# EFECTUL PRODUSELOR PE BAZĂ DE CALCIU ASUPRA CALITĂŢII CIREŞELOR ŞI PRUNELOR

# EFFECT OF CALCIUM BASED PRODUCTS ON CHERRIES AND PLUMS QUALITY

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**Abstract**

**Cherry and plum are two major fruit species grown in Romania which are extending rapidly due market demands, the stimulative price of the fruits and various possibilities for valorization Nowadays farmers needs to adopt modern growing systems and sequences, to produce high quality fruits. Therefore, researches in order to increase the fruits quality and loses reduction due to fruit crack or breakdown, need using innovative calcium based products. The researches conduced at Research Institute for Fruit Growing Pitesti, Romania reveal that application of calcium based products enhanced the fruits firmness and decreased the fruit cracking on 'Skeena' cherry variety. In addition, application of calcium based products on plum increased the production, fruits mass and firmness. On 'Carpatin', variety a good correlation was found between plums total sugar content and soluble dry mater content $R^2$=0.671800 and respectively r=0.819634. Also, the calcium based products applied in cherry and plum culture, reduced the losses caused by the brown rot - *Monilia laxa.***

**Cuvinte cheie:** cires, prun,calitatea fructelor, calciu.
**Key words**: cherry, plum, fruits quality, calcium.

## 1. Introduction

Cherry is appreciated for its fruits rich in sugars (16g/100g), vitamins: A, B1, B2, B3, B5, B6, B9, minerals: Ca 13-16mg, Fe 0,32-0,36, Mg 9-11mg, Mn 0,07-0,112 mg, P 15-21 mg, K 173-222 mg, Zn 0,07-0,1mg/100g (USDA Nutrient Database, 2017), for its flowers and for the high quality wood. The fruits market demands, the stimulative price of the fruits and various possibilities for valorization, drives the farmers to extend the plum and cherry cultures, to adopt modern growing systems, with new assortments, according the consumers requests (Asănica, 2012). Plum is the main fruit species in Romania, and is growing almost everywhere from the Carpathian hills to the plains area. Our Country is holding the 3rd place in the world after China and Serbia and the 2nd one in Europe after Serbia. Regarding the plums production, Romania holds the 4th place worldwide after China, Serbia and USA and the 2nd one in Europe after Serbia (Coman et al., 2012). During the last decade, plum production has varied from 250,000 to 400,000 t/year, which is below the national potential (the 40-year average is over 565,000 t (Botu I. et al., 2010; Sumedrea D., Sumedrea M., 2011). The plum fruits are rich in sugars (16-20%) K (100.0mg/%), P (18.0mg/%) Ca (12.0mg/%), Mg (10.0mg/%), Na (1.0mg/%), had a low proteins (0.8 g%) and lipids (0.2 g%) content, but many vitamins, vitamins A (300mg/%), B1, B2, P and C, are poor in calories 75 / 100 g, and they are designated for distillation (70-85%) processing and fresh consumption (Branişte and Drăgoi D., 1999). Cherry culture is one of the fruit species in development in the entire World and Romania is holding the 3rd place regarding the average yield (11.94 t/ha) and the 8th place as regard the average production (81842 t/year). The cherry crop is present on every continent Europe is holding 65% of the World production, USA and Canada 15%, followed by Asiatic and Latin America's countries. (Branişte and Dragoi, 1999). Under the such conditions, it was foreseen the need to carry out new researches in order to increase the fruits quality and reduction of the loses due to fruit crack or breakdown, using innovative calcium based products

## 2. Material and methods

The researches regarding the fruit quality improvement and loses reduction caused by fruit crack or breakdown, were conducted during 2015-2016 at Research Institute for Fruit Growing Pitesti-Maracineni. For cherries, the studies were done on 'Skeena' variety grafted on 'Gisela 5' rootstock, planted at 4.00 x 2.00 (1250 trees/ha) and also trained as a spindle. For plums the studies were conducted in a 10 years old high density plum orchard, on the 'Carpatin' variety grafted on 'Sant Julien' rootstock, planted at 4.00 x 2.25 (1111 trees/ha) and trained as a spindle. The soil along the tree rows was maintained using a

glyphosate based herbicide (360 g a.i./l), applied at the rate of 4.00 l commercial product/ha. Between the rows, the orchard floor was maintained with grasses and trimmed three times per season. The weeds development stages were quantified using BBCH evaluation scale (Maier et al., 2001). The calcium based products experimented were displayed three times per season, in four replicates of six trees, using an STIHL 400 SR backpack sprayer. During the study period, many experimental data were collected, including: meteorological data (using the system WatchDog with Specware Pro 9 software), pH of the experimented products (using Hanna pH meter and BestWay International sensitive paper), mean fruit weight, mean fruit number per kg, mean fruit firmness N (using the tester HPE II FFF Qualitest International Inc.), the average cracking percentage and diseases incidence. The data were stored and processed using MS Excel 2010 facilities.

## 3. Results and discussions

Evaluation of the figures 1-4 indicate the fact that the products based on calcium carbonate Omya Pro Calcium and Calcium chloride applied in cherry culture, increased the production quality and reduced the loses due to the fruit crack. Analyses of the obtained results drive us to the conclusion that on 'Skeena' cherry cultivar, in the variants treated with calcium based products, the number of fruits per kg was between 134.80-136.18, compared with the untreated control where this indicator was 138.08. In addition, the fruit average mass in the treated variants was 7.36-7.47g, compared with the fruit average mass in the untreated control, where this indicator was 7.26g.

The highest value of fruit firmness was registered in the variant treated with Omya Pro Calcium, 77.57N versus 75.92N in the variant treated with calcium chloride. Comparatively, in the untreated control variant the fruit firmness was 73.90N. Opposite, the fruits crack registered low values in the variant treated with Omya Pro Calcium, only 2.5%, compared with the variant treated with calcium chloride where the cracking percentage was 10%. In the untreated control variant, after 48h of immersion in distillate water, the cracking percentage of cherries was 23.8%.

Assessment of the figure 5 indicate that on 'Carpatin' plum variety the application of the calcium based products increased the fruit production at 163.4-176.7q/ha and fruit mass at 53.14-59.05 g. Comparatively, in the untreated control variant, the fruit production was 160.0 q/ha and the fruit mass was 54.30 g.

In the figure 6 one can see that in the variant treated with Omya Pro Calcium, the average fruit firmness was 58.22N, and 56.67N in the variant treated with calcium chloride. Comparatively, in the untreated control variant, the plums mean firmness was 52.82N. Also, in the case of the dry mater content, the differences between the products effects were small. In the variant treated with Omya Pro Calcium, the fruits soluble dry matter content was 15.70% and in the variant treated with calcium chloride, the soluble dry matter content was 15.58%. Comparatively, in the untreated control variant, the fruits soluble dry matter content was 15.10%.

Examination of the figure 7 demonstrate that calcium application in plum orchards is necessary and opportune because a good correlation was found between plums content in sugars (%) and the soluble dry matter content. Under the experimental conditions, the calculated regression coefficients were R2=0.671800 and respectively r=0.819634.

Assessment of the figure 8 reveal that calcium based product application influenced in a positive way the colour of 'Carpatin' plum variety. In the variant treated with Omya Pro Calcium, the coloration intensity (CIE*L) was 24.46 versus 24.30 in the variant treated with calcium chloride. Comparatively, in the untreated control variant, the fruits coloration (CIE*L) was 22.97.

Another series of evaluations, aimed to show the effect of calcium based products on specific diseases attack on plums in the orchard and during temporary cool storage. During 2016, under a standard phytoprotection program, application of calcium based products kept the pathogens under the economic damage threshold, especially the brown rot.

In the figure 9 one can see that after a week of cool storage, followed by another week at room temperature, in the variant treated with Omya Pro Calcium, on plum fruits, the brown rot - *Monilia laxa* incidence DISIC% was 3.19%. At the same time, in the variant treated with Calcium chloride, the brown rot incidence DISIC% was 7.86%. Comparatively in the untreated control variant, the brown rot incidence DISIC% was 23.80%.

## 4. Conclusions

**On cherry:**

- The highest value of fruit firmness was registered in the variant treated with Omya Pro Calcium 77.57N versus 75.92N in the variant treated with calcium chloride. Comparatively, in the untreated control variant, the fruit firmness was 73.90N.

- The fruits crack registered low values in the variant treated with Omya Pro Calcium (2.5%), comparative with the variant treated with calcium chloride where the cracking percentage was 10%. In the untreated control variant, the cracking percentage of cherries was 23.8%.

**On plum:**

- The application of the calcium based products increased the fruit production at 163.4-176.7q/ha and fruit mass at 53.14-59.05 g. Comparatively, in the untreated control variant, the fruit production was 160.0 q/ha and the fruit mass was 54.30 g.
- The average fruit firmness was 58.22N, and 56.67N in the variant treated with calcium chloride. Comparatively, in the untreated control variant, the plums mean firmness was 52.82N.
- In the variant treated with Omya Pro Calcium, the fruits soluble dry matter content was 15.70% and in the variant treated with calcium chloride, the soluble dry matter content was 15.58%. Comparatively, in the untreated control variant, the fruits soluble dry matter content was 15.10%.
- A good correlation was found between plums total sugar content and soluble dry mater content $R^2$=0.671800 and respectively r=0.819634.
- In the variant treated with Omya Pro Calcium, the coloration intensity (CIE*L) was 24.46 versus 24.30 in the variant treated with calcium chloride. Comparatively, in the untreated control variant, the fruits coloration (CIE*L) was 22.97.
- In the variant treated with Omya Pro Calcium, on plum fruits, the brown rot - *Monilia laxa* incidence DISIC% was 3.19%. At the same time, in the variant treated with Calcium chloride, the brown rot incidence DISIC% was 7.86%. Comparatively in the untreated control variant, the brown rot incidence DISIC% was 23.80%.
- The products based on calcium carbonate Omya Pro Calcium and Calcium chloride applied in cherry and plum culture, increased the fruits production and quality and reduced the loses due to the fruits crack and brown rot.

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**Figures and Tables:**

**Table 1. Crop development stage and meteorological conditions at calcium based products application on cherry, RIFG Pitesti, Romania, Lat. N 44,513; Long. E 24,52; Alt. 287m**

| T. | Date | BBCH | MedT [*C] | HR [%] | Wmin [Km/h] | Wmax2 [Km/h] | LWet [h] | Weeds coverage |
|---|---|---|---|---|---|---|---|---|
| 1. | 29. 05 | 81 | 15.9 | 48 | 2,3 | 2,5 | 0 | clean |
| 2. | 05.06 | 85 | 20,4 | 65 | 2,9 | 3,0 | 0 | clean |
| 3. | 11.06 | 87 | 20,9 | 60 | 2,8 | 2,7 | 2 | clean |

**Table 2. Crop development stage and meteorological conditions at calcium based products application on plum, RIFG Pitesti, Romania, Lat. N 44,513; Long. E 24,52; Alt. 287m**

| T. | Date | BBCH | MedT [*C] | HR [%] | Wmin [Km/h] | Wmax2 [Km/h] | LWet [h] | Weeds coverage |
|---|---|---|---|---|---|---|---|---|
| 1. | 28.06 | 76 | 17,4 | 93 | 0,1 | 6,0 | 3,0 | clean |
| 2. | 04.07 | 79 | 21,6 | 74 | 1,8 | 22,0 | 0,3 | clean |
| 3. | 18.07 | 81 | 20,0 | 64 | 4,0 | 32,0 | 0,0 | clean |

**Table 3. Calcium based products experimented on cherry RIFG Pitesti, Romania, Lat. N 44,513; Long. E 24,52; Alt. 287m**

| Variant / product | Active ingredients | Unit | Doza |
|---|---|---|---|
| **Untreated control** | - | g/10L | 0 |
| | | g/100L | 0 |
| | | g/1000L | 0 |
| **Calcium chloride** | Calcium chloride 16.8% (223g/L) | ml/10L | 50 |
| | | ml/100L | 500 |
| | | ml/1000L | 5000 |
| **OMYA PRO CALCIUM** | Calcium carbonate 90.0%, calcium oxide 50.4% Calcium 36% | g/10L | 50 |
| | | g/100L | 500 |
| | | g/1000L | 5000 |

**Table 4. Calcium based products experimented on plum RIFG Pitesti, Romania, Lat. N 44,513; Long. E 24,52; Alt. 287m**

| Variant / product | Active ingredients | Unit | Doza |
|---|---|---|---|
| **Untreated control** | - | g/10L | 0 |
| | | g/100L | 0 |
| | | g/1000L | 0 |
| **Calcium chloride** | Calcium chloride 16.8% (223g/L) | ml/10L | 50 |
| | | ml/100L | 500 |
| | | ml/1000L | 5000 |
| **OMYA PRO CALCIUM** | Calcium carbonate 90.0%, calcium oxide 50.4% Calcium 36% | g/10L | 43,5 |
| | | g/100L | 435 |
| | | g/1000L | 4350 |

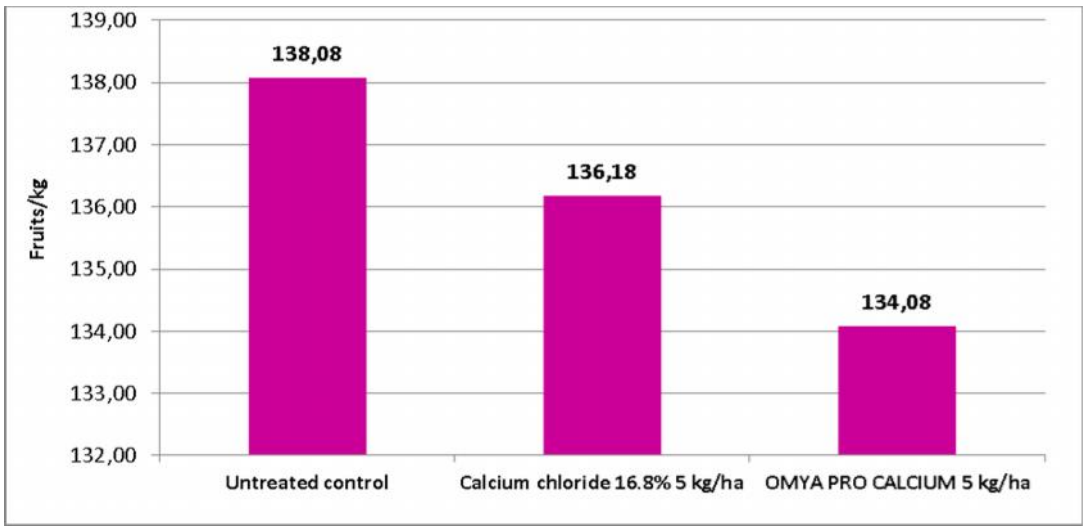


**Fig. 1. Mean number of fruits / 1 kg on 'Skeena' cherry variety in the variants treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti, Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

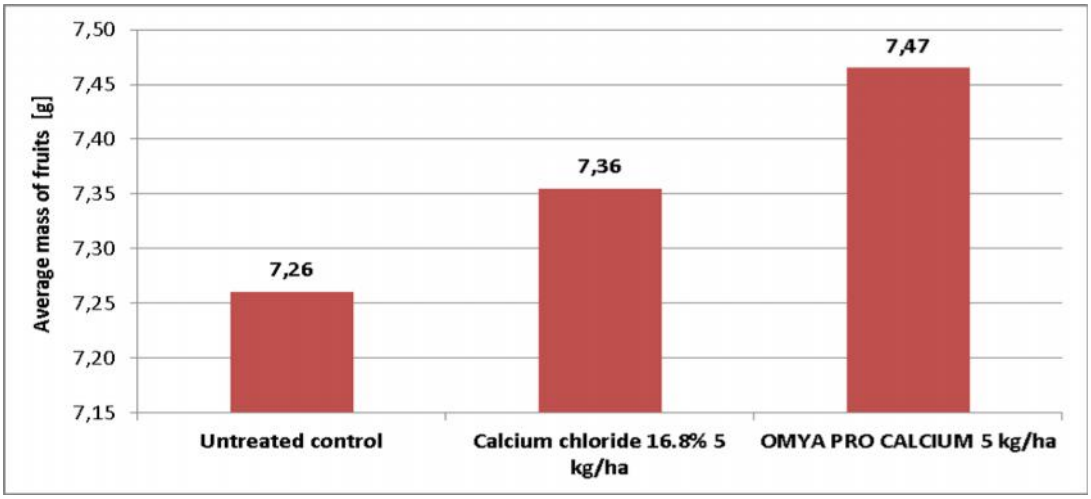


**Fig. 2. Average mass of fruits on 'Skeena' cherry variety in the variants treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

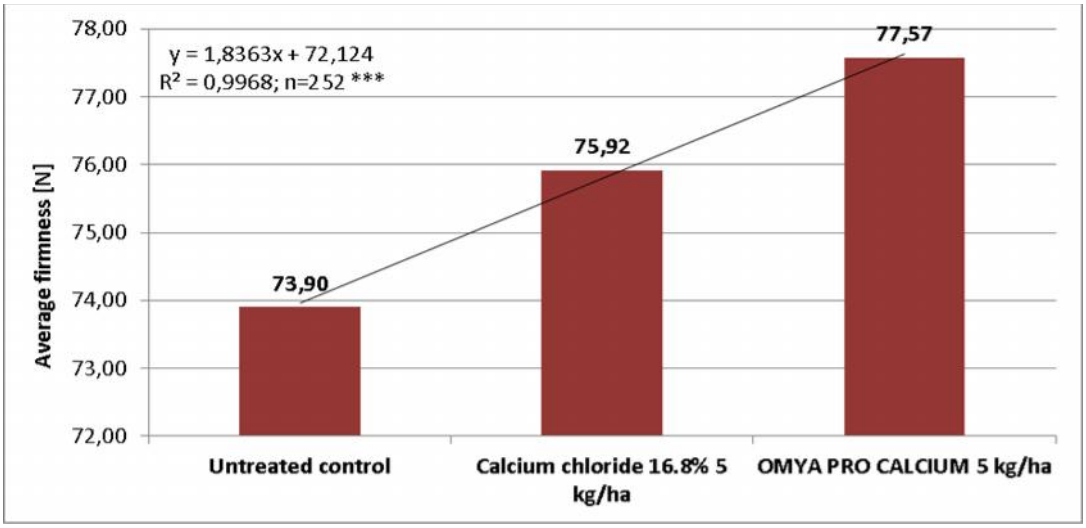


**Fig. 3. Average firmnes on 'Skeena' cherry variety in the variants treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

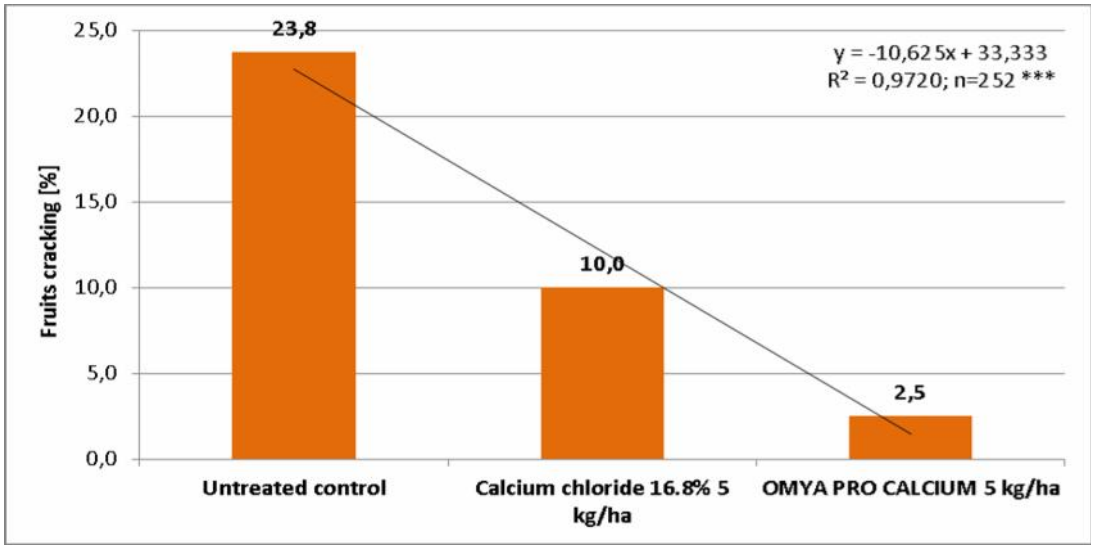


**Fig. 4. Fruits craking on 'Skeena' cherry variety in the variants treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

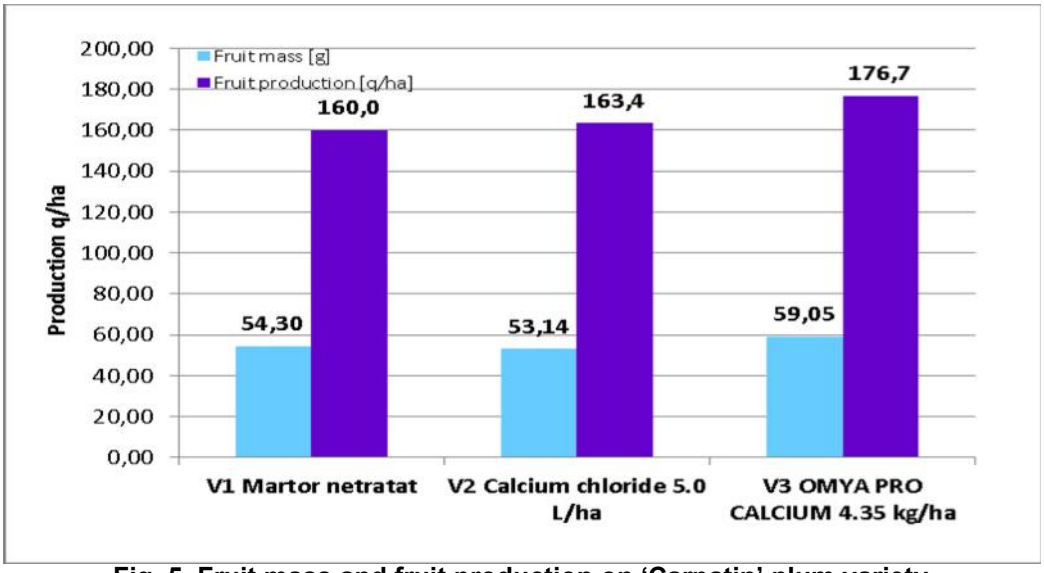


**Fig. 5. Fruit mass and fruit production on 'Carpatin' plum variety in the variants treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

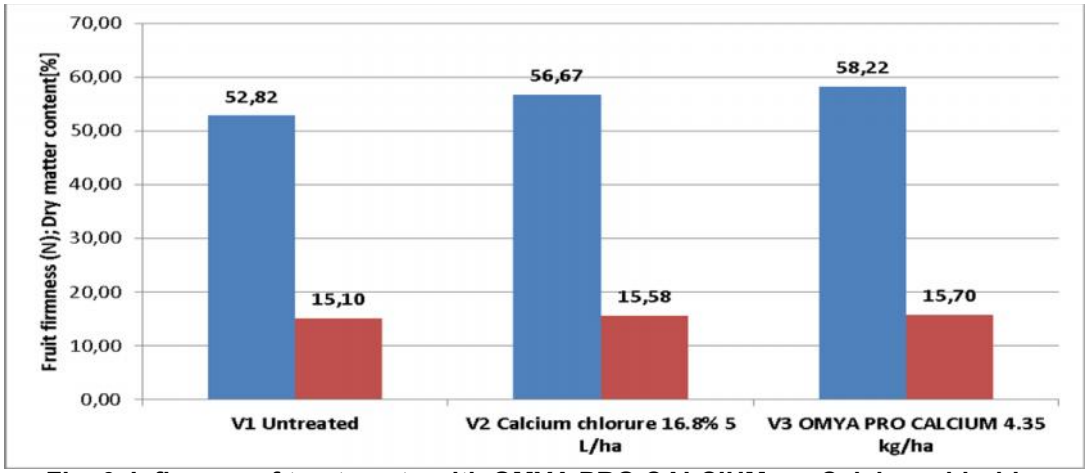


**Fig. 6. Influence of treatments with OMYA PRO CALCIUM vs. Calcium chloride, on fruits firmness and dry matter content of 'Carpatin' plum variety, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

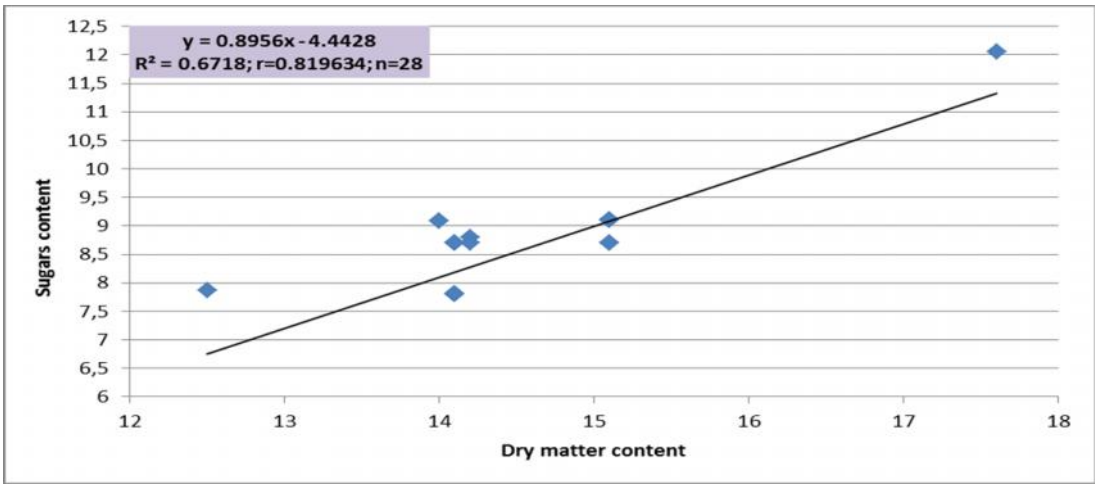


**Fig. 7. Correlation between dry matter content and sugars content of 'Carpatin' plum variety treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

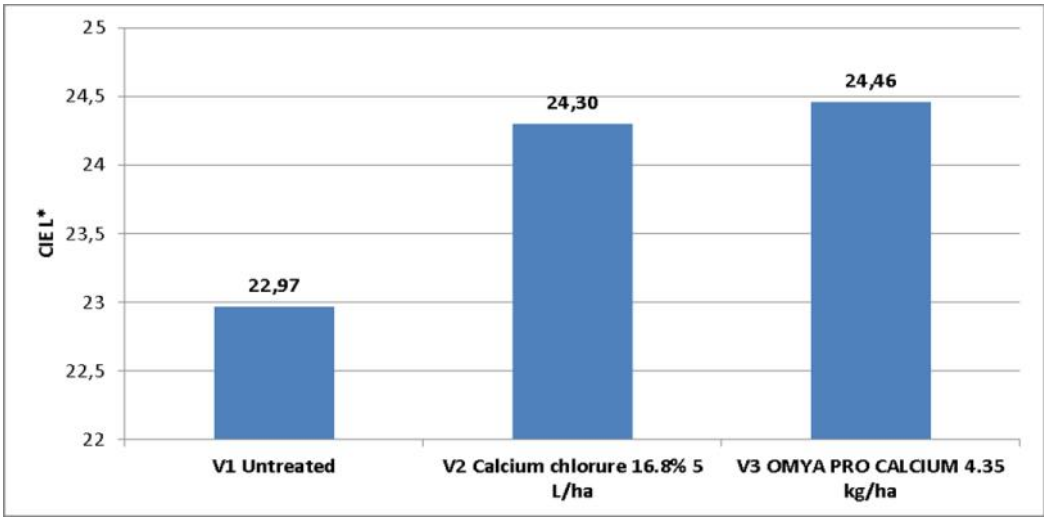


**Fig. 8. Influence of treatments with OMYA PRO CALCIUM vs. Calcium chloride on fruits color (CIE L* ), RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**

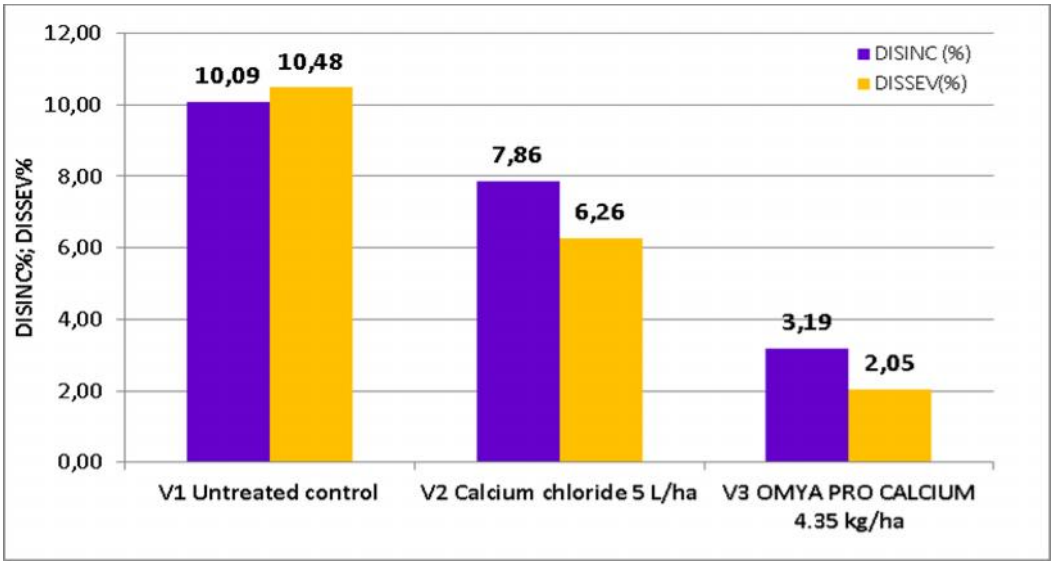


**Fig. 9. *Monilia laxa* (brown rot) incidence on 'Carpatin' plum variety in the variants treated with OMYA PRO CALCIUM vs. Calcium chloride, RIFG Pitesti Romania Lat. 44.513 N, Long. 24.52 E, Alt. 287m**