RESTORING VINEYARDS AFFECTED BY FROSTS IN WINTER

MUNTEAN L.T, GIUGEA N., MĂRĂCINEANU L.C.
University of Craiova, Faculty of Horticulture

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ABSTRACT

This paper presents the restoration of the Cardinal table grape variety, strongly affected by the frosts during 2014-2015 winter.

The causes which contributed to the total loss of the grape vines were: the vegetation strongly affected by hail in June 2014, poor maturation of the shoots due to frequent and profound wounds of the sprouts caused by hail and the large temperature variations during winter.

After determining the losses of buds from 28.02.2015, there resulted losses of 100%. The restoration of the grape vines is based on sprouts released from the buds situated at the base of the stems.

The developed root system and the lack of appropriate vegetation favor the strong development of these shoots: they become greedy shoots. On these characteristics is based the rapid recovery of the initial form of the shoot and the production potential.

INTRODUCTION

Accidents have always an external cause. This may be natural and then it is climate: frost (cold) and storm water (hail).

The strong frosts during winter, as well as the hail during the growing season are climate accidents that result in serious consequences, sometimes disastrous for the viticulture.

Depending on the intensity of the phenomena, the destructions caused can go up to 100%.

Beside total or partial loss of the production of the year, the climate accidents, especially hail it affects also the crop of the following year, largely because of the destruction of the vegetative system, of the grape vines and of their impoverishment in reserve substances.(G. Beleniuc , 2009)

The degree of resistance to frost of the grape vines was determined by a series of factors among which the intensity and duration of frost during winter, its sudden or gradual occurrence, the alternating of low and high temperatures, maturity degree of the strings and that of the preparation of the buds for winter.

The vine organs or parts of these freeze at different temperatures.

Except the diaphragm which can freeze at -5 °C the rest of the supra-terrestrial organs easily support temperatures of– 12 °C. The frosts of -15 °C begin damaging the buds, their resistance increasing from the main bud towards those of higher order. In the case of alternating freezing and thawing, the buds lose their gardening and can be damaged even by frosts of -7 – 8 °C. The most resistant to the action of frosts are the undeveloped buds, found under the multiannual wood bark.

At temperatures of -18 °C, - 22°C it begins the damaging of the wooden tissue at the annual shoots, and frosts over -24 °C affect even the multiannual formations. (T. Martin, 1968)

In nature there is a large interdependence between various factors which combined action lead either to the aggravation of the harmful effects, or to their mitigation .

Among the main factors we recall:

- Strength, duration and way of manifestation of frost. The total loss is directly proportional to the level of the low temperatures that exceeds the resistance limit of

different organs of the vine and especially with the duration of the frosty period. The loss of buds increases under the conditions of critical temperature occurrences with shock effect; that is when they occur suddenly following some periods with positive temperatures; registered at the beginning of winter.

- On the contrary, observations have shown that sometimes vineyards can bear unburied sometimes frosts of– 23 °C ,- 25 °C provided that the cold is dry, of short duration and without high amplitudes of temperature (abiotic conditions), and the strings to be well maturated and the winter buds gradually and properly tempered (biotic conditions).
- The tempering (plant physiological readiness degree) has a special importance. If the tempering unfolds gradually, the vines can easily bear the limits above shown. But if during the relative rest there occur positive temperatures (above 12 °C , 14 °C) there is produced the sensitization of the winter buds which can perish even at - 7 °C, - 8 °C (M. Oslobeanu).
- The degree of maturation of strings is crucial in terms of increasing resistance to frost. Only fully mature strings and with sufficient reserve materials an successfully resist to strong frosts during winter, especially on vines lead on stems, where the vegetative system is wintering at risk.

If for various reasons (overproduction), attack of blight or the mildew etc) the vine shoots do not mature (the wooden tissues remain loose and low in nutritive materials, lacking the cork protective layer), there are prerequisites for a massive frostbite of annual elements.

- Massive downy mildew attacks cause severe defoliation of the grape vines. The lack of assimilation foliar system leads to the lack of maturation of the vine shoots but also to an insufficient accumulation of sugars in the grapes. The vine shoots remain green on more or less extended portions of their lengths, sometimes even from their insertion on the two year wood. Such immature shoots or still green vibe shoots perish since the first frosts.
- Increased grapes production, obtained not as a result of the improvement of the nutritional conditions, but due to artificial increase of the burden of fruit, it produces a debilitation of hubs and a diminution of their resistance to frost.

The reserve substances are mainly located in the grapes and less in the sthoots, the latter being so sensitized against the winter frosts.

- Irrational fertilization, fertilization neglect, as well as the deficiencies in protecting the vine against diseases and pests, prevents the proper maturation of strings, reduce their resistance to frost.

The use of phosphatic and especially potassic fertilizer favors both the maturation of grapes and that of strings. Excessive application of fertilizers with nitrogen lead to the luxuriant grow of the vines, it delays their vegetation and therefore, reduces their resistance to frosts.

The fruit burden must be judiciously established and sustained with a fertilization program with phosphor and especially potassium.

- The age of the vines influences their resistance to frost. The old vines are the most sensitive to frost, as well as the very young (up to 4-5 years). This is the reason for which the young vines are compulsory buried, regardless the culture area and the afferent risk.
- The nature of the soil, its humidity, the exposure and altitude have an important role significant in terms of resistance to frost of the vines. In sandy soils, the frost penetrates easily and deeply and therefore the vines freeze more. The coast lands, drained and well sheltered and with southern exposure are the most favourable for the vine, favouring the maturation of the vine shoots and increasing this way the resistance of the vines to frost. On the contrary, the valleys haunted by cold currents and the plains with frequent early frosts in autumn prevent the normal maturation of vine shoots, exposing the

vines to the harmful effect of frost. It is desirable that the vines be stationed on hills, without being overcome altitudes of 200-250 m.

- The snow layer by its thickness can reduce the harmful effects of frist, the “empty” winters (without snow) are particularly harmful for viticulture. It is recommended that through various dams to prevent the spreading of snow by wind, especially in the dry areas.

- The variety is one of the factors with determining role for the resistance of the vines against frost. Among the varieties with good resistance to frost: Traminer, Feteasca alba, Feteasca neagra, Riesling Italian, Muscat Ottonel, Cabernet Sauvignon, Coarna neagra, Aligoté, Chasselas; among the varieties with low resistance to frost: Galbena de Odobesti, Tamaioasa romaneasca, Muscat de Hambourg, Afuz-Ali. Among the varieties with extreme qualities: RKatiteli as highly resistant (L. Jianu 1980) or some sensitive to frost as Merlot or Cardinal. Generally, the varieties with weak grow and dense wooden tissues, with less water, with reduced pitch, with short internodes, slightly flattened are more resistant to frost than the vigorous ones that have opposed characters.

In the same parcels there can be registered variable percentages of buds affected by frost from a grape vine to another. The more vigorous grow of the grape vines, especially thick shoots with very large dorsal-ventral diameter (strings with “wide wood”), the higher the volume of the lost buds. The smallest losses are noticed in practice to strings with normal thickness (7-9 mm in diameter).

For the table variety of grapes as Cardinal, Afuz-Ali, with the strongly expressed characteristic of delivering vine shoots, it is noticed a small percentage of affected buds on vine shoots. This fact is due to the superior resistance to frost of these buds, formed during the grow period less intense than the shoots.

MATERIAL AND METHOD

The object and study of this theme is represented by the Cardinal variety on a surface of 2,2 ha, placed in Hinova viticulture area, Bistrita Village, Mehedinti County, “Muntean” property.

The determination was performed on average tests of shoots taken from different grape vines and usually placed in diagonal of the parcel. A sample comprises around 20 shoots for a surface of 1 ha. The shoots were taken by cutting from the insertion point at the length of 1 bud. The buds destroyed by frost are Brown and the healthy ones are live green (viability control of the winter buds through longitudinal cutting, after Poenaru I., 1980). The temperatures were recorded with minimum and maximum thermometer placed at the height of the stem of Cardinal variety, conduction form Guyot semi-height, with h 80 cm.

RESULTS AND DISCUSSIONS

On 25.06.2014 the culture of vine from the above mentioned area was strongly affected by hail, here being included also the Cardinal variety (figure 1 and 2).

Figure 1. Intensity and dimension of hail

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Figure 2. The Cardinal variety affected by hail

The hail compromised the grapes production of year 2014 in 100%, it also strongly affected the vegetation: leaves and shoots.

The reduced efficacy of treatments from the date of the hail reduced the foliage mass, the shoots with dense and profound wounds lead to a weak maturation of the wood till the entry in the vegetative rest. The winter from 2014-2015 was characterized by positive temperatures (table 1) in the first period of the relative rest (till 29.12.2014) suddenly followed by a sharp temperature drop (01.01.2015).

Table 1.

Minimum temperatures 2014-2015

Date	t° during the night	t° during the day
29.12.2014	+1	+3
30.12.2014	-9	-7
31.12.2014	-10	-8
01.01.2015	-14	-12
02.01.2015	-5	-3
03.01.2015	+1	+3

During 09.01.2015 – 05.02.2015 there were recorded positive temperatures both during the day and night, that on 10.02.2015 to return high temperature alternating between day and night (table 2).

Table 2

Minimum and maximum temperature during 10.02.2015-20.02.2015

Date	t° during the night	t° during the day
10.02.2015	-6	+6
11.02.2015	-7	+6
12.02.2015	-7	+6
13.02.2015	-6	+10
14.02.2015	-5	+10
15.02.2015	-3	+2
16.02.2015	-1	+1
17.02.2015	-1	+3
18.02.2015	-7	+2
19.02.2015	-5	+10
20.02.2015	-1	+13

After 20.02.2015 there was recorded only positive temperatures day-night.

After determination the loss of the buds from 28.02.2015 by the method of the longitudinal section made through the winter buds with the aid of a razor there resulted losses of 100% (figure 3-8).

Figure 3. Cardinal variety bud distroyed by frost in winter

The restoration of the shoots with annual and multiannual wood destroyed by the frost (figure 4).

In this situation – the worst that can be found in vines – the recovery of the vines is possible only from elements at the base of the grape vines. At the grape vines which from certain reasons do not have at the base safety sprouts the recovery is based on sprouts released from the undeveloped buds situated at the base of the stems.

Figure 4. Shoots released from the undeveloped buds situated at the base of the stems

Figure 5. Shoots tied by the guardian

Figure 6. Cardinal variety shoots in early summer

Figure 7. Cardinal variety in late autumn

The developed root system and the lack of appropriate vegetation favor the strong development of these shoots: they become greedy shoots. On these characteristics is based the rapid recovery of the initial form of the shoot and the production potential.

In this end from the shoots from the base of the grape vines there are chosen 3, the rest are pruned. One of the shoots kept serves to the formation of the new stem and the others for maintaining the vegetative equilibrium (between the root and the aerial part of the grape vine).

The shoot chosen for the new stem till autumn will be sufficiently thick, and the buds developing on its upper part will be used next year for forming the fruit elements. From the other two shoots from the base of the grape vine- appeared after the fall of the leaved from the strings, it will be used the one with the position nearer the base of the grape vine at the level of the soil for making a safety sprout, which shoot in number of 2-3 became strings by protection it ensures the protection of the vine against frost. Such protection items can be restored in year 2 from the manifestation of the frost, having also the safety sprouts at the base of the grape vine.

Figure 8. Grape vine restored year 2 from the frost, having a safety sprout and production shoots

The strong frosts during winter, as well as the hail during the growing season are climate accidents that result in serious consequences, sometimes disastrous for the viticulture. These undesirable phenomena, when they have conjugated action, the present case of Cardinal variety, hail from the summer of 2014- frost winter 2014 – 2015 produce production losses both for the current year and to the following year, they produce the loss of the reduction elements (fruity shoots) which restoration require at least 2 years.

Following the production of these natural phenomena: hail, frost, I recommend the followings:

- Maintaining the vegetation of the vine through plant treatments.
- Achieving the maturation of annual shoots with sufficient reserve materials.
- Establishing the fruit balanced load.
- Rational fertilization by using mainly phosphatic and potassic fertilizers which favour the maturation of the grapes and the shoots.
- The use with caution of fertilizers with nitrogen which determines the luxuriant growing of vines; it delays their vegetation and reduces the resistance to frost.
- Protecting the young vine shoots which are compulsory buried no matter the culture area and the afferent risk.
- Choosing for the culture of vines coast lands drained and well sheltered, with southern exposure, these favouring the maturation of the shoots and increasing the resistance of vines against frost. It is desirable that the vineyards be placed on hills, without exceeding altitudes of 200 – 250 m. There will be avoided the valleys with cold currents and plains with frequent early frosts which prevent the normal maturation of shoots, exposing the vines to the harmful action of the frost.
- Preventing the spread of the snow layer in the vinicultures, the snow by its thickness being able to reduce the harmful effects of the frost.
- Using soils resistant to low temperatures.
- The load of buds will be achieved based on shoots of normal thickness (7-9mm in diameter), which records the lowest loses of viability of the buds.
- The presence in the plantation of minimum and maximum thermometers at the level of the head of the grape vine where there are developed the production elements (the fruit strings)

- Determination of the viability to establish the load of the buds or technical measures for restoration of the plantation.
- In the case of total frost of the fruit strings and the multiannual element, the restoration in the absence of the safety sprouts is made based on the shoots released from the undeveloped buds situated at the base of the stems.
- The obligation of maintaining the soil clean, without weeds, to avoid the breaking of shoots barely released at the base of the grape vine.
- Permanently maintaining tied the shoots to avoid their breakage by the wind, own load, water from dew and rain.
- Restoring the vines by keeping the equilibrium between the root and the aerial part of the safety sprout and the stem with fruit string after 2 years from the occurrence of the phenomena- hail, frost and obtaining a profitable production.

CONCLUSIONS

The table grape variety Cardinal is one of the most frost- sensitive variety grown in our country.

The first step in preventing frost damages is plating the vines in areas with mild winters, so minimum temperatures do not exceed – 15 °C or more.

Sometimes in these areas occur climate accidents to. For preventing the effects of frost in winter on thevines, several technological measures must be taken:

- The shoots have to enter the winter well matured.
- The effects of hail must decrease to minimum (anti hail nets).
- Avoid the using of nitrogen based fertilisers.
- Protection of the young vine shoots which are compulsory buried no matter the culture area and the afferent risk.

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