ANNALS OF THE UNIVERSITY OF CRAIOVA

Series: ✓*Biology*
✓*Horticulture*
✓*Food products processing technology*
✓*Environmental engineering*

Vol. XXIV (LX) - 2019

THE INFLUENCE OF GROWTH REGULATORS ON THE DEGREE OF SETTING OF PEAR FRUITS BY THE NOIABSKAIA VARIETY

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Keywords: *Setting, growth regulator, pear, production, quality.*

ABSTRACT

The study subject of the experience was Noiabrskaia pear variety, grafted on BA 29. To study setting processes of reproductive organs, fruit production and its quality in 2017 year were experimented the following variants of treatment: 1. Control – without treatment; 2. GA_3 – 20 ppm (18.04.2017); 3. GA4+7 – 40 ppm (18.04.2017); 4. GA_{4+7} – 40 ppm (26.04.2017); 5. Prohexadion Ca (P-Ca) – 10 ppm + GA_{4+7} – 40 ppm (26.04.2017). During the research, it was established that the growth regulator GA3 in dose of 20 ppm can be included in the technology system when 30-40% of the flowers are open to increase the resistance of the reproductive organs at low temperatures, improving the physiological processes in the plant, increasing the degree of fruit setting, the amount of fruit in the pear tree crown and plantation production.

INTRODUCTION

Pear culture has an important role in the intensification of the fruits growing and in our country places second among the seed species after the apple culture.
The role of the growth regulators in fruit growing is of particular importance, because only after their correct use, these products attract the improvement of the physiological processes within the plants and the increase of the fruits production at a surface unit (Deckers & Schoofs 2004, Dennis 1973, Neamţu & Irimie 1994).

To increase the resistance to low temperatures, the degree of fruit binding and productivity is recommended to treat pear shafts with gibberelinic acid GA_3, GA_{4+7}, with Prohexadion Ca and a mixture of these growth regulators (Deckers 1994, Peşteanu et al. 2018).

Pear producers in order to increase the resistance of the generative organs at low temperatures, to the degree of fruit setting and productivity, frequently administer various mixtures of growth regulators such as GA_{4+7} and 6BA or Prohexadion of Ca and GA_{4+7}. These growth regulators are administered during the flowering period, which function as growth promoters at the cellular level and improve the degree of fruits binding immediately after flowering (Negi & Sharma 2005).

The application of growth regulators whose active ingredient is GA_3, GA_{4+7}, 6BA and Prohexadion de Ca in the intensive pear cultivation system is widely practiced in the countries where the pear is grown in order to obtain high, constant

and competitive quality productions of fruits (Flick & Hermann 1978, Lafer 2008, Silva & Herrero 2008, Vercammen & Gomand 2008).

MATERIAL AND METHODS

The researches were carried out during the year 2017, in the orchard founded, in the autumn of 2010 at the company S.R.L. "Terra Vitis".

In order to determine the efficiency of growth regulators with various active ingredients and the treatment period in the Noiabrskaia variety, in 2017 an experience with the following variants was organized (tab. 1).

The first treatment was performed on 18.04.2017, before the low temperatures occurred. On that day, in the Noiabrskaia variety, the flowering degree of the trees constituted 30 - 40% of the flowers. The following treatment was carried out on 26.04.2017, when the danger of the return of the low temperatures no longer persists.

Table 1

The scheme of the treatment experience of the pear trees of the Noiabrskaia variety with growth regulators

Variants	Application date	Commercial name of the product	Application method
Witness	18.04.2017	-	By spraying
GA_3 – 20 ppm	18.04.2017	Gobbi Gib 2LG	
GA_{4+7} – 40 ppm*	18.04.2017	Gerlagib LG	
GA_{4+7} – 40 ppm*	26.04.2017	Gerlagib LG	
Prohexadion Ca (P-Ca) – 10 ppm + GA_{4+7} – 40 ppm	26.04.2017	Regalis Plus Gerlagib LG	

* - GA_{4+7} - 40 ppm growth regulator at which various application periods have been studied

The researches were carried out under field and laboratory conditions according to accepted methods of carrying out experiments in fruit crops with growth regulators.

Statistical processing of the data was performed by the method of dispersion analysis.

RESULTS AND DISCUSSIONS

The investigations, show us, that the amount of inflorescences (tab. 2) on the variants studied in the trees of the Noiabrskaia variety ranged from 60 to 64 pcs/tree. The treatments carried out with the growth regulators provided could not influence the amount of inflorescences, because the fruit buds have differentiated in 2016.

The treatments performed on the inflorescences when 30 - 40% of the flowers were flowered (18.04) and after the frosts period (26.04) influenced the degree of fruit setting.

The lowest degree of fruit binding during the research at the Noiabrskaia variety was recorded in the control variant, where the studied index constituted 7.7%.

Within the trees of the Noiabrskaia variety, the variants treated with growth regulators have differentially increased the degree of pear binding. Significantly higher values than in the control variant were obtained when treating with GA_{4+7} - 40 ppm gibberellic acid (18.04), constituting 8.9%, or an increase by 1.2% compared to the control variant.

Table 2

The influence of growth regulators on the amount of fruits from the Noiabrskaia variety and the degree of binding in the pear plantation

Variants	Application date	The amount of inflorescences, pcs/tree	The amount flowers, pcs/tree	The amount of fruits, pcs/tree	The setting degree,%
Witness	-	61.0	427	33	7.7
GA_3 – 20 ppm	18.04	63.0	441	92	20.9
GA_{4+7} – 40 ppm	18.04	61.0	427	38	8.9
GA_{4+7} – 40 ppm	26.04	60.0	420	131	31.2
P - Ca – 10 ppm + GA_{4+7} – 40 ppm	26.04	64.0	248	206	46.0

The treatment with GA_{4+7} - 40 ppm gibberellic acid in the period after low temperatures (26.04) increased by 3.5 times the weight of the related fruits compared to the variant treated with the same product during the period when 30 - 40% of flowers were in bloom. The weight of fruits spoiled in the respective variants constituted 21.46% and 2.65% respectively.

The treatment with gibberellic acid GA_3 - 20 ppm in the period until the occurrence of late spring frosts recorded a binding degree of 20.9%, or 92 fruits of higher quality, the weight of deformed fruits in the crown of trees used for industrialization constituted 2.54%.

The highest degree of fruits binding was obtained in the variant treated with the mixture consisting of Prohexadion of Ca - 10 ppm and gibberellic acid GA_{4+7} - 40 ppm, registering values of 46.0%.

The investigations carried out revealed (tab. 3), that in the control variant of the Noiabrskaia variety, the average quantity of seeds from the fruit constituted 0.76 pcs.

The treatments performed on trees of Noiabrskaia variety with growth regulators have influenced differently the parthenocarpic phenomenon. Practically, in the variants treated with gibberellic acid GA_3 - 20 ppm and the mixture of Prohexadion of Ca - 10 ppm and gibberellic acid GA_{4+7} - 40 ppm only parthenocarpic fruits were formed, the seminal chamber and seeds were not detected.

In variants treated with GA_{4+7} - 40 ppm gibberellic acid, even after low temperatures occurred, major deviations between the obtained values were not recorded and constituted, respectively, 0.40 and 0.38 pcs/fruit.

The study carried out on the weight of deformed fruits shows us that, in the control variant, the index studied on the trees of the Noiabrskaia variety constituted 9.18%.

The weight of the deformed fruits in the variant treated with gibberellic acid GA_3 - 20 ppm during the phase when 30 - 40% of the flowers were flowered (18.04) constituted 2.54%, and in the variant treated with gibberellic acid GA_{4+7} - 40 ppm - 2.65 %.

Table 3

The influence of growth regulators on the amount of seeds in the fruits of Noiabrskaia variety and the weight of deformed fruits

Variants	Application date	The quantity of fruits, pcs/tree	The average quantity of seeds, pcs	The share of deformed fruits,%
Witness	-	33	0.76	9.18
GA_3 – 20 ppm	18.04	92	-	2.54
GA_{4+7} – 40 ppm	18.04	38	0.40	2.65
GA_{4+7} – 40 ppm	26.04	131	0.38	21.46
P - Ca – 10 ppm + GA_{4+7} – 40 ppm	26.04	206	-	55.34

When applying a treatment with gibberellic acid GA_{4+7} - 40 ppm (26.04) the weight of fruits increased to 21.46%, and in the variant where the mixture between Prohexadion of Ca - 10 ppm and gibberelic acid GA_{4+7} - 40 ppm was administered , more than half of the fruits obtained in the crown of the tree (55.34%) had deformations and were classified in the rejected category.

The smallest quantity of fruits in the trees of the Noiabrskaia variety during the research was recorded in the control variant - 33 pcs (tab. 4).

Table 4

The influence of growth regulators on average weight and productivity of pear plantation of the Noiabrskaia variety

Variants	Applica-tion date	The quantity of fruits, pcs/tree	The average weight of a fruit, g	Production		In % compared to witness
				kg/tree	t/ha	
Witness	-	33	217.3	7.2	9.0	100.0
GA_3 – 20 ppm	18.04	92	186.3	17.1	21.4	237.7
GA_{4+7} – 40 ppm	18.04	38	257.9	9.8	12.3	136.6
GA_{4+7} – 40 ppm	26.04	131	145.9	19.1	23.9	265.5
P - Ca – 10 ppm + GA_{4+7} – 40 ppm	26.04	206	81.3	16.7	20.9	232.2
LSD 0.05	-	5.7	10.3	0.77	0.94	-

Analyzing the amount of fruits according to the active ingredient used in the treatment, we find that, in all the variants exposed to treatment, there was an increase of the index in the study. If the treatment was done until frost with the growth regulators based on GA_{4+7} - 40 ppm, the amount of fruits in a tree recorded values of - 38 pcs, and with GA_3 - 20 ppm - 92 pcs. If the treatment was carried out after the freezing period with products based on GA_{4+7} - 40 ppm and a mixture of Prohexadion of Ca - 10 ppm and GA_{4+7} - 40 ppm, an increase in the value of the index in the study was recorded being respectively 131 and 206 pcs/tree.

In the trees of the Noiabrskaia variety, the highest average weight of a pear fruit was recorded in the variant treated with gibberellic acid GA_{4+7} – 40 ppm (18.04) - 257.9 g. Values lower than in the respective variant were recorded in control variant - 217.3 g, variant treated with gibberellic acid GA_3 - 20 ppm (18.04) - 186.3 g, variant treated with gibberellic acid GA_{4+7} - 40 ppm (26.04) - 145.9 g and on its last position placed variant mixture of Prohexadion of Ca - 10 ppm and GA_{4+7} - 40 ppm (26.04) - 81.3 g.

The fruit production obtained in 2017 from the trees of the Noiabrskaia variety constituted respectively 7.2 kg/tree and 9.0 t/ha.

When treating the trees of the Noiabrskaia variety with growth regulators, productions of more than 20 t/ha were registered in three variants. The combined treatment of Prohexadion of Ca - 10 ppm and GA_{4+7} - 40 ppm (26.04) produced a pear production of 16.7 kg/tree or 20.9 t/ha. The large amount of fruits (206 pcs/tree) and the low average weight of a fruit highlight the inferior quality of the fruits of the respective variant. Treatment with gibberelinic acid GA_3 - 20 ppm until frost (18.04), fruit production amounted to 17.1 kg/tree, or 21.4 t/ha. Higher values of the index in the study were obtained in the variant treated with gibberellic acid GA_{4+7} - 40 ppm (26.04), where the fruit production constituted, respectively 19.1 kg/tree and 23.9 t/ha. The treatment with the same product, only during the period until the frost (18.04), when 30 - 40% of the flowers were flowering allowed to form yields of 9.8 kg/tree or 12.3 t/ha. The lowest values of the index under study was recorded in control variants.

According to the results obtained (tab. 5) in the studied year, we can see that the quality of the pear fruits is influenced by the treatment period and the growth regulator administered.

Table 5

The influence of growth regulators on the quality of the fruits of the Noiabrskaia variety expressed by weight,%

Variants	Application date	Fruits weight, g					Scrap
		300-350	250-300	200-250	150-200	100-150	
Witness	-	31.3	30.3	25.3	2.0	2.1	9.0
GA_3-20 ppm	18.04	16.4	25.8	25.1	15.3	14.9	2.5
GA_{4+7}-40 ppm	18.04	45.5	28.2	12.7	5.5	5.5	2.6
GA_{4+7}-40 ppm	26.04	1.1	11.5	19.9	31.0	14.9	21.6
P - Ca -10 ppm + GA_{4+7}-40 ppm	26.04	-	0.5	5.5	14.8	22.1	57.1

In the Noiabrskaia variety, in the control variant, we registered a more uniform redistribution of production. In the category of fruits with the weight 300 - 350 g is assigned 31.3%, fruits with the weight 250 - 300 g - 30.3%, fruits with the weight 200 - 250 g - 25.3%, fruits with the weight 150 - 200 g - 2.0%, fruits with the weight 100 - 150 g - 2.1% and in the category discarded 9.0%.

Further studying of how the treatment period influenced the quality of production recorded that, in the Noiabrskaia variety, more convincing values were obtained in the variant GA_{4+7} gibberellic acid administered on 18.04.2017, until freezing. In this variant, the highest weight of fruits is attributed to fruits with weight

300 - 350 g - 45.5%, fruits with weight 250 - 300g - 28.2%, fruits with weight 200 - 250g - 12.7%, fruits weighing 150 - 200 g and 100 - 150 g each 5.5%, and 2.6% were found in the waste compartment.

Studying the influence of growth regulators on the quality of the fruits expressed by weight, more convincing results in the Noiabrskaia variety were recorded in the variant treated with GA_3 - 20 ppm gibberellic acid during the period when 30 - 40% of the flowers were flowered. In this case, to the fruit class weighing more than 300 g is assigned 16.4%, to the class 200 - 300 g - 50.9%, to the fruit weighing 150 - 200 g - 15.3%, the fruit with weight 100 - 150g - 14.9% and only 2.5% in the rejected category.

CONCLUSIONS

The treatments performed on the inflorescences when 30 - 40% of the flowers were flowered (18.04) and after the passage of the frosts (26.04) had a positive influence on the degree of fruits binding.

Higher quality fruits of the Noiabrskaia variety was recorded when the trees were treated with GA_3 - 20 ppm gibberellic acid growth regulator during the period when 30 - 40% of the flowers in the crown were flowering.

The GA_3 growth regulator administered in the 20 ppm dose can be included in the technological system when 30 - 40% of the flowers are opened to increase the resistance of the reproductive organs at low temperatures, to improve the physiological processes in the plant, to increase the degree of binding of the ovaries, the amount of fruits in the crown of pear trees and the productivity of the whole plantation.

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