

The influence of growth regulator stimolante 66 f on the setting degree and productivity of cherry fruit of the Regina variety

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Abstract Fruit setting and their size can be improved with the application of growth regulators, such as synthetic auxins and gibberellins. The aim was to evaluate the influence of growth regulator Stimolante 66 f on fruit setting and physiological processes, fruit production and its quality. The study subject of the experience was Regina cherry variety was grafted on Gisela 6. The trees were trained as spindle system. The distance of plantation is 4.0 x 2.0 m. The experimental plot it was placed in the orchard „Vindex-Agro” Ltd. founded in 2012 year. The research was conducted during the period of 2016 year. To study fruit setting, physiological processes, fruit production and its quality were experimented the following variants of treatment: 1. Control – without treatment; 2. Stimolante 66 f – 0.2 l/ha; 3. Stimolante 66 f – 0.3 l/ha. Active ingredient of Stimolante 66 f is ANA (0,01 g/l) and solution of microelements (0,11 g/l). Grow regulator Stimolante 66 f were sprayed in two periods: the first at the beginning of bloom (16.04.16) and the second - after the fall of the petals (25.04.16). During the research, it was studied the setting degree, average of fruits, tree production and their quality. It was established that the setting degree, physiological processes, average of fruits, fruit production and its quality increase when treating with growth regulators Stimolante 66 in dose of 0.3 l/ha in two periods: the first at the beginning of bloom and the second - after the fall of the petals.

Key words

Cherry, Growth regulator, Setting degree, Production, Quality

Cherry is a valuable fruit species with the nutritional, technological and commercial attributes of fruits. [3,4,11]. Cherry blossoms usually take place in the third decade of April. The duration of bloom depends on the variety and climatic conditions. Within the same variety, the duration of the flowering of a tree under favorable climatic conditions is 8-12 days. If the air temperature is low, the blooming time can be up to 18-20 days. From a floral bud are formed in the middle 3 flowers arranged in flowered inflorescences. Flowers are hermaphrodite [1,2,6].

Different insects, especially bees, carry out flower pollination. Flowers, being rich in nectar, are attractive to bees. If the weather conditions are favorable, the anthers crack the day after the flower is opened. The pollen stigma's receptivity lasts for 4 days, but the first two after the opening of the flower are optimal. The embryo bag has a rather short viability time, only 4 days. Under optimal temperature conditions (+ 21°C), the pollen tube needs 48-72 hours from germination to penetration into the embryonic sac. Taking into account these limiting factors, we mention that the optimal period for pollination and fertilization of a flower is short, about 2 days, and the effective pollination period of a tree lasts 4-5 days [7,8,9].

In case of low temperatures during this period, or atmospheric precipitation, pollination, fertilization and pollen tube formation is more problematic, and to exclude these shortcomings, fruit growers are currently performing various treatments with boron-based products and after flowering, or growth regulators that stimulate these processes [12,14].

Along with the modern techniques and technologies used to increase fruit production, both quantitatively and qualitatively in the cherry crop, a major role plays the growth regulators [1,2,5,10].

The growth regulators manage the growth and development process of cherry trees, enable to increase the plant resistance to stress, increase the degree of fruit binding, influence the cellular division, fruit weight gaining and reduce damage caused by physiological diseases during storage and retaining period. Their use in modern agriculture with a high biological and economic efficiency, it becomes a necessity [10,13,14].

For this, it was necessary to study the influence of growth regulator on fruit setting, physiological processes, fruit production and their quality in the climatic conditions of the Republic of Moldova.

Material and Method

The research was conducted during the year of 2016, in the intensive cherry orchard founded near the village Malaesti, Orhei district, during the spring of 2012 in the „Vindex-Agro” Ltd., with one-year-old trees shaped as a rod. The subject of the experience was Regina cherry variety grafted on rootstock Gisela 6. The crowns it conducted by thin spindle system. The planting distance was 4.0 x 2.0 m. In the experimental sector, according to the experience scheme (tab. 1), the following variants were tested. In

the second variant, the first treatment with Stimulants 66 f was performed at the beginning of flowering (16.04.16) - in the dose of 0.2 l/ha, and the second - in the phase of the fall of the petals (25.04.16) - in the dose 0.2 l / ha.

In variant three, were also carried out two treatments during the vegetation period with Stimolante 66f growth regulator. The first treatment was carried out at the beginning of the blooming (16.04.16) - at a dose of 0.3 l/ha, and II - in the phase of the fall of the petals (25.04.16) - in a dose of 0.3 l/ha.

Table 1

The scheme of experiments to determine the biological efficiency of growth regulator Stimolante 66 f on the setting degree and stimulation of physiological processes in cherry trees

Variants	Active ingredient	Application method
Control - without treatment	-	-
Stimolante 66 f, 0,2 l/ha	ANA (0,01 g/l) and solution of microelements (0,11 g/l)	By sprinkling two foliar treatments: I - at the beginning of bloom; II - after the fall of the petals
Stimolante 66 f, 3 l/ha		

The trees were treated with the portable sprinkler in the hours without wind, in the morning. The amount of solution at a tree was 0.8 liters, based on the number of trees per unit area and the recommended water quantity of 1000 l/ha.

Location of plots was made in blocks, each variant having 4 rehearsals. Each rehearsal consisted of 7 trees. At the border between parcels and experimental rehearsals, one untreated tree was left to avoid overlapping variants or rehearsals during the treatments.

The records for determining the setting of flowering were established during the pink button period and the percentage of fruit bound after the fall of the non-fetched ovaries to 4 model trees in each variant.

The number of fruits, the average weight of a fruit, the production per tree and a unit of surface, were established during harvesting. The harvest establishment for each variant was carried out by weighing individually the fruits on the 28 trees. The average fruit weight was determined by weighing a sample of 1 kg of cherries in each rehearsal and counting them.

The fruit diameter was established during the harvest period using the recommended pattern for sorting cherries with holes of 26, 28, 30, 32, 34 and 36 mm corresponding to the mass of 8.5, 10; 11.5; 13; 14.5; 16 g respectively.

The height of the fruit was determined by the measurement method and represents the distance between the base and the peak. The large and small diameter of the fruits was measured in their equatorial part. The mentioned above parameters were evaluated of 20 fruits collected per row of each rehearsal.

The average weight of the pit was determined by the weighing method, and it is an indicator that was obtained as a result of the pulp perennial detachment. The weight of the pit in the fruit is the ratio between the weight of 20 pits and the weight of these fruits in each repetition reported as a percentage.

The firmness of the fruits was measured using the AGROSTA 100 penetrometer. The soluble dry matter content was determined in the orchard by using the ATAGO N-20E portable refractometer, expressing the data in Brix%. Total acidity - by the titration method with 0.1% NaON solution.

The significance of differences men values of investigated parameters was determined by using the LSD test for the likelihood of 0.05.

Results and Discussions

The investigations carried out during the vegetation period show that in the crown of the cherry tree were from 2200 to 2232 flowers (tab. 2). The number of flowering flowers shows that the trees under study have constant values and experiments can be fitted to test the growth stimulator Stimolante 66 f according to the program in force.

If, in the control variant, where the flowers were not treated, the number of flowers was 2200 pcs/tree, then in the variants treated with the tested growth regulator the values from 2220 to 2232 pcs/tree were recorded. Basically, the essential difference between the control variant and the variants treated with the growth regulator Stimolante 66 f was not recorded, as confirmed by the statistical calculations.

Investigations carried out by researchers in the country

and abroad show that in the years with a normal flowering, in order to obtain a stable crop of cherry fruit, the degree of binding of the reproductive organs should be 20-22%. However, during the vegetation period, some disasters, such as low temperatures up to and after flowering, bad weather during the flowering, pollination and fertilization of the flowers, can negatively affect the viability of the reproductive organs and the degree of fruit binding. Treatments made with growth regulator Stimolante 66 f, from flowering until after the fall of petals has a positive influence on plant physiological processes, diminishes the stresses that can be recorded during that

period, increases the resistance of flowers to the influence of low temperatures, stimulates the process of pollinating of the flowers. The degree of ovarian binding is higher, eventually recording a higher number of fruits in the tree crown. The results shown in table 2 demonstrate that growth regulator Stimolante 66 f influences on the setting degree of fruit in the crown of the trees. When treated with the tested growth regulator Stimolante 66 f at a dose of 0.2 l/ha, the degree of fruit binding consisted of 24.4%, or an increase of 2.0% compared to the control variant.

Table 2

The influence of growth regulator Stimolante 66 f on the number of flowers, fruits and their setting after the physiological fall of June in the cherry trees of the Regina variety

Variants	Number of flowers, pcs/tree	Setting degree, %	Number of fruits, psc/tree
Control	2200	22,4	493
Stimolante 66 f, 0,2 l/ha	2232	24,4	544
Stimolante 66 f, 0,3 l/ha	2220	25,3	561
LSD 0.05	107	1,06	23,7

The highest values of the degree of fruit binding were recorded in the variant treated with Stimolante 66 f at a dose of 0.3 l/ha, where the study index constituted 25.3%, or an increase of 2.9% compared to control without treatment.

Studying the degree of fruit binding between variants treated with Stimulants 66 f at the dose of 0.2 l/ha and Stimolante 66 f at a dose of 0.3 l/ha, we recorded a 0.9% difference in favor of the last variant .

The study of the number of fruits in the tree crown shows that the growth regulators used in research have recorded different values. The lowest number of fruits, 493 psc/tree, was recorded in the control variant, where the trees were not treated.

During the researches, the largest number of fruits was recorded in the variant treated with Stimolante 66 f at a dose of 0.3 l / ha - 561 psc / tree, or an increase compared to the control variant by 13.8%. This increase in the number of fruits in the tree crown was recorded as a result of the increase in the setting of the reproductive organs.

In the case of trees with Stimolante 66f growth regulator in the dose of 0.2 l/ha, we record that the number of fruits formed was by 10.3% higher compared to the control variant.

Studying the influence of the growth regulator on the number of fruits, we note that the lowest value was obtained in the variant treated with Stimolante 66 f at a

dose of 0.2 l/ha, where the study index consisted of 544 pcs/tree. The highest value in the variant treated with Stimolante 66 f in a dose of 0.3 l/ha - 561 pcs/tree, which are argued and accompanied by statistical data.

The results obtained showed that the treatments with the Stimolante 66f growth regulator at the dose of 0.3 l/ha had a positive influence on the degree of binding of the reproductive organs and the number of cherry fruits in the tree crown.

The fruit production is the final index, which shows how all agro-technical measures have been carried out in the Regina cherry plantation.

Using for treatment the growth regulator with stimulation effect Stimolante 66f, we found the degree of fruit binding increased (tab. 2), but there was no influence on the average weight of a fruit. However, the fruit production at a tree and at a surface unit recorded maximum values compared to the control variant.

Due to a smaller number of fruits obtained in the control variant, without treatment - 493 pcs/tree, we recorded higher values of the average weight of a fruit - 10.18 g (tab. 3). When using growth regulators with stimulatory action, we record that the number of fruits increases and the average weight is slightly diminishing compared to the control variant and ranged from 9.98 to 10.01 g.

Table 3

The influence of the growth regulator Stimulants 66 f on the average weight and production of Regina cherries variety

Variants	Average weight, g	Fruit production		In %, compared to the witness
		kg/tree	t/ha	
Control	10,18	5,02	6,27	100,0
Stimolante 66 f, 0,2 l/ha	10,01	5,44	6,80	108,4
Stimolante 66 f, 0,3 l/ha	9,98	5,60	7,00	112,3
LSD 0.05	0,45	0,23	0,32	-

The lowest average weight on the variants treated with growth regulators with stimulating action was recorded in Stimolante 66 f at the dose of 0.3 l/ha - 9.98 g. This decrease was possible due to the higher degree of binding ovaries and obtaining a greater number of fruits. The average weight of a fruit obtained in the variants treated with the growth regulator Stimolante 66 f diminished by 1.7 - 2.0% compared to the control variant, but all the fruits obtained were of high quality. Fruit production at a tree is in close correlation with the number of fruits in the tree crown and their average weight. The investigations show that during the researches, the lowest fruit production per tree and a surface unit was obtained in the control variant, where it constituted 5.02 kg/tree or 6.27 t/ha respectively.

Using the tested growth regulator Stimulants 66 f, it shows an increase in production on a tree and on a surface unit. In the case of the treatment of the trees with the Stimolante 66 f at the dose of 0.2 l/ha, we record that the fruit production increased compared to the control, constituting 5.44 kg/tree or 6.80 t/ha, which are also statistically demonstrated.

In the case of the treatment of the trees with the stimulated growth regulator Stimolante 66 f at a dose of 0.3 l/ha, we record that the fruit production increased compared to the control variant with 0.73 t/ha, or 12.3%. The difference between the variant and

the control variant is also statistically demonstrated.

Studying the influence of the treatment dose on the fruit production, we record that with the increase of the quantity of product administered from 0.2 l/ha to 0.3 l/ha, the study index increases by 0.2 t/ha, or 2.9%. Statistical data on fruit production denotes that there is practically a statistical difference between the control variant and the variants treated with the growth regulator Stimolante 66 f.

The obtained results show that among the variants treated with the growth regulator, the highest fruit production was recorded when the growth regulator Stimolante 66f was used at a dose of 0.3 l/ha.

At present, in the modern research carried out in cherry plantations, the treatment with growth regulators in the auxin group is widely used to increase the average fruit weight and their quality parameters (height, width, thickness, kernel weight).

Studying the size of the Regina cherry fruits, we recorded that the larger values were of their larger diameter (d_1), then the height was lowered and the small diameter (d_2) was at the last position. If the large diameter during the investigations on the variants studied was 30.6 - 30.8 mm, then the index of the height and the small diameter of the fruit constituted 27.9 - 28.1 and 26.9 - 27.2 mm (tab. 4).

Table 4

The influence of growth regulator Stimolante 66 f on the quality of cherry fruits of the Regina variety

Variants	Size, mm			Pit average weight, g	% pit
	Height (h)	Large diameter (d_1)	Small diameter (d_2)		
Control	28,1	30,8	27,2	0,58	5,7
Stimolante 66 f - 0,2 l/ha	27,9	30,7	27,0	0,57	5,7
Stimolante 66 f - 0,3 l/ha	27,9	30,6	26,9	0,57	5,7

The carried out investigations show that on the variants in the study, the lowest height of a fruit was recorded in the variants treated with growth regulator Stimolante 66 f at a dose of 0.2 and 0.3 l/ha - 27.9 mm. In the control variant, the height of the fruit was the highest and constituted 28.1 mm. This recorded difference in fruit height between the control variant and variants 2 and 3, was due to the higher number of fruit setting in the variants treated with growth regulator Stimolante

66f.

At the time of harvesting, the highest value of the large diameter in cherry fruits was recorded in the control variant - 30.8 mm. Upon treatment with growth regulator Stimolante 66 f, we recorded a slight decrease in the study index. In this case, the studied index constituted 30.6 - 30.7 mm, or a decrease of 0.1 - 0.2 mm compared to the control variant. The increase in the treatment dose did not affect the large diameter

of the Regina cherry variety. The same is valid for their small diameter.

Due to the higher number of fruits bound in the tree crown, the treatments with Stimolante 66 f growth regulator did not influence the height / diameter ratio of the fruit. Practically, in all variants studied, the height / diameter ratio of fruit constituted 0.91.

The size of the pit in the fruit is an important element when appreciating the quality of cherries. The investigations show that the average weight of the pit in the control variant and in the case of treatment with the growth regulator Stimolante 66 f, has practically the same values, is 0.57 - 0.58 g.

The ration of the pit in the fruit is influenced by the average weight of the pit and the average weight of the fruit. The investigations carried out did not reveal one or another variant and the study index constituted 5.7%.

Therefore, the treatments with growth regulator Stimolante 66 f, did not have a positive influence on the height, width and thickness of the fruit, since the number of fruits recorded in the crown was much higher than in the control variant.

Our investigations show that direct influence exists between the weight of fruits according to their diameter and the variants of the experience. The results obtained in table 5 demonstrate that the fruit production obtained from the variants in the study differs from each other, recording higher values in the case of treatment with the growth regulator Stimolante 66 f.

The investigations show that the share of the fruits in the control variant without treatment with the diameter of 22-26 mm was 23.6%, with the diameter 26-30 mm being 31.1% and the diameter greater than 30 mm - 45.3%. Therefore, the share of fruits with a diameter greater than 26 mm in the control version is 76.4%.

Table 5

The influence of growth regulator Stimolants 66 f on redistribution of cherry fruits of the Regina variety according to their diameter

Variants	The share of fruits (%) according to their diameter (mm)		
	22-26	26-30	>30
Control	23,6	31,1	45,3
Stimolante 66 f – 0,2 l/ha	25,1	30,8	44,1
Stimolante 66 f – 0,3 l/ha	26,2	30,4	43,4

In case of treatment with growth regulator Stimolante 66 f, due to the higher production, the quality of cherry fruit diminished negligibly compared to the control variant. When treated with Stimolante 66f growth regulator in a dose of 0.2 l/ha, the share of the fruits with a diameter of 22 - 26 mm increased compared to the control variant and constituted 25.1% and the ones with the diameter of 26 - 30 mm and more than 30 mm decreased, constituting 30.8 and 44.1%, respectively. Therefore, the proportion of fruits with a diameter greater than 26 mm was 74.9%, or a decrease compared to the control variant by 1.5%.

When treated with growth regulator Stimolante 66 f in a dose of 0.3 l/ha, the share of the fruits with a diameter of 22 - 26 mm increased compared to the previous variants and consisted of 26.2%, and of the 26

- 30 mm diameter and more than 30 mm diminished insignificantly, constituting 30.4 and 43.4%, respectively. In this case, the fruits with a diameter larger than 26 mm constituted 73.8%, or a decrease compared to the control variant by 2.6%, and with the variant treated with the growth regulator Stimolante 66 f in a dose of 0.2 l/ha by 1.1%.

It is very important that the cherries are harvested at the optimum time. If cherries are harvested prematurely, about 13-16% of the crop is lost because they have insufficient size and low weight.

The data of the investigations carried out (tab. 6) show that the firmness of the cherry pulp on the variants studied at the time of harvesting (27.06.2016) was 315 - 332g/mm². The smallest firmness of the pulp was recorded in the control variant - 315 g/mm².

Table 6

The influence of growth regulator Stimolante 66 f on the firmness and biochemical index of cherry fruits of the Regina variety

Variants	Firmness, g/mm ²	Soluble dry substances,%	Titrateable acidity,%	Vitamin C, mg%
Control	315	14,5	0,68	16,2
Stimolante 66 f – 0,2 l/ha	329	14,9	0,63	16,8
Stimolante 66 f – 0,3 l/ha	332	15,0	0,62	16,8

Upon treatment with the Stimolante 66 f growth regulator, we recorded an increase in pulp firmness. In this case, the studied index constituted 329 - 332

g/mm², or an increase of 14 - 17 g/mm² compared to the control variant. The increase in the treatment dose did not significantly affect the firmness of the pulp.

The content of soluble dry matter is a sort of variety, after which the optimum harvesting time can be determined. The investigations show that the quantity of soluble dry substances in the Regina cherry variety on the variants in the study constituted 14.5 - 15.0%.

The smallest value of the share of the soluble dry substances was recorded in the control variant without treatment - 14.5%. In case of treatment with growth regulator Stimolante 66 f, we record an increase in the studied index to 14.9 - 15.0%. That is to say, when treating Stimolante 66f growth control regulator as a test preparation, the amount of fruit-soluble dried fruit increases by 0.4-0.5% compared to the control variant.

Studying the influence of the treatment dose on the quantity of soluble dry substances of the fruits, we record that with the increase of the quantity of product administered from 0.2 l/ha to 0.3 l/ha, the studied index did not increase significantly. If the difference between the variant treated with growth regulator Stimolante 66 f at a dose of 0.2 l/ha and at a dose of 0.3 l/ha was 0.1%, then between the control variant and the variant treated with Stimolante 66f in the dose of 0.2 l/ha was 0.4%. Thus, the treatments with growth regulator Stimolante 66 f have somewhat influenced the increase in the amount of soluble dry matter.

The share of titratable acids in fruits is in direct dependence on the amount of soluble dry matter. Concomitantly, with the decrease of the quantity of dry substances soluble in fruits the share of titratable acids increases, registering the highest value in the control variant - 0.68%.

In the variant treated with the growth regulator Stimolante 66 f at the dose of 0.2 l/ha, the share of titratable acids in the fruit constituted 0.63%, or a decrease of 0.05% compared to the control variant.

Treatments with the growth regulators Stimolante 66 f at a dose of 0.3 l/ha reduced the titratable acid share constituting 0.62%, or a decrease of 0.06% compared to the control variant.

Vitamin C is a key feature in appreciating the quality of cherry fruits. The investigations show that the lowest amount of vitamin C was recorded in the control variant, where it was 16.2 mg%.

Treatments with the growth regulator Stimolante 66 f at the dose of 0.2 l/ha, as well as Stimolante 66 f at a dose of 0.3 l/ha, increased the vitamin C content to 16.8 mg%, or increase by 0.6 mg% compared to the control variant.

The investigations show that values of pulp firmness, soluble dry matter, titratable acidity and vitamin C at the same or slightly higher level are recorded when treatments with the test growth regulator Stimulants 66f at a dose of 0.3 l/ha were made.

Conclusions

The growth regulator Stimolante 66 f has

positively influenced the physiological processes in the plant, increasing the fruits setting, average number of fruits in the tree crown, the amount of production and maintaining quality in optimal parameters.

Based on the obtained experimental results, growth regulator Stimolante 66 f can be included in the technological system for the improvement of the physiological processes in the plant, increasing the setting degree and the number of fruits in cherry trees at the dose of 0.3 l/ha, applied twice by foliar spraying. The first treatment to be done at the beginning of the flowering, and the second after the fall of the petals.

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