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THE INFLUENCE OF GROWTH REGULATORS ON THE INCREASING OF RESISTANCE OF REPRODUCTIVE BODIES AT LOW TEMPERATURES IN BLOSSOMING PERIOD OF SOME PEAR VARIETIES

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Abstract

The experimental plot it was placed in the orchard „Terra Vitis" Ltd. founded in 2010 year. The research was conducted during the period of 2017 year. The study subject of the experience was 'Vistavocinaia' and 'Noiabrskaia' pear varieties, grafted on BA 29. The trees were trained as spindle system. The distance of plantation is 4.0 x 2.0 m. To study setting processes of reproductive organs, fruit production and its quality were experimented the following variants of treatment: 1. Control - without treatment; 2. GA_3 - 20 ppm (18.04.2017); 3. Prohexadione de Ca - 10 ppm + GA_{4+7} - 40 ppm (26.04.2017). During the research, it was studied degree of fruit setting, average of fruits, plantation production and their quality. It was established that the growth regulator GA_3 in dose of 20 ppm can be included in the technology system when 30-60% 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.

Key words*: pear, growth regulator, setting, production, quality.*

INTRODUCTION

The role of growth regulators in fruit growing is of particular importance because only through proper use these products bring about improvement in plant physiological processes and increased fruit production at a surface unit (Neamţu, G., Irimie, Fl., 1991).

In the pear culture, the productivity of young plantations increases more slowly compared to other species, though they make a large quantity of flowers in the tree crown. This is explained by the fact that during this period there is an abundant increase, which creates competition for the fruits (Deckers, T., Schoofs, H., 2004; Dennis, F.G., 1973).

In order to exclude this phenomenon, in countries with advanced pear tree growing, it uses various growth regulators during the blooming time and the fall of petals (Flick, J. D., Hermann, L., 1978; Lafer, G., 2008).

To increase the degree of binding of the pear fruits growth and plant productivity, it can be treated with GA3, GA4 + 7, 6BA, Prohexadione Ca and mixtures of these products (Costa, G. et al., 2002; Deckers, T., 1994; Negi, N. D., Sharma, N., 2005).

These growth regulators are administered during the blossoming period, which act as growth promoters at the cellular level and improve the binding of the fruit immediately after flowering (Silva, L., Herrero, M., 2008; Vercammen, J., Gomand, A., 2008).

Therefore, the application of growth regulators such as GA3, GA4 + 7, and Prohexadione Ca in intensive pear growth systems is considered to be an important cultural practice to increase yield and obtain good fruit quality.

MATERIALS AND METHODS

The research was carried out during the year 2017, in the intensive pear orchard near the village of Burlacu, Cahul district, founded in the autumn of 2010 at the company Terra Vitis, with trees in the shape of a hoop on BA 29 rootstock. The planting distance was 4.0x2.0 m. The crown form was common spindle.

In order to determine the effectiveness of growth regulators with various active ingredients and treatment period according to the biological particularities of the varieties, in 2017 a bifactorial experience of 2x3 type was organized with the following graduation of the factors:

Factor A - variety:

A_1 - 'Vistavocinaia' variety;

A_2 - 'Noiabrskaia' variety;

Factor B - Growth regulator and treatment period (Table 1):
The first treatment was performed on April 18, 2017, before the low temperatures occurred. At that day, the 'Vistavocinaia' variety represented 50-60% of the flowers, and in the 'Noiabrskaia' range 30-40%. The following treatment was performed on April 26, 2017, when the danger of returning low temperatures disappeared.

Table 1. The scheme of experience tree treatment with the researched growth regulators and treatment period

Variants	Application date	The commercial name of the product	Application method
Control	18.04.17	-	By spraying
GA_3 - 20 ppm	18.04.17	Gobbi Gib 2LG	
Ph Ca - 10 ppm + GA_{4+7} - 40 ppm	26.04.17	Regalis Plus Gerlagib LG	

The plots were located in blocks, with four rehearsals for each variant. Each rehearsal consisted of 7 trees. Between parcels and experimental rehearsals, one untreated tree was left to avoid overlapping variants or rehearsals during treatment.
Tree treatment was carried out with the portable sprinkler in the morning hours without wind. The amount of solution per tree was 0.8 litres, based on the number of trees per unit area and the recommended water quantity of 1000 l/ha.
The investigations were conducted in field and laboratory conditions according to the accepted methods of experimentation with growing crops.

RESULTS AND DISCUSSIONS

The varieties taken in the research showed different amounts of inflorescences (Table 2). Among the varieties a studied, higher amount of inflorescences in the control variant was registered with the 'Vistavocinaia' variety - 95 pieces/tree compared to the 'Noiabrskaia' variety - 61 pieces/tree.
Since, for the research were taken trees with a more constant number of inflorescences, not to influence the investigations on the variants studied, in the 'Vistavocinaia' variety were taken trees with an inflorescence of 93 - 96 pieces/tree, and in the 'Noiabrskaia ' the range was 62 to 64 pieces/tree.
The balance between the amount of fruits and the quantity of flowers is the degree of binding of the ovaries. Treatments on inflorescences when 30-60% of them were blooming (18.04) and after spring frosts (26.04) positively influenced the degree of fruit binding.
The lowest degree of fruit binding during the research was recorded in the 'Vistavocinaia' variety compared to 'Noiabrskaia' variety. In the Vastavocinaia variety, the degree of fruit binding in the control variant constituted 1.9% compared to 'Noiabrskaia' where the studied index was 7.7%, by 5.8% higher. For the 'Vistavocinaia' variety, the degree of fruit binding is considered rather low, whereas the 'Noiabrskaia' variety is an average value, recommended for pear culture.
When treating the 'Vistavocinaia' variety with GA_3 - 20 ppm gibberellic acid growth regulator, the weight of the bound fruits was 4.8%, and when using the mixture of Prohexadione Ca - 10 ppm and gibberellic acid GA_{4+7} - 40 ppm, the study index constituted 5.8%.

Table 2. The influence of growth regulators on the quantity of fruits and the binding degree of the pear varieties

Variants	Number of inflorescences, pcs/tree	The amount flowers, pcs/tree	The amount of fruits, pcs/tree	The degree of binding, %
'Vistavocinaia' variety				
Control	95.0	665	9	1.3
GA_3 - 20 ppm	93.0	651	31	4.8
Ph Ca - 10 ppm + GA_{4+7} - 40 ppm	96.0	672	39	5.8
'Noiabrskaia' variety				
Control	61.0	427	33	7.7
GA_3 - 20 ppm	63.0	441	92	2.9
Ph Ca - 10 ppm + GA_{4+7} - 40 ppm	64.0	248	206	46.0

In case of 'Noiabrskaia' variety, the variants treated with growth regulators have increased the degree of binding of pears differently. The variant treated in the period up to late spring frosts with gibberellic acid GA_3 - 20 ppm recorded values of 20.9%, or 92 fruits were formed in the tree crown. A higher fruit binding rate was obtained in the variant treated with Prohexadione Ca - 10 ppm and gibberellic acid GA_{4+7} - 40 ppm. In this variant the study index recorded values of 46.0%. This increase is explained by the fact that the growth retardant inhibitor also has the ability to increase the degree of fruit binding.
Analysing the data obtained in Table 3, we can see that the smaller amount of fruits during the investigations in the control variant was recorded in the 'Vastavocinaia' variety - 9 pieces, compared to the 'Noiabrskaia ' tree - 33 pieces, or an increase by 3.7 times compared to the previous variety.
If we analyse the quantity of fruits according to the active ingredient used in the treatment, we find that in both varieties and in all the variants exposed to the treatment there was an increase of the index in the study. If, on the 'Vistavocinaia' variety, in the control variant the quantity of fruits was 9

pieces/tree, when treated with the GA_3 growth regulator - 20 ppm (18.04), it constituted 31 pieces/tree. Adding treatments with Prohexadione Ca 10 ppm and GA_{4+7} - 40 ppm (26.04) increased the amount of fruits to 39 pieces/tree. In 'Noiabrskaia' variety, the higher amount of fruits in the tree crown was recorded when the growth regulator treatments were performed after the low temperatures (26.04). If, for example, the quantity of fruits per tree in the control variant consisted of 33 pieces, then the frost-free treatment with GA_3 growth regulators - 20 ppm increased their number to 92 pcs. Treatment after the frost-free period with a mixture of Prohexadioe of Ca - 10 ppm and GA_{4+7} - 40 ppm increased the value of the study index to 206 pieces/tree.

Table 3. The influence of growth regulators on average weight and productivity of pear plantations

Variants	Application date	Amount of fruits, pcs/tree	Average weight of a fruit, g	Production		In % compared to the control variant
				kg/tree	t/ha	
'Vâstavocinaia' variety						
Control	-	9	416.0	5.0	6.2	100.0
GA_3 - 20 ppm	18.04	31	346.0	10.7	13.4	216.1
Ph Ca - 10 ppm + GA_{4+7} - 40 ppm	26.04	39	231.5	9.0	11.3	182.2
LDS 0,05	-	1,3	15.4	0.37	0,46	-
'Noiabrskaia' variety						
Control	-	33	217.3	7.2	9.0	100.0
GA_3 - 20 ppm	18.04	92	186.3	17.1	21.4	237.7
Ph Ca - 10 ppm + GA_{4+7} - 40 ppm	26.04	206	81.3	16.7	20.9	232.2
LDS 0,05	-	5.7	10.3	0.77	0.94	-

Table 4. The influence of growth regulators on the quality of the pears expressed by weight, %

Variants	Application date	Fruits weight, g						Scrap
		>350	300-350	250-300	200-250	150-200	100-150	
'Vistavocinaia' variety								
Control	-	6.1	21.6	8.1	5.4	-	-	2.8
GA_3 - 20 ppm	18.04	39.5	41.9	7.0	7.0	-	-	4.6
Ph de Ca - 10 ppm + GA_{4+7} - 40 ppm	26.04	19.8	15.5	6.0	6.0	12.9	14.7	25.1
'Noiabrskaia' variety								
Control	-	-	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
Ph de Ca - 10 ppm + GA_{4+7} - 40 ppm	26.04	-	-	0.5	5.5	14.8	22.1	57.1

If we analyse the quantity of fruits according to the active ingredient used in the treatment, we find that in both varieties and in all the variants exposed to the treatment there was an increase of the index in the study.

If, on the 'Vistavocinaia' variety, in the control variant the quantity of fruits was 9 pieces/tree, when treated with the GA_3 growth regulator - 20 ppm (18.04), it constituted 31 pieces/tree. Adding treatments with Prohexadione Ca 10 ppm and GA_{4+7} - 40 ppm (26.04) increased the amount of fruits to 39 pieces/tree.

In 'Noiabrskaia' variety, the higher amount of fruits in the tree crown was recorded when the growth regulator treatments were performed after the low temperatures (26.04). If, for example, the quantity of fruits per tree in the control variant consisted of 33 pieces, then the frost-free treatment with GA_3 growth regulators - 20 ppm increased their number to 92 pcs. Treatment after the frost-free period with a mixture of Prohexadioe of Ca - 10 ppm and GA_{4+7} - 40 ppm increased the value of the study index to 206 pieces/tree. The quality of the pears influences the biological characteristics of the variety, the

treatment period and the growth regulator administered (Table 4).

If we analyse the influence of the biological characteristics of the variety on the quality of the fruits, we note that a higher proportion of fruits in the control variant of the 'Vistavocinaia' variety is attributed to the class of fruits weighing more than 350 g - 62,1%, fruits weighing 300- 350 g - 21,6%, fruits weighing 250 - 300 g - 8,1%, fruits weighing 200-250 g - 5,4% and in the category of scrap are assigned 2,8%. The higher weight of fruits weighing more than 350 g is explained by the small amount of fruits (9 pieces/tree) and their excessive development. In 'Noiabrskaia' variety, in the control variant, we record a more even redistribution of production. In the category of fruits weighing 300-350 g, 31.3%, fruits weighing 250-300 g - 30.3%, fruits weighing 200-250 g - 25.3%, fruits weighing 150-200 g - 2.0%, fruit weighing 100-150 g - 2.1% and in the scrap category 9.0%. This more uniform redistribution is explained by a larger number of invariable fruits and a more balanced development of them. Such fruits are more demanded by consumers.

Studying the influence of growth regulators on the quality of the fruits by weight, convincing results in both varieties were recorded in the variant treated with gibberellic acid GA_3 - 20 ppm in the period when 30-60% of the flowers were blooming. If, in the 'Vastavocinaia' variety, the weight of the fruits weighing more than 300 g was 81.4%, then the fruit class with the weight of 200-300 g is assigned 14% and only 4.6% of the fruits are scrap category. In the 'Noiabrskaia' variety, fruits with a weight of more than 300 g are assigned 16.4%, in the class 200-300 g – 50.9%, fruits weighing 150 - 200 g – 15.3%, fruits with weight 100 - 150 g - 14.9% and only 2.5% for the scrap category.

In the variant of the treatment after the low temperature period with the mixture of Prohexadione of Ca - 10 ppm and GA_{4+7} - 40 ppm, we record an uneven distribution by quality categories. For the 'Vistavocinaia' variety, 60.2% of the fruits is attributed to the fruit category with a weight of more than 150 g, 14.7% of the fruits weighing 100 - 150 g, then 25.1% of the fruits is assigned to the category of scrap. In this variation, 'Noiabrskaia' trees noticed conflicting results. In the class of fruits weighing more than 150 g, 20.8%, fruits weighing 100-150 g - 22.1% are assigned, and in the scrap class, the weight of the fruits has reached maximum values compared to all variants taken in research and constituted 57.1%. Fruits in the scrap category were weighing less than 100 g, there was a growing blockage, "pygma" fruit, and many of them had shape deformations.

Higher results on the quality of the fruits of both varieties were obtained when the trees were treated with the GA_3 gibberellic acid growth regulator - 20 ppm at a time when 30-60% of the flowers in the crown were blooming**.**

CONCLUSIONS

The lowest degree of fruits binding during the research was recorded in the 'Vistavocinaia' variety (1.9%) compared to 'Noiabrskaia' (7.7%). For Vastavocinaia variety, the degree of fruits binding is considered rather low, whereas in the 'Noiabrskaia' variety an average value is recommended for apple and pears. Larger pear production in both varieties was obtained as a result of GA_3 gibberellic acid treatment at 20 ppm (18.04) before low temperatures occurred.

Higher quality of fruit of both varieties was recorded when the trees were treated with the GA3 gibberellic acid - 20 ppm, when 30-60% of the flowers in the crown were blooming.

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