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Plant Growth Regulators Used For Decreasing The Severity of Alternate Bearing in Olive

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SUMMARY

Endogenous factors (fruit load, nutrition, hormonal balance) and exogenous factors (ecology, cultural techniques) affect the alternation which is an important physiological problem. Too many studies have been carried out in olive which has a tendency to alternation in order to regulate the bearing. In recent years intensive researches have been continued related to the use of growth regulating chemical substances (NAA, NAD, GA_3, CCC, SADH etc.) nearby other cultural techniques in important olive producing countries. As a matter of fact, similar studies have been started in Turkey. In the development of our olive production, it will be really useful to carry out these researches more, and to put their results into practice.

Key words: Olive, alternance, plant growth regulator.

ÖZET

Zeytinde Periyodisitenin Şiddetini Azaltmak Amacıyla Kullanılan Bitki Büyümesini Düzenleyici Maddeler

Önemli bir fizyolojik sorun olan periyodisite üzerine içsel (meyve yükü, beslenme, hormonal denge) ve dışsal (ekoloji ve kültürel teknikler) faktörler etki

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yapmaktadır. Periyodisiteye karşı eğilimi oldukça fazla olan zeytinde de verimin düzenli hale getirilmesi amacıyla birçok çalışmalar yapılmaktadır. Son yıllarda önemli zeytin üreticisi ülkelerde, diğer kültürel tekniklerin yanısıra, büyümeyi düzenleyici kimyasal maddelerin (NAA, NAD, GA_3, CCC, SADH vb.) kullanımı amacıyla araştırmalar yoğun bir şekilde devam etmektedir. Nitekim, Türkiye'de de benzer çalışmalar başlatılmıştır. Bu çalışmaların yaygınlaştırılarak, uygulanmaya alınması zeytinciliğimizin gelişmesi açısından yararlı olacaktır.

Anahtar sözcükler: Zeytin, periyodisite, bitki büyümesini düzenleyiciler.

INTRODUCTION

The severity of alternate bearing may change according to families, species and even cultivars although irregular bearing almost appears in all horticultural crops. For example, although some olive cultivars including "Mission", "Manzanillo", "Galega", "Chemlali" and almost all native cultivars have alternation, cv. "Frantoio", "Ascolana" bear regularly other than genetic factors, alternation is influenced by phsiological (overload, nutritional and hormonal imbalanace) and other (ecology and cultural techniques) factors (Monselise and Goldschmidt 1982, Milella 1983, Yüce et al. 1986, Poli 1987).

Overload in "on" year affects importantly the occurence of flower buds in following year by irregulation of nutritions and phytohormones in fruit seeds (Teskay and Shoemaker 1978, Hartmann et al. 1980, Monselise and Goldschmidt 1982). Generally excessive flower and fruit production in "on" year causes the carbohydrates and other nutrients necessary for plant to exhaust or decrease to very low quantities. Trees fruit nothing or very low for one year because of accumulation of these nutrients in "off" year (Westport 1978). The same condition is valid for olives. In spring time the appearance of vegetative and generative development at the same period brings about typical nutrient competition (Monselise and Goldschmidt 1982).

The effects of plant leaves on alternate bearing is originating from hormonal activities to great extent. Generally nutrients and hormonal compounds are translocated from the same sources. So, it is very difficult to distinguish them. It was found that some hormonal substances in the leaves of most of the alternate bearing species prevented the flower bud initiation. As an example, ABA in pecan leaves can be considered (Monselise and Goldschmidt 1982).

Ecological factors also affect the irregularity between vegetative growth and fruiting that cause alternation directly or indirectly (Hartmann et al. 1980, Milella 1983, Poli 1987). When the cold reguirement is not provided sufficiently

or extremely low temperatures occurred, the development is affected negatively. Thus, severity of alternation is increased. On the other hand, excessive relative humidity brings about the yield decline by decreasing the probability of pollen germination in olives, oranges and grapefruits. Also the incidence of pests and diseases is closely related to relative humidity. High humidity leads to the appearance of parasitic diseases and therefore it can cause weakening of the tree and appearance of alternation.

Like many fruit species that show alternate bearing, different cultural methods are applied in olive in order to decrease the severity of the irregular bearing. Among these methods, the possibilities of utilization of chemical substances have been studied widely in recent years.

1. GROWTH REGULATING SUBSTANCES USED IN ORDER TO DECREASE THE SEVERITY OF ALTERNATE BEARING

It was observed that effective results were obtained in enhancing the fruit quality and minimizing the irregularity of yield by applying growth regulating substances in different times. Although it differs among species and cultivars these chemical substances are used for thinning or promoting flower bud initiation (Westport 1978). Important examples related to these are explained below:

Auxins

Auxins group compounds used to decrease the severity of alternation in olive are generally applied for thinning. Among these substances, NAA (Naphtalene Acedic Acid) is most commonly used (Barut and Eriş, 1992).

The observations in USA indicated that the best time for flower thinning by NAA is 12-18 days after full bloom and for fruit thinning it is small fruit stage before olive seed becomes hardening. In general the application dose of NAA is obtained by multiplying the dates after flowering by 10. If the thinning is applied to fruit, 200-250 ppm is recommended (Hartmann et al. 1980, Sibbett and Martin 1981). As a matter of fact, Krueger et al. (1987) suggested 150 ppm (15 days after full bloom) for flower thinning and 150-450 ppm for fruit thinning in application with NAA on cv. "Manzanillo". Rallo and Barranco (1986) studied on the same subject reported that the effectiveness of chemical applications could vary depending on length of flowering period in the thinning by NAA in Spain. Therefore, prolonged flowering period gives more positive results with respect to fruit set and this decrease the severity of alternation.

In a study conducted in Israel, thinning was applied with NAA and NAD at different doses (80-240 ppm) on cvs. "Manzanillo", "Arida-5" and "Kalamata" irrigated by different methods. In the applications on 4., 8. and 12. days after full bloom the effect of NAA in improving the yield and fruit size was found much better when compared with NAD (Lavee and Spiegel-Roy 1967). In California State of USA NAA applied on cv. "Manzanillo" and in "on" year 12., 13., 14. and 15. days after full bloom gave the best result with 150 ppm and it was found that the most suitable thinning time to decrease the severity of alternation was 15 days after full bloom (Martin et al. 1980). On the other hand, Hartmann et al. (1980) determined with the same cultivar that NAA applied 2 weeks after bloom increased yield 30 % in "off" year in USA.

In Turkey NAA applications (100 and 150 ppm) were performed for flower thinning 10 days after full-bloom "on" cv. "Gemlik". At the end of the study, when the applications were carried out in "on" period, both of the doses were found more effective on decreseing the severity of alternance (Barut and Eriş 1992).

Gibberellins

GA_3 (Gibberellic Acid) is one of the most commonly used chemical substances to enchance the yield of olive and decrease affectiveness of alternation. And rather promising results are obtained with this substance. For instance, GA_3 applications conducted at different stages from fruit set to ripening in cvs. "Ascolana Tanera" and "S. Agostino" in Italy reduced preharvest drop, thus brought about an increase in both "on" and "off" year yields. Finally, 500 ppm GA_3 was found as the best application dose (Rotundo and Gioffre 1984). Lavee et al. (1983) studied on the effect of GA_3 on flower initiation and fruit set in Israel reported that applications (25-100 ppm) conducted during flowering period could give positive results. Similarly Li (1987) in China reported that 150 ppm GA_3 applied during bud burst increased the yield by 4 times when compared with controls.

In Turkey GA_3 applications at fruitlet stage were generally found successful with respect to increasing of panicle, flower and fruit set. So, researchers indicated the positive effect of GA_3 on the formation of flower buds in next year (Barut and Eriş 1992).

Other Plant Growth Regulators

Studies were conducted related to use of some other plant growth regulators other than auxin like substances and GA_3 with the aim of alleviating

alternation. For instance, different applications were carried out for more than two years in Egypt. As a result, 200-500 ppm CCC (Cycocel) and 2000 ppm SADH (Daminozide) applications were determined to enhance flower bud formation and number of perfect flowers. Thus it was reported that these chemical substances may be effective through the augmentation of yield in olive especially in "off" year (Hegazi and Stino 1985). In Italy it was observed that Putrescine Diclorid (5000 ppm) and Putrescine (4800 ppm) applied at first blooming on "Pendolina" and at full blooming on "Leccinio" caused an increase in yield in both "on" and "off" year but reduced the fruit weight (Rugini and Mencuccini 1985). In Greece foliar and soil applications of Paclobutrazol (2000 ppm) were carried out. This substance was recommended to be used with aim of thinning while it reduced yield in "on" year cvs. "Hondrolia" and "Hulkidikis" (Porlagis and Voyiatzic 1987).

In 1972-1973, CCC applications were conducted on cvs. "Memecik" and "Ayvalık" in order to increase yield and improve the fruit quality in Aegean Region of Turkey. It was observed that 1200-1600 ppm applications conducted 15-30 days before full bloom increased the fruit set in "off" year. However it caused a reduction in fruit size. Therefore CCC application was reported to be suitable for oil cultivars rather than table cultivars (Usanmaz 1974).

Nearby all studies, researchers attempted to implement the girdling by using growth regulator substances. For this purpose they studied with cvs. "Manzanillo" and "Ouve di Piccione" in Israel. Chemical girdling applications by treating scaffold branches with Morphactin (125 l/l CM: 72-210) in Springtime increased the flower formation and yield as well as other classical (Mechanical) girdlings and decline the severity of alternation by 41.6 %. Considering all these facts the researchers recommended the chemical girdling applied in order to block phloem systems of the tree because of the fact that it is easer and less risky (Ben-Tal and Lavee 1985).

2. RESULTS

Alternation is an important physiological irregularity which influences the yield negatively in olive like other fruit species. A lot of cultural techniques, primarily breeding are used widely to minimize the severity of this irregularity. Also utilization possibilities of growth regulating chemical substances in order to achive this goal has been considered in recent years. Especially the positive effect of chemical substances on thinning is an undiscussable fact. Moreover, it was determined that these substances could be

effective on flower formation when applied at proper time. Other than the removal of the irregularity in yield, an advantage of such chemical substances is the improvement in fruit quality. However, it is compulsory to be careful by health when using these substances.

The studies realted to decreasing the severity of alternation by use of chemical substances are quite recent in Turkey. The application of growth regulating chemical substances along with other cultural techniques in such studies, no doubt, is important in achievment of our goal in a short time. On the other hand, the investigations on chemical girdling nearby classical methods will be beneficial not only for olive but also for other fruit species that require girdling.

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