mediterranean use its oil and conserved fruits Payvandi *et al.* (2001). The world area of olive cultivation is around more than 9 m ha, with major oil production in 5 Mediterranean countries viz., Greece, Italy, Spain, Tunisia and Turkey (95 % of 2.5 Mt oil) (FAO Stat. 2003).

Olive needs winter chilling for flowers initiation where as long warm dry summer promotes the development of oil in the fruit. Noor *et al*., (1995) reported increase of flowering and fruit set as a result of improved nutrition and girdling operations. Foliar application of nutrient elements especially boron on olive (El-Khawaga, 2003, 2007) and calcium on Mango (Sabour, 2001) improved fruit setting. Kamal (2000) studied the effect on spraying zinc (0.3 and 0.6 and 0.5%) and calcium at 0.3% significantly increased fruit setting and oil contents in comparison with the control. In addition to above finding, Brown (2001) studied the effect of boron fertigation on pistachio cv. Kerman, olive cv.Manzanillo and revealed that foliar boron application increased fruit setting and yield when applied during reproductive growth. Foliar application of boron @ of 0.25% or 0.50% significantly decreases the percentage of imperfect flowers and improved fruit setting. All nutrients play an important role in activating growth and fruiting through encouraging cell division and stimulating the biosynthesis of organic foods the number of inflorescences / shoot and number of flowers per inflorescences. Two flowering aspects were possibly affected by establishing girdling ands spraying of Gibberellins nutrients, either singly or in combination compared to the check treatment (El-Khawaga, 2007). The plant growth regulator "Siapton" 10L at 500ml and 1000ppm, boric acid at 50ppm and 66F at 100ppm was applied to check fruit checking of olive cv. Frantoio. Boric acid 100ppm and Siapton led to notable increase in percent fruit set and corresponding plant productivity (Bartolini *et al*., 2000). In a first trial, Promalin (GA 4 + 7 +BA) at 0.75, 1.0 or 1.25ml/L, applied 16 days after full bloom significantly increased fruit set. In a second trial, similar Promalin applications at full bloom, or before full bloom, tended to reduce fruit set. The reduction was greater at the highest concentration. Application before full bloom did not affect fruit set. Fruit size was not affected by promalin applications (Qrunfleh *et al.,* 2003). Generally olive plant may flower profusely but the fruit set is poor. Certain chemicals such as 2% biuret urea, 3% potassium nitrate and 4% potassium sulphate, applied as foliar spray during first and second fruit development stage have been shown to decrease fruit drop and increased yield, fruit quality and oil contents (Inglese *et al*., 2002). Enhancing fruit growth such as citrus (Eman *et al.*, 2007; EL-Sese 2005), lichi (Stem and Gazit, 2000; Chang and Lin, 2006), guava (EL-Sharkawy *et al.*, 2005), and pear (Zhang *et al*., 2007), in all species so far studied, gibberellins had the potential for increasing fruit size.

The beneficial effects Gibberellic acid (GA3) and nutrient elements sprays specially zinc on yield and fruit quality of different fruit crops were mentioned by many investigators including Swietlik (2002). Also, the use of GA3 as a growth regulator to promote size and to control fruit drop was reported by Arteca (1996). Since, most of

olive cultivars introduced from Italy and Turkey at NARC produce flower profusely but fruit setting and yield is very low. It is important to explore various procedures to decrease fruit drop and increase yield of olive cultivars. The above findings clearly indicate that the use of GA_3 and boron for enhancing yield and olive quality. Main objective of the present study was to check the positive response of GA_3 and boron on olive cv. Uslu, which is being popularized in humid and rainy climate of Islamabad due to ripening after the onset of rains.

MATERIALS AND METHODS

Olive (*Olea europaea* L. cv.Uslu) trees of similar vigor, age (eight years old) and size were selected for sprays treatments during 2009 season at NARC Islamabad. For each replication of treatment, same shoot with regard to height, vigor and number of fruit was selected.

Trees were grown in sand loamy soil, 3 x 3.5 m apart from plant to plant and row to row. The plants were grown on a single wire trellis system at experimental farm of olive research orchard. The olive cv. Uslu, introduced from Turkey. The experiment was of a randomized complete block design (RCBD) with four replications fashion, in each treatment. The spray material was applied in full coverage with a hand sprayer. Different concentrations of Boron spray @ of (0, 0.03%, 0.06% and 0.09%) was applied to bearing olive cv. Uslu, two week before anthesis, while Gibberellic acid (GA3) was applied in four levels viz; 0, 20ppm, 25ppm and 30ppm after flower opening and 0 treatment was kept as control.'Uslu' is an early maturing olive cultivar with its small fruit and superior quality and in recent decades has become one of the major cultivar in Potohar region of Islamabad. Total number of inflorescence and flower developed were counted from each treatment after one week of foliar Boron application while total perfect flowers were counted after flower opening a week later of Boron spray. Numbers of imperfect flowers were determined by subtracting from total number of flowers. Number of fruit set was counted after three week of pollination. After the fruits were fully mature, fruits from three branches were randomly harvested from each plant to determine fruit weight and number of fruits per treatment. The data obtained was analyzed statistically by computer using 'statistics 8.1' package and the means were compared using least significance difference (LSD) test at 0.05% significant level (Steel and Torri, 1984). All data presented here is on the basis of fresh weight.

RESULTS AND DISCUSSION

Results regarding of all seven characteristics showed significant difference among the treatments. The data regarding the effect of Boron and Gibberellic acid on percentage of perfect flowers, fruit setting, fruit harvest percentage, fruit size and fruit weight were recorded during 2009 (Table 1)

Percentage of Perfect Flowers

The data of both Boron and Gibberellic acid showed that all the treatments increased the percentage of perfect flowers, fruit set percentage and harvested fruit percentage over control. Maximum number of perfect flower was observed in the treatment where Boron was applied @ 0.09% (778), which was significantly higher than the treatments, where Boron was applied @ 0.06% (708) and @ 0.03% (612). The largest number of perfect flowers were found with Gibberellic acid when GA3 was applied @ 20ppm (432), which was followed by @ 25ppm and GA3 @ 30ppm, which were (356, 3112) respectively. Both the treatments produced higher percentage of perfect flowers than control. Martin *et al*. (1990) reported that variation in perfect flowers occur among cultivars and further added that this variation was due to variation in climate (temp and rain fall etc), nutritional status and state the plant health during the study season.

Fruit set percentage

Fruit set percentage provides the information about determining the production of the olive at economic and commercial level. The data regarding to fruit set percentage on the basis of perfect flowers indicated in table I, clearly showed that there was significantly higher difference among the Boron and GA3 treatments for fruit setting percentage. The average fruit set percentage was significantly higher in the treatment with GA3 @ 20ppm was found 6 .52% and it was followed by the treatment GA3 @ 25ppm 5.90% and GA3 @ 30ppm was 4.32%. Boron @ 0.09% had the minimum percentage of fruit setting 1.43% on the basis of perfect flowers. The Boron application in different concentrations did not produced good fruit setting indicating that Boron does not has good influence on fruit setting percentage on the basis of perfect flowers. The superiority of GA3 in fruit setting could be attributed to the accumulation of carbohydrate and essential hormones, which could have balanced C/N ratio in the leaves to a level, which enhanced the production of perfect flowers as well as increased the percentage of fruit setting. Many Researchers have now demonstrated that foliar application of Boron, immediately prior to flowering effectively

increase the fruit set in the trees (Nyomora *et al*., 1999; Hanson, 1991).

Table 1. Effect of boron and ga3 application on growth and fruit yield of olive (olea europeae l.) cv. USLU.

Treatments	Fruit Setting % on total flowers	Fruit setting % of perfect flowers	Fruit Number	Fruit Size (cm)	Fruit Weight (kg)
Control	0.5467 e	1.173 e	15.750 b	1.5474 b	1.562 d
Boron @ 0.03%	0.7233 d	1.247 de	28.500 c	1.6050 ab	3.295 c
Boron @ 0.06%	0.9600 c	1.330 de	42.500 b	1.6200 ab	3.467 b
Boron @ 0.09%	2.107 b	1.513 d	63.500 a	1.7125 a	3.562 a
GA_3 @ 20 ppm	0.6167 e	5.320 c	17.500 ab	2.957 b	2.495 c
GA_3 @ 25 ppm	1.070 b	5.800 b	20.250 ab	3.650 a	3.263 b
GA_3 @ 30 ppm	2.150 a	6.710 a	25.00 a	3.787 a	3.650 a
LSD value @ (0.05 %)	0.0795	0.287	5.333	0.138	0.083

Fruit Size

Data regarding fruit size, the maximum out put was achieved with GA3 @ 30ppm (3.787cm) followed by GA3 @ 25ppm (3.6500cm). However, GA3 applied @ 20ppm resulted significantly less 2.957 cm. Similar results were obtained with GA3 application. A best result was found with Boron @ 0.09% (3.562 cm) followed by Boron treatments @ 0.06% and @ 0.03% i.e. (3.467 cm) and (3.295cm) respectively, whereas non-significant difference was observed among them. Most off-putting result (1.562 cm) was achieved by control treatment. Our results are in line with Ramezani and Shekafandeh (2007), however they used Zinc sulphate and GA3 and reported that these treatments accelerated fruit growth of olive, and also increased both fruit size and total yield per tree.

Fruit Weight

Weight of fruit as shown in Table 1 depicted that GA_3 sprays at 30 ppm performed well than applying GA_3 at other concentrations and control. Results regarding fruit weight illustrated that GA_3 gave prominent (3.650 g) and (3.262 g) results at 30 ppm and 25 ppm concentration respectively followed by (2.495 g) at GA_3 20 ppm. Whereas Boron treatments are non significant among each other. Most excellent (3.642 g) results were attained at 0.09% followed by (3.467 g) at 0.06% and (3.295 g) at 0.03% respectively. Most repulsive (1.562 g) results were shown by the control treatment. The role of GA_3 in improving the fruit quantity namely, fruit weight and fruit size may be due to its role in increasing cell elongation. Increasing yield due to GA_3 or Boron may be attributed to their effects on increasing levels of IAA (Eman *et al*., 2007).

CONCLUSION

The present study concluded that GA_3 @ 30ppm and Boron @ 0.09% encouraged cell enlargement which in turn caused a significant improvement in the perfect flowers; fruit set percentage, fruit size percentage and fruit weight. Ultimately it is recommended that GA_3 and Boron may be used for yield enhancement and increase in its economic value.

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