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THE EFFICACY OF FRUIT GROWTH REGULATORS ON FRUIT YIELD OF KORDIA AND REGINA VARIETIES

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ABSTRACT

The research was carried out in the plantation of the S.R.L. "Staragro Group" company in 2019-2020. The orchard was planted in the spring of 2015. As the object of research were the trees of Kordia and Regina varieties grafted on Gisela 6 rootstock. The following growth regulators were investigated in the research plot: Stimolante 66f (1-NAA, 0.1 g/l), Gobbi Gib 2LG (GA3, 20.54 g/l), ReTain (AVG, 150 g/l). During the research, indicators such as: fruit set, yield, fruit weight and firmness were studied. It was reported that applying ReTain at the dose of 0.8 kg/ha at 30 % tree flowering had a significant effect on fruit set (34.9-35.9 %), yield (11.06-12.34 t/ha) and while decreasing insignificantly the average fruit weight (9.81-10.65 g).

INTRODUCTION

Kordia and Regina are among the most spread sweet cherry varieties in the orchard structure of the Republic of Moldova (Balan et al. 2023, Pește anu, 2022). These varieties are in demand on the market due to the exceptional quality of their fruits, representing a benchmark in terms of transportability, flavour, fruit diameter, and shape (Balan et al. 2023, Long et al. 2014). One of the disadvantages of these varieties under the conditions of the Republic of Moldova is their susceptibility to weak fruit set, which causes low yields and modest profits for cherry growers (Pește anu et al. 2018).

The phenomenon of reduced fruit set is caused by insufficient insect pollination, lack of overlap in the flowering phase between the variety and its pollinator, insufficient pollinator density, reduced pollen germination and low pollen viability, poor pollen tube growth, and rapid ovule senescence (Long et al. 2021, Sabir et al. 2021, Pește anu & Lozan 2021a).

Growth regulators significantly influence plant processes, including increasing stress resistance and fruit set, cell division, fruit growth, and shelf-life (Pește anu et al. 2018, Pește anu & Lozan 2021b).

Gibberellins play a vital role both in pollen germination and in fruit set as well as in tree development (Balan et al. 2023, Lozan 2024, Pește anu et al. 2023).

Auxins stimulate cell division at low concentrations and promote cell elongation at higher concentrations (Pește anu et al. 2018).

Ethylene is considered the main phytohormone which, during flowering, triggering flower and ovule senescence, a process that reduces fruit set. The product

ReTain inhibits ethylene synthesis in years with unfavourable flowering conditions for varieties with weak fruit set (Lozan 2024).

The aim of this study was to investigate the effectiveness of applying growth regulators to enhance fruit set in the Kordia and Regina varieties in the central region of the Republic of Moldova.

MATERIAL AND METHODS

The research was conducted during the years 2019–2020 in a sweet cherry orchard established in the spring of 2015, using one-year-old trees within the company SRL "Staragro Group" (Ustia village, Dubăsari rayon). The study was carried out on trees of the Kordia and Regina varieties, grafted on Gisela 6 rootstock, planted at 4×2 m distance, with trees trained as spindle.

According to the experimental design, the following treatments were carried out:

1. Control, sprayed with water at full bloom;
2. Stimolante 66f (1-naphthaleneacetic acid [1-NAA], 0.1 g/l) at a dose of 0.3 l/ha, applied twice – at 30% flowering and after petal fall;
3. Gobbi Gib 2LG (GA_3, 20.54 g/l) at a dose of 0.5 l/ha, applied twice – at 70 % flowering and after petal fall;
4. ReTain (AVG, 150 g/l) at a dose of 0.4 kg/ha, applied at 30% flowering;
5. ReTain (AVG, 150 g/l) at a dose of 0.8 kg/ha, applied at 30% flowering.

The experiments were performed using standard methods employed in sweet cherry trials, both in the field and in the laboratory.

Tree treatments were carried out with a portable sprayer during calm morning hours, at a temperature of +15 °C. The solution volume per tree was 0.8 litres, based on tree density per unit area and the recommended application rate of 1000 l/ha.

Results were expressed in comparison to the control.

Experimental data were processed using ANOVA, with the aid of the Statgraphics 18.0 software package.

RESULTS AND DISCUSSIONS

Research conducted on Kordia demonstrated that a higher fruit set rate was recorded in 2019 in control (28.7 %) compared to 2020 (14.2 %), when the value decreased by half in comparison to the previous year (table 1). This reduction in fruit set can be explained by the impact of low temperatures during the early vegetative period on the floral organs of Kordia, a variety considered more sensitive to such meteorological conditions.

The Regina variety exhibited a more stable fruit set, with values recorded in control of 25.6 % in 2020 and 23.8 % in 2019. This allowed for an average yield of 9.74 t/ha, a value considered below the expectations of cherry growers for a high-density orchard.

While analysing the average fruit set for Kordia over the two years of research, the following order of increase in the studied parameter can be observed: the lowest values were recorded in control (21.5 %), followed by Stimolante 66f, 0.3 l/ha (25.1 %), ReTain, 0.4 kg/ha (26.8 %), Gobbi Gib 2 LG, 0.5 l/ha (27.8 %), and the highest in ReTain, 0.8 kg/ha (34.9 %).

Table 1

Fruit set rate depending on variety and applied growth regulator, %

Variants	Kordia variety			Regina variety		
	2019	2020	average	2019	2020	Average
Control	28.7	14.2	21.5	23.8	25.6	24.7
Stimolante 66f, 0.3 l/ha	32.3	17.8	25.1	25.5	29.5	27.5
Gobbi Gib 2LG, 0.5 l/ha	34.4	21.2	27.8	29.2	31.8	30.5
ReTain, 0.4 kg/ha	34.4	19.1	26.8	27.2	30.0	28.6
ReTain, 0.8 kg/ha	41.3	28.4	34.9	35.5	36.3	35.9
Average	34.2	20.1	27.2	28.2	30.6	29.4

The average fruit set values in trees of Regina were higher compared to those recorded in Kordia. Moreover, higher values were obtained in the treatments with growth regulators. Thus, in control the fruit set rate was 24.7 %, while in the other treatments the values were: Stimolante 66f, 0.3 l/ha – 27.5 %; ReTain, 0.4 kg/ha – 28.6 %; Gobbi Gib 2LG – 30.5 %; ReTain, 0.8 kg/ha – 35.9 %.

According to the results obtained in the Kordia rows, higher yields in the control treatment were recorded in 2019 (10.11 t/ha) compared to 2020 (5.86 t/ha), representing a decline of 72.5 % (table 2). This decrease is explained by the damage of a considerable proportion of flowers caused by low temperatures during the early flowering period.

Table 2

Fruit yield in the sweet cherry orchard depending on the variety and applied growth regulator, t/ha

Variants	Kordia variety			Regina variety		
	2019	2020	2019	2020	2019	Media
Control	10.11	5.86	7.99	8.19	11.29	9.74
Stimolante 66f, 0.3 l/ha	10.85	7.18	9.01	8.98	12.00	10.49
Gobbi Gib 2LG, 0.5 l/ha	11.38	8.50	9.94	9.45	12.94	11.20
ReTain, 0.4 kg/ha	11.38	7.36	9.37	9.06	11.97	10.52
ReTain, 0.8 kg/ha	12.54	9.59	11.06	11.06	13.62	12.34
DL 5%	0.39	0.28	-	0.32	0.46	-

Regina variety was less affected by meteorological factors, which allowed for more stable yields during the study period. In control, total yield in 2019 was 8.19 t/ha, while in 2020 it reached 11.29 t/ha, representing a 37.8 % increase compared with the previous year.

On average across the study years, higher yields were recorded in Regina (9.74 t/ha) compared to Kordia (7.99 t/ha), with a difference of 21.9 % between the two varieties.

The treatments with growth regulators had a considerable effect on fruit yield (20.44 %), with variations depending on the year and variety. For Kordia, lower yields in 2019 were registered in control (10.1 t/ha), followed in ascending order by Stimolante 66f, 0.3 l/ha (10.85 t/ha), Gobbi Gib 2LG, 0.5 l/ha and ReTain, 0.4 kg/ha (both 11.38 t/ha). The highest yield value was recorded in the treatment with ReTain, 0.8 kg/ha (12.54 t/ha).

In 2020, the same trend was observed with some deviations: control – 5.86

t/ha, Stimolante 66f, 0.3 l/ha – 7.18 t/ha, ReTain, 0.4 kg/ha – 7.36 t/ha, Gobbi Gib 2LG, 0.5 l/ha – 8.50 t/ha, and ReTain, 0.8 kg/ha – 9.59 t/ha. This pattern is also confirmed by the average yield across the study years, which amounted to 7.99, 9.01, 9.37, 9.94, and 11.06 t/ha, respectively.

Growth regulators applied to Regina trees had a significant effect on fruit yield. Over the research years, lower yields were obtained in control (8.19 and 11.29 t/ha). In the treatments with Stimolante 66f, 0.3 l/ha and ReTain, 0.4 kg/ha, similar values were recorded (8.98 and 9.06 t/ha, and 12.00 and 11.97 t/ha, respectively). Higher yields compared with the previous treatments were obtained in the variants with Gobbi Gib 2LG, 0.5 l/ha (9.45 and 12.94 t/ha) and ReTain, 0.8 kg/ha (11.06 and 13.62 t/ha). In the treatments with growth regulators, yield increased by 0.75–2.60 t/ha compared with control.

During the study, average fruit weight varied, being partially influenced by variety but more significantly by the growth regulators applied to enhance fruit set (table 3).

Table 3

Average sweet cherry fruit weight depending on variety and applied growth regulator in the orchard, g

Variants	Kordia variety			Regina variety		
	2019	2020	2019	2020	2019	2020
Control	11.00	11.73	11.37	11.71	11.41	11.56
Stimolante 66f, 0.3 l/ha	10.58	11.32	10.95	11.63	11.12	11.38
Gobbi Gib 2LG, 0.5 l/ha	10.38	11.01	10.70	11.00	10.85	10.93
ReTain, 0.4 kg/ha	10.17	11.26	10.72	11.14	11.01	11.08
ReTain, 0.8 kg/ha	9.55	10.07	9.81	10.77	10.54	10.65
DL 5%	0.51	0.57	-	0.61	0.54	-

A higher average fruit weight in control for the variety Kordia was recorded in 2020 (11.73 g), while for Regina it was obtained in 2019 (11.71 g). The lowest average fruit weight in Kordia was observed in 2019 (11.00 g), whereas for Regina it occurred in 2020 (11.41 g).

Analysis of the average fruit weight in the treated variants revealed that the lowest values in both varieties were obtained under the treatment with ReTain, 0.8 kg/ha, where fruit set was also the highest. By contrast, higher average fruit weights were observed in the control treatment, characterized by a lower fruit set (Table 3). For example, in Kordia trees in 2019, average fruit weight under ReTain, 0.8 kg/ha was 9.55 g, whereas in control it reached 11.00 g, representing a 15.2 % increase compared with the previous variant. The same trend was observed in 2020, when the difference increased to 16.5 %.

In Regina, the difference between the control and ReTain, 0.8 kg/ha was less pronounced than in Kordia, amounting to 8.7 % in 2019 and 8.3 % in 2020.

The influence of the other growth regulators on average fruit weight was more balanced, with no statistically significant differences among them. The multiannual average values show that the lowest weights were obtained in the ReTain, 0.8 kg/ha treatment (9.81 g), followed by Gobbi Gib 2LG, 0.5 l/ha (10.70 g), ReTain, 0.4 kg/ha (10.72 g), and Stimolante 66f, 0.3 l/ha (10.95 g). The highest value was recorded in the control treatment (11.37 g).

Across the research years, the lowest fruit weights were consistently recorded under ReTain, 0.8 kg/ha (10.54 and 10.77 g). These were followed, in ascending order, by Gobbi Gib 2LG (10.85 and 11.00 g), ReTain, 0.4 kg/ha (11.01 and 11.14 g), and Stimolante 66f, 0.3 l/ha (11.12 and 11.63 g), with the control treatment showing the highest values (11.41 and 11.71 g). On average, the pattern described above remained consistent across years.

The product dosage influenced average fruit weight indirectly, through its effect on fruit set. Higher weights were recorded in ReTain 0.4 kg/ha compared to 0.8 kg/ha. Thus, in Kordia, average fruit weight amounted to 9.81 g at 0.8 kg/ha and 10.72 g at 0.4 kg/ha, while in Regina it was 10.65 and 11.08 g, respectively. Increasing the product dose enhanced fruit set but reduced average fruit weight.

Cherry firmness is an important postharvest quality parameter, with a major impact on shelf life. In 2019, both varieties exhibited medium firmness (3.25–3.27 kg/cm²), while in 2020 values ranged from 3.00 to 3.13 kg/cm² (table 4). The multiannual average indicated that Kordia cherries were slightly firmer (3.20 kg/cm²) compared with Regina (3.13 kg/cm²).

Growth regulator treatments did not reveal a clear trend regarding fruit firmness. The multiannual average values in Kordia were marginally higher in the treatments with Stimolante 66f, 0.3 l/ha (3.29 kg/cm²) and ReTain, 0.4 kg/ha (3.26 kg/cm²) compared to the other variants, where firmness varied between 3.12 and 3.19 kg/cm².

Table 4

Sweet cherry fruit firmness depending on variety and applied growth regulator, kg/cm²

Variants	Kordia variety		Regina variety	
	2019	2020	2019	2020
Control	3.20±0.11	3.03±0.08	3.22±0.07	2.97±0.09
Stimolante 66f, 0.3 l/ha	3.34±0.10	3.25±0.09	3.26±0.12	3.04±0.10
Gobbi Gib 2LG, 0.5 l/ha	3.28±0.17	3.10±0.14	3.29±0.09	3.05±0.11
ReTain, 0.4 kg/ha	3.31±0.12	3.22±0.07	3.26±0.06	2.98±0.06
ReTain, 0.8 kg/ha	3.24±0.09	3.05±0.13	3.23±0.08	2.97±0.14
Media	3.27	3.13	3.25	3.00

The multiannual average firmness of Regina cherries was higher in the Gobbi Gib 2LG, 0.5 l/ha treatment (3.17 kg/cm²) and in the Stimolante 66f, 0.3 l/ha treatment (3.15 kg/cm²), while the control, ReTain 0.4 kg/ha, and ReTain 0.8 kg/ha treatments showed a slight, non-significant decrease (3.10–3.12 kg/cm²) compared to the previous variants. Thus, cherry fruit firmness appears to depend largely on the year and variety.

CONCLUSIONS

The highest fruit set was recorded in the treatment with ReTain at 0.8 kg/ha, with a multi-year average of 34.9 % for the Kordia variety and 35.9 % for Regina.

Fruit yield showed a direct relationship with the fruit set, reaching maximum values in the ReTain 0.8 kg/ha and Gobbi Gib 2LG 0.5 l/ha treatments.

The application of growth regulators had an insignificant effect on the firmness of Kordia and Regina sweet cherries.

Treatments with ReTain at 0.8 kg/ha, applied at 30 % flowering, positively

influenced fruit set (34.9–35.9 %) and yield per hectare (11.06–12.34 t/ha), while slightly reducing the average fruit weight (9.81–10.65 g).

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