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EFECTUL UNOR METODE DE PREVENIRE A BRUMELOR ȘI A ÎNGHEȚURILOR DE REVENIRE LA CAIS ȘI PIERSIC

THE EFFECT OF SOME METHODS CONCERNING THE PREVENTION OF RETURNING FROST AND HOARFROST ON THE PEACH AND APRICOT TREE

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Abstract

Apricot and peach are species with a short dormancy, being able to start growing season even in February; the resistance of the trees to frosts and late frosts during this period is reduced. The risk is even higher in the south-east of the country where the probability of thermal amplitudes is very high, both during February and March. Although it is an important phenomenon, the information's of how to protect trees from frost are relatively limited. There is a need for information to support orchards owners to approach this issue. The purpose of this paper was to apply measures and methods to combat this phenomenon in intensive apricot and peach orchards, measures that contribute to "saving" fruit production.

Cuvinte cheie: agrofrost, tăieri, tratamente, piersic, cais.
Key words: agrofrost, cuttings, treatments, peach, apricot.

1. Introduction

Apricot-tree and peach-tree are fruit species whose culture is traditional in Dobrogea, having a high degree of profitability. The production of apricots and peaches is very important, because a balanced diet also involves the consumption of seasonal fruits for as long as possible; apricots and peaches are of very good quality and can be eaten fresh only during the summer. Adherence to a suitable technology for growing trees, taking into account the cultivar and current climatic conditions is an important factor leading to a rich, high-quality fruit yield and increased economic efficiency (Mihaiescu, 1998). The applied technology must take into account the appearance of late frosts and hoarfrosts, which due to climate change in recent years make their presence felt more and more often and can completely compromise the fruit yield.

When temperatures drop below critical temperature of the phenophase in the spring, there is a risk of production losses, especially in species with earlier flowering, such as apricot and peach.

Damages caused by recurrent frosts causes the formation of extracellular ice inside plant tissue, a phenomenon that attracts cellular water, dehydrates cells and causes damage to them. After periods, the plants tend to harden against frost damage, but they lose this resistance after a period of warmer weather (http://www.omafra.gov.on.ca/english/crops/facts/85-116.htm).

Similar studies have shown that the delay in flowering is dependent on the cultivar and the products applied. When applying ethylene-generating compounds, the delay in flowering resulted from both prolonged dormancy and slow bud development once the dormancy stage was complete (Wax, C.L, Rasberry, F.P., Matta, F.B., 1987). Susceptibility to frost damage depends on the tree's stage of development, cultivar, and location, but certain preventative measures can be taken.

The lowest several hundred feet of the atmosphere becomes stratified under calm, clear, frost conditions. An inversion condition thus exists, meaning that temperature increases as it rises to the top of the inversion layer. A wind machine mixes the warmer air from the upper portions of the inversion layer with the colder air near the ground, raising air temperatures around the trees by a few degrees.

Wind machines are motor driven and therefore consume fuel, although not nearly as much as stack heaters. There are two types of wind machines: those that have the engine mounted at the top of the fan and those with the engine located on the ground (https://extension.psu.edu/orchard-frost-protection-with-wind-machines).

The frost resistance of apricot and peach flower buds is a physiological feature conditioned by a series of factors such as: absolute temperature, the evolution of the temperature from the end of winter dormancy until flowering and the physiological status of the trees (Balan et al., 2008).

By using special gas-based equipment, good results have been obtained in terms of protecting the trees against late frosts. Thus, on an area of 5 ha, for protected trees, a no. average fruit/ tree of 126 compared to 17 fruits / tree in the unprotected version, given that a temperature of -9^{o}C was recorded (http://www.agrofrost.eu/frostbuster).

The purpose of this paper was to apply measures and methods to combat this phenomenon in intensive apricot and peach orchards, measures that contribute to the "rescue" of fruit yield. The data presented are preliminary results, the study will continue in the coming years.

3. Material and methods

The study was conducted at Research Station for Fruit Growing (RSFG) Constanta, in the springs of 2020 and 2021, in the demonstrative lots of peach and apricot, the trees being in the 10th year after planting; the planting distance is 4m / 4m, number of trees per hectare 625; the trees crown is improved vase. Climatic data were recorded at the weather station, type iMetos, IMT 300 Pessl Instruments from Austria which belongs to RSFG Constanța. The following methods for preventing frost and frostbite have been studied:

1 - AGROFROST antifreeze and anti-fog machine, Elivent, Elibrina model. It was used in the apricot and peach plots on February 13 (fig. 1), on March 7 and April 11. Negative temperatures were announced on those dates.

2 - spraying trees of apricot and peach species, with "MIF" type antifreeze cupric substance.

The experiment was organized on 3 cultivars of peach and apricot with different periods of fruit ripening. The peach varieties studied were ‘Springcrest’, ‘Cardinal’ and ‘Redhaven’; at the time of treatment (on 06.04), the vegetation phase at ‘Springcrest’ was 50% flowering, at ‘Cardinal’ 15% flowering, and at ‘Redhaven’ a pink bud.

The apricot cultivars. studied were ‘Sirena’, ‘Sulmona’ and ‘Olimp’, at the time of applying the treatment in the 15% flowering phenophase;

The treatment was performed with the spray pump, with a capacity of 1000 liters, the added antifreeze cupric substance being 5% (Fig. 2).

3 - application of pruning to delay flowering in two cultivars of peach, ‘Florin’ and ‘Florica’ and two cultivars of apricot ‘Tudor’ and ‘Augustin’. An early cultivar and a late cultivar were chosen from both species. The pruning was applied starting with 04.02 and 22.02 trees in dormancy; 02.03-flowers in swelling phenophase; 12.03- swelling, temperatures of - 40C from 00:00 a.m to 7:00 a.m; 24.03- trees in the phase, temperatures from -20C at night to 50C during the day. Observations were made on control annual shoots (15 annual shoots from each marked tree), fruit annual shoots taken from different heights of the crown (0.8m, 1.2m, 2.0m), being sectioned flower buds and establishing their viability.

3. Results and discussions

The results obtained after two years of study (2020-2021) with the anti-freeze and anti-fog machine AGROFROST, Elivent, Elibrina model. In 2020, after temperatures that reached +20.70C (February 2020), in March 2020 an absolute temperature of -5.60C was recorded. Thus, the effect of late frosts on fruit buds was dramatic, especially for the apricot species. On February of 2021, the weather station indicated a temperature of -13.4°C, while in the previous days temperatures were recorded between + 14.8°C- + 18.9°C. On March of the same year, the temperatures of -5.5°C were recorded, before this date being high temperatures, up to +18°C. On April, temperatures of -1.4°C were recorded, after in the first decade of the month temperatures were between +9.3°C and +20.4°C. The mentioned climatic accidents occurred in phenophases such as swelling of buds, bud burst and flowering, that greatly affecting fruit production.

Very high temperature fluctuations between day and night had negative repercussions for fruit buds, forced to start in the vegetation when positive temperatures appear, then the frosts during the night were very aggressive. Although the above-mentioned antifreeze machine operated on nights with negative temperatures, it could not cope with the very low temperatures recorded, not proving effective in this situation.

Table 1 shows that the ‘Amiral’ variety (early apricot cultivar) was the most affected, in proportion of 85%; the earliest peach variety studied (‘Springcrest’) had losses of 65%. In the ‘Harcot’ and ‘Redhaven’ cultivars, with the harvest period in July, the bud losses were between 50 and 60%; the least affected were the late cultivars (with the ripening period of the fruits at the end of August, beginning of September), both apricot and peach, these having losses between 25 and 35% respectively.

Results regarding the spraying of apricot and peach trees with "MIF" type anti-freeze copper substance. After 15 days from the application of the treatment on the trees of the two studied species, its effect on the fruit buds was noted, data presented in table 2.

The losses of fruit buds also depended on the phenological phase, the peach varieties, which were in a more advanced vegetation phase, registered greater damages (‘Springcrest’ and ‘Cardinal’); the late cultivars (peach-‘Redhaven’ and apricot-‘Olimp’) had a better resistance to frost after applying the treatment with anti-freeze cupric substance, because the fruit buds stagnated for several days.

Results regarding the application of pruning to delay flowering. By applying the pruning at different times, the delay of flowering was found by 2-4 days and the percentage of fruit bud losses of 70-75% for early varieties and 35-40% for late varieties. Similar results were obtained for apricots in Rep Moldova. https://www.youtube.com/watch?v=JBbjPcQFDhs.

4. Conclusions

In both years of study (2020-2021), due to unexpected climatic phenomena, fruit production has been affected since mid-February, when the trees started growing by swelling the fruit buds of early apricot and peach cultivars in 85%.

As a consequence of the positive temperatures took place the swelling of the fruit buds very early, then the mass flowering; at that time the losses were visible, a large part of the fruit buds remained necrotic and dried on the tree in both peach and apricot;

In peaches, the application of the treatment with the anti-freeze cupric product in the flowering phenophase did not prove to be effective (in the early 'Springcrest' cultivar, 90% production losses were registered). The application of the cupric product will continue in the next year for more conclusive determinations;

In apricots, following the application of the treatment, the 'Olimp' variety showed a resistance 30% higher than the 'Sirena' cultivar; In the experiment with pruning to delay flowering, at distances of over 2 meters from the crown the fruits resisted, live buds could be seen in the mass, because the warm air rose to the upper level of the crown, the frost being much more aggressive from the ground to 1.5 meters high crown. The pruning made later (24.03) kept the trees in vegetative rest for several days (2-4 days).

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Tables and figures

Table 1. Average data on the viability of fruit buds on May in 2020-2021, AGROFROST % of buds affected by frost

Data	**27.05**		
Apricot cultivars	Amiral	Harcot	Olimp
%	85	50	25
Peach cultivars	Cardinal	Redhaven	Southland
%	65	60	35

Table 2. The effect of applying the anti-freeze cupric substance type MIF, Valu lui Traian (2020-2021)

No.	**Date of treatment / Date of evaluation of tied fruit**	**Cultivar**	**The phenophase in which the treatment was applied**	**% of set-up fruits**
Apricot tree				
1.	06.04/20.04	Olimp	15% flowering	50
2.		Sirena	15% flowering	20
3.		Sulmona	15% flowering	35
Peach tree				
1.	06.04/20.04	Springcrest	50% flowering	10
2.		Cardinal	15% flowering	30
3.		Redhaven	Pink bud	50

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Table 3. The effect of the application of pruning, Valu lui Traian, 2020-2021

Cultivar	Date of pruning	Phenophase	% of fruit losses
Florin	04.02 22.02	Dormancy	70
	02.03 12.03	Swelling	
	24.03	Pink bud	
Florica	04.02 22.02	Dormancy	35
	02.03 12.03	Swelling	
	24.03	Pink bud	
Tudor	04.02 22.02	Dormancy	75
	02.03 12.03	Swelling	
	24.03	Pink bud	
Augustin	04.02 22.02	Dormancy	40
	02.03 12.03	Swelling	
	24.03	White bud	

Fig. 1. Implementation of the AGROFROST anti-freeze and anti-fog machine, Valul lui Traian, 2021

Fig. 2. Application of the antifreeze substance "MIF" in the demonstration lots from SCDP Constanța, Valu lui Traian, 2021