

## **Potential winter buds fertility of the vine variety Rebo**

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### **Abstract**

The potential buds fertility along the fruit canes of the Rebo vine variety grown on Goblet and double Guyot were studied. It was established that in both pruning systems there were no dead primary buds in the winter buds, fruit buds with 3 inflorescences and inflorescences with length of more than 750  $\mu\text{m}$ . The average value of the potential coefficients along the whole cane at the Goble pruning system is relatively lower 0.97% compared to double Guyot 1.12. If we want to obtain higher yield with Goble pruning system, a mixed pruning should be carried out, leaving canes or spurs. With the double Guyot yield will be obtained even from the spurs and the fruit canes should not be longer than 13 winter buds. In both variants, the yield will be mainly formed by green shoots with one inflorescence with the length of 350  $\mu\text{m}$  to 550  $\mu\text{m}$  and 550  $\mu\text{m}$  to 750  $\mu\text{m}$ .

*Key words:* variety Rebo, buds, indicators of potential fertility, double Guyot

### **Introduction**

Studies of fruitfulness of buds in different varieties have always been a scientific interest because of the direct link between the number of set inflorescences in the bud and the obtained yields and quality of the grapes. Information on the potential productive capabilities of newly introduced or native varieties distributed on different areas is important for the vines so that the pruning system can be optimized for that individual variety. According to Брайков (1975, 1981) the pruning system on which the vine variety is grown significantly affects the

coefficient of potential fertility, the presence of more effective temperature sum, a good nutrient regime and favors the organogenesis of reproductive organs in the buds. There is a certain dependency between the formation of inflorescences in the winter buds and growth stages of the vine leading shoot (Божинава, 1973, 1975). There are a large number of scientific papers devoted to the formation and differentiation of inflorescences in the buds on the vine (Pratt 1971; Círami, El-Zaftawi, 1973; Hegedus, 1972; Брайков, 1972; Бабриков, 1977; Брайков, Йорданов, 1982; Йорданов, Брайков, 1986; Roychev, Braykov, 2001; Брайков, Ройчев, 2002; Брајков, Ројчев, 2003; Ројчев, Брајков, 2003; Неделковски, 2016; Неделковски и др., 2017; Nedelkovski et al., 2017; etc.). The purpose of this comparative study is to establish the parameters of the main indicators characterizing the potential fertility of buds (winter buds) at the wine variety Rebo grown on two pruning systems Goblet and double Guyot.

### Materials and Methods

During the winter months in 2018 – 2019, 40 canes with a length of 11 buds (winter buds) were collected from vines grown on Goblet system and 15 winter buds from vines grown on double Guyot system. The investigated vines on both pruning systems were on the same age - 4 years. Samples of winter buds were taken through a knot and fixed in a water-spirit mixture - 70% ethyl alcohol, according to a method described by Брайков, (1972). Microscopic biometric observations of the anatomical structure of longitudinal slits from the winter buds with a stereoscopic MBC-2 binocular at an increase of 16x were made. The average values of the parameters of the potential fertility of buds were calculated: percentage of dead primary buds, potential coefficient of fertility (K) based on healthy buds and all winter buds, percentage of fruitless and fruitful buds, percentage of fruitful winter buds with 1, 2 and 3 inflorescences. According to the length of the inflorescences they were divided into four groups: first group - to 350  $\mu\text{m}$ , second group - from 350 to 550  $\mu\text{m}$ , third group 550 to 750  $\mu\text{m}$  and fourth group - over 750  $\mu\text{m}$ . Experimental vines were grown in northern part of the country near the town Kriva Palanka, with planting distances between the plants 3.2 x 1.2 m. During the study, no extreme changes in climatic factors have been observed that could influence the nature of the experimental work.

## Results and Discussion

The main parameters of the potential fertility of buds at the variety Rebo grown on the pruning system Goblet indicate that there are no dead primary buds along the entire length of the shoot (Tab. 1). Potential coefficient of buds fertility (K) is mostly generalized and provides the most information about the biological production potential of each vine variety.

The values calculated on the basis of healthy and total number of buds are completely altered along the length of the fruitful shoot. The buds from the 3rd to 11th (node) were determined to have the highest values for the indicators that are extremely important for the preliminary individual vine load. That means that during the pruning, depending on the use of the grapes, we can be left spurs with 4 to 7 winter buds and fruitful canes with 11 winter buds. Their average values are 1.00 (3rd, 7th, 11th bud); 1.05 (4th-6th-8th-10th bud) to 1.10 (5th-9th bud). The average value of the potential coefficients for bud fertility for the whole shoot is 0.97%, which means that this variety in this particular growing area and agrotechnical conditions the pruning system, shows good potential fertility. To obtain higher yields, a mixed pruning system should be performed by leaving fruit shoots or spurs. The average percentage of fruitful primary buds is high - 84.39%, the values for this indicator are increasing from 50.00% to 70.00% in 1st to 2nd bud to 90.00% in sector 4th - 9th bud of the fruit cane. Morphogenesis analysis shows that predominate fruit buds with 1 inflorescence an average of 86.17%, followed by those with 2 inflorescences - 13.83%, and winter buds with 3 inflorescences are missing. The percentage of buds with one inflorescence decreases from the base of the cane: the 1st bud - 100.0% to 5th bud - 77.78%, in the middle sector the values increase from 6th to the 8th bud from 83.33 % to 88.89%, decreased in the 9th bud - 77.78% and increased to the top of the fruit cane to 87.50% in the 11th bud.

The realization of potential bud fertility in actual bud fertility depends strongly on the degree of inflorescences differentiation in the winter buds. With relatively higher average percentages are winter buds with size of inflorescence form 350  $\mu\text{m}$  to 550  $\mu\text{m}$  - 53.83% (second group) and 550  $\mu\text{m}$  to 750  $\mu\text{m}$  - 46.17% (third group). The group of inflorescences with the largest share in the yield formation at this variety is the one with inflorescences size from 350  $\mu\text{m}$  to 550  $\mu\text{m}$  (first group), with lowest values in the cane sector from 9th (27,27%) to 10th (35,86%) bud, and highest values at the base of fruit cane in the sector from the 1st to 3rd bud - 80,00% - 70, 00%. The third group of inflorescences can be relied for obtaining bigger grape clusters if the pruning system is designed to leave fruit canes up to 11 buds long. The smallest

inflorescences up to 350 µm and poorly differentiated inflorescences, as well as the largest and best differentiated inflorescences with a length of over 750 µm are missing. According to the parameters of the main indicators of the potential buds fertility of the grape variety Rebo, grown on the pruning system double Guyot, no primary buds are lost in the winter buds during the vegetation period, which is extremely favorable for the formation of grape yield (Table 2). This means that both potential coefficients based on healthy and all buds, will have the same values along the entire length of the fruit cane. Their average value is comparatively higher than the one grown on Goblet system - 1,17. The potential fertility of the first few buds in the sector from 1st to 3rd bud is 1,20, then the coefficient increases in the 4th bud to 1,30 and 1,40 in the 5th bud, and in the 6th bud again decreases to 1,20. From this sector to the end of the fruit cane the coefficients decrease with a certain deviation in the 9th bud - 1.20 and reach 1.00 in the 11th bud. The summarized data for potential fertility of the buds for these experimental conditions show that the vines from the variety Rebo grown on double Guyot system, the yield can also be obtained from the spurs, and the fruit canes should not be longer than 11 winter buds. The percentage of fruit primary buds is very high, almost at the entire length of the cane and varies slightly from the 1st to the 11th bud from 90.00% to 100.00%. The % of infertile buds in this cultivated on Guyot is 6.36%, twice as low as those of the previous one (Goblet system) - 15.61%. They are mainly located at the base and at the end of the fruit cane.

In most of the fruit buds one inflorescence is set - an average of 74.94%, followed by those with two inflorescences - 15.96%. From the 1st to the 5<sup>th</sup> bud, the buds with 1 inflorescence are from 66.67% to 60.00%, and then their amount increases from 74.44% in the 6th bud to 88.89% in the 11th bud. Winter buds with three inflorescences were not observed in any of the samples. These data show that the yield of this variety will mainly be formed by shoots with one inflorescence. Buds with two inflorescences are relatively more in the sector from 1st to 3rd bud (33,33%) and 4th (36,67%) - 5th bud (40,00%).

Table 1. Basic parameters of potential buds fertility at the variety Rebo grown on Goblet pruning system

Parameters	Buds along the length of the fruitful cane											Average
	1	2	3	4	5	6	7	8	9	10	11	
1. Dead primary buds, %	-	-	-	-	-	-	-	-	-	-	-	-
2. K based on healthy buds	0,5	0,75	1	1,05	1,1	1,05	1	1,05	1,1	1,05	1	0,97
3. K based on all buds	0,5	0,75	1	1,05	1,1	1,05	1	1,05	1,1	1,05	1	0,97
4. Fruitless primary buds, %	50	30	10	10	10	10	10	10	10	10,6	11,1	15,61
5. Fruitful primary buds, %	50	70	90	90	90	90	90	90	90	89,4	88,9	84,39
6. Fruitful buds with:												
1 inflorescence, %	100	94,4	88,9	83,3	77,8	83,3	88,9	83,3	77,8	82,6	87,5	86,17
2 inflorescences, %	-	5,56	11,1	16,7	22,2	16,7	11,1	16,7	22,2	17,4	12,5	13,83
3 inflorescences, %	-	-	-	-	-	-	-	-	-	-	-	-
7. inflorescences with length (%):												
to 350 µm	-	-	-	-	-	-	-	-	-	-	-	-
from 350 – 550 µm	80	75	70	57,7	45,5	52,7	60	43,6	27,3	35,9	44,4	53,83
from 550 – 750 µm	20	25	30	42,3	54,6	47,3	40	56,4	72,7	64,1	55,6	46,17
above 750 µm	-	-	-	-	-	-	-	-	-	-	-	-

K – coefficient of the potential bud fertility

Table 2. Basic parameters of potential buds fertility at the variety Rebo grown on double Guyot pruning system

Parameters	Buds along the length of the fruitful cane											Average
	1	2	3	4	5	6	7	8	9	10	11	
1. Dead primary buds, %	-	-	-	-	-	-	-	-	-	-	-	-
2. K based on healthy buds	1,2	1,2	1,2	1,3	1,4	1,2	1	1,1	1,2	1,1	1,00	1,17
3. K based on all buds	1,2	1,2	1,2	1,3	1,4	1,2	1	1,1	1,2	1,1	1,00	1,17
4. Fruitless primary buds, %	10	10	10	5	-	5	10	5	-	5	10	6,36
5. Fruitful primary buds, %	90	90	90	95	100	95	90	95	100	95	90	93,64
6. Fruitful buds with:												
1 inflorescence, %	66,67	66,67	66,67	63,33	60	74,44	88,89	84,44	80	84,44	88,89	74,94
2 inflorescences,%	33,33	33,33	33,33	36,67	40	25,56	11,11	15,56	20	15,56	11,11	15,96
3 inflorescences,%	-	-	-	-	-	-	-	-	-	-	-	-
7. inflorescences with length (%):												
to 350 µm	-	4,17	8,33	4,17	-	-	-	-	-	5	10	3,78
from 350 – 550 µm	83,33	75	66,67	65,48	64,29	67,14	70	55,83	41,67	40,83	40	60,93
from 550 – 750 µm	16,67	20,83	25	30,35	35,71	32,86	30	44,17	58,33	54,17	50	36,19
above 750 µm	-	-	-	-	-	-	-	-	-	-	-	-

K – coefficient of the potential bud fertility

By cultivating Rebo on double Guyot pruning system the grape yield will be determined by inflorescences with size from 350  $\mu\text{m}$  to 550  $\mu\text{m}$  - 60.93% (second group) and 550  $\mu\text{m}$  to 750  $\mu\text{m}$  - 36.19% (third group). Inflorescences from group I were also noted, with length of up to 350  $\mu\text{m}$ , an average of 3.78%. They are observed in the sector from 2nd to 5th bud and the 10th and 11th bud and should not be relied on their significant increase in yield. There are no inflorescences with sizes above 750  $\mu\text{m}$ , which is most likely a varietal characteristic.

Along the fruit cane inflorescences of the second group are mostly present in the sector from 1st to 7th bud from 64.29% (5th bud) to 83.33% (1st bud). In the rest of the cane, the percentages of the inflorescences of the same group decreased to 40.00% in the 11th bud. The change in the amount of inflorescences of the group III along the length of the fruit cane is in the reverse order.

### Conclusion

The coefficients of potential fertility of the buds along the fruit cane of the grape variety Rebo grown on the pruning system Goblet have highest values in the sector from the 3rd to the 11th bud. According to this, during the pruning, depending on the use of the grapes, spurs with 4-7 winter buds and fruit canes with 11 winter buds can be left. The average percentage of fruitful primary buds is high - 84.39%, fruit buds with 1 inflorescence predominate with an average of 86.17%. The average percentages of winter buds with inflorescences with sizes from 350  $\mu\text{m}$  to 550  $\mu\text{m}$ , are relatively high, 53.83% and from 550  $\mu\text{m}$  to 750  $\mu\text{m}$  - 46.17%.

When this variety is cultivated on double Guyot pruning system the potential fertility of the buds is significantly greater at the base of the cane and in the sector from 1st to 3rd bud the coefficient of potential bud fertility is 1,20, then the coefficient increases in the 4th bud to 1,30 and 1,40 in 5th bud, and in the 6th bud decrease to 1,20. From this sector to the end of the fruit cane the coefficients decrease with a certain deviation in the 9th bud - 1.20 and reach 1.00 in the 11th bud. The percentage of fruitful primary buds is very high almost the entire length of the canes from 95.00% to 100.00%. Only one inflorescence is set in most of the fruit buds an average of 79.35%. The inflorescences with dimensions from 350  $\mu\text{m}$  to 550  $\mu\text{m}$  - 51.35% and from 550  $\mu\text{m}$  to 750  $\mu\text{m}$  - 36.19% dominate.

From the investigation in both pruning systems dead primary buds in the winter buds, fruit buds with 3 inflorescences and inflorescences with a length of more than 750  $\mu\text{m}$  were not found. The average value of the potential coefficients for the whole cane for the pruning system

Goblet is relatively smaller 0.97 of the same coefficient for the pruning system double Guyot - 1.17. When the variety is grown on the first system to obtain a higher yield, a mixed pruning system should be carried out, leaving fruit spurs or small canes, and when it's grown on the second system the yield will be obtained from the spurs and canes with length no longer than 11 winter buds. In both variants the yield will be formed mainly by the shoots with one inflorescence with a length of 350 µm to 550 µm and 550 µm to 750 µm.

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