

**EFFECT OF BIOSTIMULATOR “FERTILEADER GOLD”
ON DEVELOPMENT OF SUNFLOWER PLANTS**

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The aim of the research was to determine the influence of foliar nutrition with “Fertileader Gold” on growth indices of sunflower plants under field conditions. Results showed that foliar application of mentioned biostimulant increased the growth rate with about 6% compared to control. The highest positive influence of the fertilizer was on the head diameter (about 28% at stage 70 days after planting), comparing with plant height. This study may help the integrated nutrient management for oil seed crops especially the sunflower, and biostimulators as “Fertileader Gold” can be beneficial to improve growth and development of treated sunflower.

Keywords: *sunflower, fertilizer, biostimulator, plant height, head diameter.*

**EFFECTUL BIOSTIMULATORULUI „FERTILEADER GOLD”
ASUPRA DEZVOLTĂRII PLANTELOR DE FLOAREA-SOARELUI**

Scopul cercetării a inclus studierea influenței nutriției foliare cu „Fertileader Gold” asupra parametrilor de creștere a plantelor de floarea-soarelui în condiții de câmp. Rezultatele obținute au demonstrat că aplicarea acestui biostimulator a indus majorarea ratei de creștere cu cca 6%. O influență mai mare a exercitat asupra diametrului calatidiului, care a înregistrat (la a 70-a zi de la cultivare) valori mai mari cu cca 28% față de control. Aceste rezultate pot fi utile în managementul nutriției integrate pentru plantele de cultură oleaginoase, în special floarea-soarelui, iar biostimulatorul „Fertileader Gold” este recomandat pentru a fi utilizat la stimularea creșterii și dezvoltării acestei culturi.

Cuvinte-cheie: *floarea-soarelui, fertilizant, biostimulator, înălțimea plantei, diametrul calatidiului.*

Introduction

Continuous application of chemical fertilizers causes soil health problems even if applied in balanced proportion [26]. It has been established that organic material improves soil health and phyto-availability of the nutrients by increasing organic matter contents in the soil and improving the soil texture [16,1].

Considering the environmental and health problems arising from chemical fertilizers usage, much attention has been drawn to the application of biological fertilizers in agriculture.

Generally, the biostimulants are the organic substances used in low concentrations, involved in physiological processes of growth and plant development, which produce favorable effects, both quantitative and qualitative on crops while reducing losses due to transport and storage products [2].

The biostimulants and their combinations significantly affect growth processes and some growth attributes and agronomic characters as well as yield and its components [5].

Application of fertilizers having nutrients like nitrogen, phosphorous and potash can increase sunflower growth and yield substantially [17,21,10,8,22]. All these combine to create improved agronomic performance and as the result, improved profitability for the grower.

Plant mineral nutrition is a vital area of research to understand the mineral needs of plants, especially crops, and increase crop yields. Plants require both macronutrients (C, H, O, N, P, S, K, Mg, and Ca) and micronutrients (Fe, Mn, Zn, Cu, B, Mo, Cl, and Ni) in specific concentrations for their growth and development [14].

Nutritional elements can be used as foliar application. Nutritional spray on plants can decrease the delay between absorption and consumption of elements by plants that are very important for fast growth stages of plants [24].

Foliar feeding or foliar fertilization includes the application of necessary plant nutrients to the above ground, living plant parts. Its purpose is not to replace soil fertilization, but rather to supplement plant nutrient needs during short and/or critical growth stages.

Considering the economic importance and yield potential of the crop, this study was conducted to investigate the effects of biostimulant “Fertileader Gold” application, which is supplemented with nitrogen, boron and molybdenum on growth indices of *Helianthus annuus* L. under field conditions.

Material and methods

Fifteen commercial sunflower hybrids (*Sandrina*, *ITC-06*, *ITC-09*, *Procera 2*, *Super 5*, *Super 3*, *Super 1*, *Performer*, *Alex*, *Novi Sad 1*, *Novi Sad 2*, *Novi Sad 3*, *Limagrain 3*, *Limagrain 4*, *Limagrain 5*) were used in our research. Seeds were obtained from National Agricultural Research and Development Institute, Fundulea, Romania and other European Sunflower Seed Producers.

The investigations were carried out at Institute of Genetics and Plant Physiology of Academy of Sciences of Moldova (Latitude 47° 0' 0" N, Longitude 28° 55' 0" E and Altitude 39 m above sea level). The experimental non-irrigated field (0,5 hectare) was prepared for the “International Symposium on Broomrape (*Orobanche* pp.) in Sunflower”, Chisinau, Republic of Moldova, August 25-27, 2011. The experimental design included two sub-blocks with and without foliar nutrition (control plants).

For each hybrid was planted 4 rows with 26 m length. The distance between rows was 70 cm and between plants was 35 cm. Seeds were sown to a depth of 5 – 8 cm. Crop was planted manually in last week of April of 2011.

Plant height and head diameter were recorded on 80 randomly selected plants in each plot at different development stages: 30, 40, 50, 60, 70 days after planting and at harvest.

The applied biofertilizer was “Fertileader Gold” (1%), produced by S. C. Timac AGRO România S. R. L. This foliar biostimulant contain the patented SEACTIV base, molecular complex of Iso-pentényl adenine (IPA) extracted from marine seaweeds [25], and supplemented with fertilizing elements such as nitrogen, boron and molybdenum.

According to the Producer Fertileader's powerful biostimulant reduces environmental stress, increases nutrient movement, and increases chlorophyll activity in crop to maximize yield potential. Also, this product boost the potential of normal plant physiological processes, like root development, photosynthesis and mineral movement within the plant.

The fertilizer was directly sprayed on the plants at vegetative stage (4-8 leaves).

Obtained data were statistically analyzed using standard methods [27].

Results and discussions

Growth and development of sunflower are a combination of many events at many different levels, from biophysical and biochemical to tissue and organ levels. A few reports are available on the influence of organic fertilization on the phasic development of sunflower. Hocking and Steer [13] and Blanchet *et al.* [7] stated that rate of development and growth of both vegetative (leaves) and reproductive (florets and seed) organs are very much influenced by scarcity of biofertilizer nutrition.

Variety is an important factor considering plant height. Under the present study, plant height was significantly influenced by different genotypes of sunflower at different days after planting (DAP). Results showed that the hybrids Alex and Novi Sad 2 were evident for highest plant height at all growth stages. The tallest plant at 30; 40 and 50 DAP were 100,7; 133,3 and 145,0 cm respectively was obtained with Super 5 (Fig.1).

Fertilizer is the most important factor for achieving best yield of crop. Plant height was significantly influenced by “Fertileader Gold” application under the present study (Fig.1). It is evident that plant height was the highest after treatment at different growth stages of almost varieties of sunflower. The highest plant height at fertilized hybrids was 154,0 cm (Limagrain 4); 194,3 cm (Novi Sad 2) and 210,7 cm (Alex) at 30, 40 and 50 DAP respectively. The maximum increasing (24,8%; 15,5% and 11,7%) by fertilizer was induced at Super 5 genotype at 30, 40 and 50 DAP respectively. The hybrids Performer, Alex, Novi Sad 3 and Limagrain 4 showed no significant effects on this trait at all studied stages. Comparing dependence of fertilizer influence on growth stages, it was demonstrated that it increase growth rate with about 6% at all three studied stages.

However, applying biostimulator “Fertileader Gold” tended to increase plant heights of sunflower cultivars and the effect of it application was significant in most genotypes. Our research data concur with the literature [15,19,20].

The data taken for plant height at harvest are shown in figure 1. At the control genotypes the highest plant height were observed at two hybrids: Novi Sad 2 (200,93 cm) and Alex (200,58 cm). The minimum plant height recorded in control was attested at sunflower genotypes Sandrina (142,48 cm) and Super 5 (142,63 cm). Moreover, all treated plants had more height than non-treated plants. Application of “Fertileader Gold”, increased the plant height by 12,65% (ITC-06) and 11,54% (Super 5), compared to control respectively

(Table). These results are in line with the findings of other researchers [3]. Ceyhan *et al.* [9] also found significant effects of B application for plant height in chickpea.

Another growth trait was the head diameter, which contributes considerable share in final achene yield as it influences both the number and weight of achenes. The head diameters of sunflower plants varied with each genotype and these differences were found to be significant. The lowest value of this trait recorded at Sandrina (3,2 cm) at 30 DAP; Limagrain 5 (6,0 cm) at 40 DAP; at Limgrain 3 (18,3 cm) at 60 DAP and at Limagrain 3 (19,3 cm) at 70 DAP. The highest value of the head diameter recorded at Limagrain 3 and Limagrain 4 (5,5 cm) at 30 DAP; ITC-09 and Limagrain 4 (8,5 cm) at 40 DAP; at Super 1 (23,7 cm) at 60 DAP; Super 1 (24,7 cm) at 70 DAP (Fig.2).

Head diameter was significantly influenced by “Fertileader Gold” application under the present study (Fig.2). It is evident that value of this trait was the highest after treatment at different growth stages of almost varieties of sunflower. The highest head diameter at fertilized hybrids was at Limagrain 3 (6,7 cm) at 30 DAP; Super 3 (9,8 cm) at 40 DAP; at Sandrina (27,2 cm) at 60 DAP; at the some genotype (31,3 cm) at 70 DAP.

The maximum increasing (33,3%; 27,8%; 16,4% and 35,0%) by fertilizer was induced at Limagrain 5 genotype at 30, 40, 60 and 70 DAP respectively. Obtained data (Fig.2) indicated that “Fertileader Gold” application significantly influenced head development. At first three stages treatment induced increasing of head diameter at all genotypes with 13,1%; 12,8% and 10,6% respectively. The most influence was detected at 70 DAP, when fertilizer applying increased values of this traits with 28% (average value).

Obtained data at harvest showed that, the plants grown with fertilizer nutrition achieve remarkable size of head. At the control plants the minimum head diameter was noticed at hybrid Limagrain 3 (19,9 cm) and the maximum value (25,6 cm) – at Super 3 hybrid (Table). At fertilized plants the maximum size of head diameter (29,3 cm) was recorded at genotype Novi Sad 3.

Table

Effect of biostimulant "Fertileader Gold" application on height and head diameter of different sunflower hybrids (at harvest)

No.	Genotype	Plant height, cm			Head diameter, cm		
		control	treated	Effect of fertilizer, %	control	treated	Effect of fertilizer, %
1.	Sandrina	142,48 ± 4,17	150,10 ± 4,27	5,34	25,08 ± 0,55	27,29 ± 0,79	8,81
2.	ITC-06	155,65 ± 2,75	175,35 ± 2,03	12,65	24,38 ± 0,58	26,34 ± 0,41	8,03
3.	ITC-09	162,40 ± 1,34	173,73 ± 1,41	7,97	23,14 ± 0,30	25,05 ± 0,38	8,25
4.	Procera 2	173,85 ± 1,72	180,95 ± 1,45	4,08	21,33 ± 0,26	24,48 ± 0,30	14,76
5.	Super 5	142,63 ± 1,56	159,10 ± 1,57	11,54	24,80 ± 0,34	27,78 ± 0,31	10,80
6.	Super 3	150,98 ± 2,93	164,25 ± 2,71	8,78	25,64 ± 0,46	27,25 ± 0,58	6,27
7.	Super 1	186,38 ± 1,27	195,80 ± 1,33	4,75	24,80 ± 0,34	27,35 ± 0,40	10,28
8.	Performer	197,18 ± 1,56	198,73 ± 1,36	0,78	21,26 ± 0,30	24,75 ± 0,53	16,41
9.	Alex	200,58 ± 1,10	206,55 ± 1,1	2,97	21,59 ± 0,22	24,16 ± 0,26	11,90
10.	Novi Sad 1	192,00 ± 0,86	196,50 ± 0,92	2,34	22,63 ± 0,27	26,39 ± 0,33	16,62
11.	Novi Sad 2	200,93 ± 1,64	204,93 ± 1,94	1,99	22,53 ± 0,46	25,76 ± 0,60	14,34
12.	Novi Sad 3	184,95 ± 0,93	192,38 ± 1,4	4,02	23,94 ± 0,35	29,29 ± 0,36	22,35
13.	Limagrain 3	164,23 ± 1,06	171,40 ± 0,94	4,37	19,93 ± 0,24	23,11 ± 0,22	15,96
14.	Limagrain 4	178,33 ± 1,06	179,25 ± 1,27	0,52	22,08 ± 0,30	25,08 ± 0,36	13,59
15.	Limagrain 5	185,28 ± 1,32	186,45 ± 1,62	0,63	22,84 ± 0,23	27,56 ± 0,31	20,67
Average		174,52	182,36	4,85	23,06	26,11	13,27

The plants that were treated with this biostimulant showed 22,4 % more head diameter (Novi Sad 3), than non-treated plants (Table). The results for head diameter are in concordance with results obtained by Asad *et al.* [4]. This contributed to the improvement of pollen development and growth from an application of B [11]. Sing *et al.* [23], Bhagat *et al.* [6] and Hassan *et al.* [12] also reported increasing trend of sunflower head diameters with increasing sulfur fertilization.

This increase in growth attributes might be due to the role of this fertilizer containing nitrogen, boron and molybdenum, on structure of protein molecule, which is necessary for biological activity and improvement of plant metabolism as well as growth of stems and leaves. Adequate supply of nitrogen is required to accelerate all protein based metabolic processes, responsible for rapid expansion in vegetative and generative growth and higher yields [18]. It has been proved in all sorts of experiments that by enhancing the provision of nitrogen fertilizer, a boost in growth and photosynthesis also existed.

The result of the correlation analysis between percent of effect of biostimulant on sunflower plant height and its influence on head diameter (at harvest) revealed a negative correlation ($r = -0,6662$) between mentioned traits, as shown in figure 3. Also this correlation depends on the genotype. This information may be useful for selecting higher yielding varieties for sunflower production.

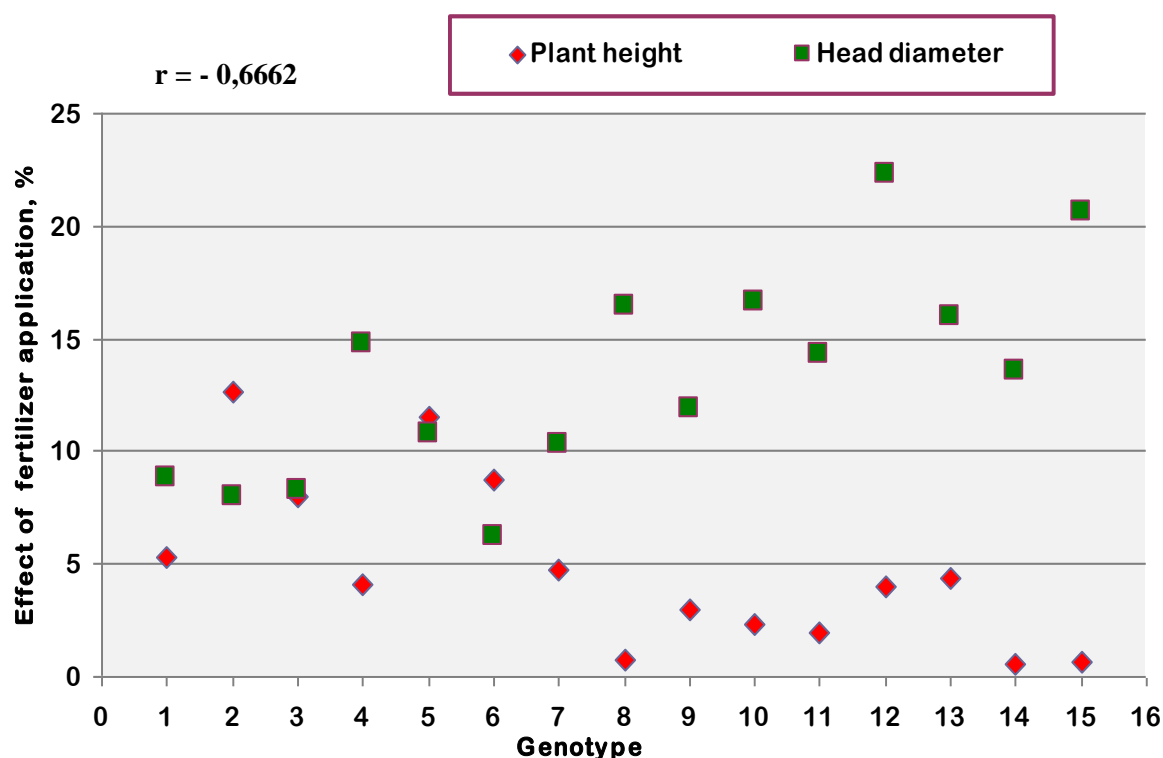


Fig.3. Correlation between the effect (%) fertilizer on plant height and its influence on head diameter (at harvest)

Conclusions

In summary, results obtained from this study clearly indicated that biostimulant treatment had significant effect on growth stages of sunflower and head development. Its application represents an important measure to correct nutrient deficiencies and to replace elements removed in the products harvested, and has been shown to be particularly effective with respect to yield formation. “Fertileader Gold” biostimulant can be beneficial to improve growth, development and total yield of inoculated sunflower.

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Acknowledgement. We express our appreciation to the National Agricultural Research and Development Institute, Fundulea, Romania and other European Sunflower Seed Producers: “*Limagrain*”, “*Syngenta*”, “*Nidera*”, “*Novi Sad institute*”, “*Quality Crops*”, “*ITC Seeds*” and “*Procera*” for providing sunflower hybrid seeds. We would like to thank S.C. Timac AGRO România S.R.L. which provided us the Fertilizer used in our experiments.

Prezentat la 19.11.2013