Investigation on The Effect of Some Plant Growth Regulators on Sunflower *(Helianthus Annuus* L.*)*

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With a view to establish the effect of some plant growth regulators on sunflower (Helianthus annuus L.) production and oil content was made an experiment. The agricultural test was carried out in the experimental base of Agricultural University of Plovdiv, Bulgaria in 2001- 2003.The investigation was pulled out by block design with four replications with crop plot size 20 m^2, previously sowed with wheat. The tested chemicals are as follows plant growth regulators: "H- 40'' (alfanaftilvinegar acid), "M-2'' (amid of dicarbonovy acids of benzolovid number), "31''(derivate of naphthalene with auxin efficacy), "XP'' (ftalaminova acid) content micro and macro elements, synthesised in Research Institute of Cryobiology and Food Technology, Sofia in dose 1 cm^3 / l water and Agat 25 EK- 2.5 g/da (Too bio biz Ltd.).

The investigation was made on Bulgarian sunflower hybrid Super Start, treated during pinhead and flowering. The effect of the tested plant growth regulators on the quantity of yield and some structural elements (sunflower heads number, seeds number, seeds mass, mass/ 1000 seeds, oil content and oil yield) was reported in the process of investigation. The effect grade of growth regulators is fixed due to non-treated control.

By the dispersal analysis method, it is made a mathematics processing of the values of received data. The results of investigation showed that there is no significantly difference between the seed yield kg/da and oil content l/da in pinhead period by the use of plant growth regulators - ''31'' (1cm^3/l water) and ''Agat 25 EK'' (2.5 g/ da). In the flowering period when treated with the same plant growth regulators, the seed yield is increased as of 15.3 % and the oil content increased as of 16.4% (with Agat 25 EK) but it is decreased as of 18.6% by the application of "31".

Key words: sunflower, plant growth regulators, effect, yield, oil content.

Bazı Bitki Büyüme Düzenleyicilerinin Ayçiçeğine *(Helianthus Annuus* L.*)* Etkisinin Araştırılması

Ayçiçeği (*Helianthus annuus* L.)'nin verim ve yağ içeriğine bazı bitki büyüme düzenleyicilerinin etkisinin belirlendiği araştırma, 2001–2003 yılları arasında Bulgaristan Filibe Tarım Üniversitesinde yürütülmüştür. Daha önce buğday ekilen alanda tesadüf blokları deneme desenine göre kurulan denemde parseller 25 $m^{2'}$dir. Araştırmada bitki büyüme düzenleyicisi olarak H- 40' (alfanaftilvinegar asit), M-2 (benzolovid sayısının amid -dicarbonovy asit), 31 (oksin etkisiyle naftalinden türetilmiş) ve XP (ftalaminova asit) kullanılmıştır. Dozlar 1 cm^3/l su ve Agat 25 EK- 2.5 g/da şeklinde uygulanmıştır. Makro ve mikro element içerikleri Sofya Cryobiyoloji ve Gıda Teknolojisi Araştırma Enstitüsü'nde yaptırılmıştır. Düzenleyiciler Bulgaristan kökenli hibrit Süper Start ayçiçeği çeşidinin iki farklı döneminde (çiçek tablası oluşum dönemi ve çiçeklenme) uygulanmıştır. Tabla oluşum döneminde 31 ve Agat 25 uygulaması verimi ve yağ içeriğini etkilememiştir. Çiçeklenmede uygulanan Agat 25 EK tohum verimini %15.3 ve yağ içeriğini %16.4 artırırken 31 uygulaması %18.6 azaltmıştır.

Anahtar Kelimeler: Ayçiçeği, bitki büyüme düzenleyicileri, etki, verim, yağ içeriği

Introduction

The investigation about the effect of kinds of plant growth regulators on the yield and oil content of sunflower seeds and other oil productive crops is in the field of great number of scientific investigations (Ahishin 1997, Ghosh 1991). In some of these works a greater attention is paid for the effect of pre-sowing treatment of seeds with substances that improve germinatelly and stability of plants against diseases (Kalyani 1984, Klochkov 1993).

According to some of the authors, the usage of certain substances in seed treatment before

sowing leads to increase of yield by 13.3%. There is considerably little information about the treatment of sunflower with plant growth regulators in vegetation period and their effect on growth, development and productivity of plants (Ames 1988; Mattson 1984; Slavov 1996; Fournier et al., 2005; Yamada et al., 1998).

The growth processes of sunflower are accelerated by the treatment of 12 days old plants with growth regulators - LAB, BAS, 100W and BAC 111W(Kar 1993). The use of giberillic acid and benzyladenine (Beltrano 1994) leads to increase of seed mass and seed number in the middle part of sunflower head and lately to seed yield increase about 25 %.

Materials and Methods

The investigations carried out between 2001-2003 at the Study Experimental Base of Agricultural University- Plovdiv, Bulgaria, by block design with four replication on 25 m^2 of crop plot size. The test was made on the following plant growth regulators: "H-40'' (alfanaftilvinegar acid), "M-2'' (amid of dicarbonovy acids of benzolovid number), "31''(derivat of naftalin with aukcin efficacy), "XP'' (ftalaminova acid) content micro and macro elements, synthesised in the Research Institute of Cryobiology and Food Technology, Sofia with 1 cm^3 / l water and Agat 25 EK- 2.5 g/da (Too bio biz Ltd).

Super Start hybrid sunflower, was treated with 60 l solution/da in pinhead and flowering period. The investigation was carried out on meadow- marshy soil, with horizon A 25 -28 cm power (Yanchev et al. 1999). The humous was about 4%, the soil reaction faintly alkali (pH = 7.15). The physical clay content in upper horizon was 50%. It was dark colored with clear structure and with satisfying moisture keeping features because of $CaCO_3$ content (Gyurov 1959).

We investigated the effect of the studied plant growth regulators on seed yield and some structural elements of yield as number of sunflower head, seed number, seed yield, seed weight, oil content and oil yield. The oil yield per da. is determined by soxhelet method for oil extraction with ether. The meteorological condition during 2001- 2003 were different in different months and years. The rainfall quantities during vegetation period of sunflower were as follows:

- In 2001- 280,0 mm, 2002 - 350,1 mm and 2003- 238,1 mm to 240,0 mm for the period (1965 – 1995). With respect to rainfall, the investigated years can be characterized as follows:

- 2001 - normal with expressed drought in July when there were no rains and that reflected adversely on the yield.

-2002- favorable for the development of sunflower with optimal distribution of rainfall per months.

-2003 - drought because of 78,8 mm less rainfall quantity during the critical for sunflower period.

Statistic processing data were carried out by the dispersion method analyses.

Results and Discussion

The seed yield is the most representative indicator that characterizes the effect of the tested plant growth regulators on sunflower (table 1). It is determined that the yield treated with the same studied substance varies during the years because of the effect of the meteorological conditions.

The lowest seed yield was produced in 2003 without concerning any of the chemicals because of the considerable drought period in July and the highest in 2002, which was favourable for growth, and development of sunflower. Seed yield by the control variant is 262 kg/da. The highest seed is produced by treatment with the growth regulator - "31'' in flowering period (1cm^3 / 1,76 pints water- variant 8) as of 302 kg/da or it is 15.3 % greater than by the control variant next comes - treatment with growth regulator - ''Agat 25 EK'' in the flowering period (25 g/da- variant 10). That one was resulted in 297 kg/da or it is 13.4 % greater yield. It is proved that the treatment of sunflower in pinhead period with the tested plant growth regulators does not increase seed yield.

The mathematically proved increase of seed yield when the sunflower is treated in flowering period can be explained by the fact the studied growth regulators have improved the processes of pollination in the middle part of the sunflower head, which gives greater increase of yield. The average data about some structural elements of the yield during the investigation in

2001 - 2003 are shown on table 2. With respect to indicator - number of sunflower heads on 25 m^2 there are no mathematically improved differences.

It was determined that the seed number per head increases when treated with growth regulators - ''31'' in flowering period - 100 seeds, and with ''Agat 25 EK'' - 65 seeds more than the control variant.

Table 1. Seed yield

Treatments	2001		2002		2003		Mean	
	kg/da	%	kg/da	%	kg/da	%	kg/da	%
Pinhead stage								
1.H-40 1cm^3/l water	267	105.9	334	103.1	223	106.2	275	105.0
2.M-2 1cm^3 /l water	260	103.2	330	101.8	216	102.9	269	102.7
3. 31 1cm^3 /l water	279	110.7	343	105.9	231	110.0	284	108.4
4.XP 1cm^3/l water	256	101.6	327	100.9	214	101.9	266	101.5
5.Agat 2.5g/da	271	107.5	339	104.6	226	107.6	279	106.5
Flowering stage								
6.H-40 1cm^3/l water	274	108.7	341	105.2	232	110.5	282	107.6
7.M-2 1cm^3/l water	269	106.7	337	104.0	229	109.0	278	106.1
8. 31 1cm^3 /l water	291	115.5	365	112.7	249	118.6	302	115.3
9.XP 1cm^3/l water	264	104.8	332	102.5	221	105.2	272	103.8
10.Agat 2.5g/da	286	113.5	361	111.4	243	115.7	297	113.4
11.Control	252	100.0	324	100.0	210	100.0	262	100.0
GD 5 %	*25.0*		*34.9*		*32.9*			
1 %	*33.6*		*47.1*		*44.3*			

Table 2. Structural elements of the yield (2001- 2003)

Treatments	Sunflower, heads, number/ 10 m2	Seeds, number	Mass seeds (g)	Mass/ 1000 seeds,g	Oil content (%)	Oil yield, (l/da)
Pinhead stage						
1.H-40 1 cm^3/l water	51.5	975	52.1	53.4	44.7	122.9
2.M-2 1 cm^3/l water	51.6	970	50.5	52.1	44.5	119.7
3. 31 1 cm^3/l water	51.3	990	54.8	55.4	44.9	127.5
4.XP 1 cm^3/l water	51.4	960	49.7	51.8	44.6	118.6
5.Agat 2.5 g/da	51.2	980	53.4	54.5	44.8	125.0
Flowering stage						
6.H-40 1 cm^3/l water	50.4	1038	58.0	55.9	45.6	128.6
7.M-2 1 cm^3/l water	50.3	1020	56.4	55.3	45.3	125.9
8. 31 1 cm^3/l water	50.9	1050	62.3	59.3	45.7	138.0
9.XP 1 cm^3/l water	50.2	1009	54.7	54.2	45.2	122.9
10.Agat 2.5 g/da	50.6	1015	59.6	58.7	45.6	135.4
11.Control	50.1	950	49.7	52.3	44.4	116.3
GD 5 %	*1.76*	*64.3*	*9.50*	*6.35*	*1.44*	*9.86*
1 %	*2.36*	*86.6*	*12.78*	*8.55*	*2.01*	*13.28*

Treatment with these growth regulators also increases the seed mass with corresponding 12.6 g (variant 8) and with 9.9 g (variant 10) heavier that by the control variant. Mass of 1000 seeds at the different variants is from 51.8 g to 59.3 g, which shows that the usage of these substances changes the values of this indicator. At the control variant (11) mass of 1000 seeds is 52.3 g. Most heavier seeds are produced by treatment during flowering period with plant growth regulators - "31'' (variant 8) - 59.3 g. and with Agat 25 EK - 58.7g (variant 10). The heavier seed mass in these variants relates with the greater seed yield. The separate variants have insignificant difference from one another in respect to oil content in seeds.

Conclusions

The final aim of the testament of the different plant growth regulators contribute to insignificant increase in oil content/da. In most cases, this indicator affected the value of seed yield and oil content and runs the changes of these two factors. The results show that in the variants with greater seed yield and oil content is also increased, because of that the total sum of oil content in these variants is greater.

This is in respect to plant growth regulators - *31* (variant 8) - 138.0 l/da oil and *Agat 25 EK* (variant- 10) - 135.4 l/da oil, while in the control variant is content 116.3 l/da oil.

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