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Fruiting Evaluation of the First to Twelfth Buds in Tayefi Gulabi Varieties of Grapes

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ABSTRACT

Fruit trees can be pruned 3 years after planting and every year after the leaves fall in autumn, before new buds appear in spring. The most important factors in pruning grape trees lies in determining how many buds should be left on each cane. Environmental factors, grape varieties, plant age, the number of trees per hectare, earlier pruning system, and plant-breeding method determine the necessary number of buds after pruning. In this study, yield components of Tayefi grape variety with 4, 8 and 12 buds on a branch were studied. The grape trees were grown using Gui grape growing system in Tajikistan. The collected data were subjected to analysis of variance as factorial experiment based on randomized complete block design by MSTAT-C. Percentage of clusters appeared on each bud, number of clusters, number of branches without clusters, with one cluster, with two clusters, fruiting coefficient and total number of green branches per bud were measured. The grape trees were pruned during two periods, before and after the cold winter. The results showed that the most fruiting branch was transferred to the first and second buds in four-buds pruning. In eight-buds pruning, the most fruiting branch was transferred to the first to sixth buds. In twelve-buds fruiting, the most fruiting branch was transferred to the seventh to eleventh buds. In addition, the number of branches without clusters increased as pruning decreased. This trend increased sharply after cold winter. Maximum fruiting coefficient was observed before cold winter in four-bud pruning.

KEYWORDS: buds, pruning, Grape vines, Tayefi, vinifera

INTRODUCTION

Grapes are vigorous plants and need to be pruned back severely [1]. Grapes grow annually; therefore, grape fruits should be pruned every year to prevent excessive elongation. This plant with the scientific name of Vitis vinifera belongs to the family of Vitiaceae that contains 11 genera and more than 600 species. Removing or cutting off parts of plant based on a specific formula and objective is called pruning, which affects both vegetative and reproductive growth as well as arrangement of grape trees. As a result, pruning increases product; moreover, the plant grows properly and favorably. In grapes pruning, a number of additional non-fertile branches are removed and the remaining branches are shortened in order to establish a balance between roots and shoot to obtain adequate quantities of high-quality fruits. Pruning supplies the new fruit canes for the next year's growing season. Grape fruits are pruned every four years based on the growing system in two periods, before and after cold winter (after fall of leaves in autumn before the buds appear in spring). Determining how many buds should be left on each grape cape is important in pruning the grape trees. Environmental factors, grape varieties with the relevant coordinates, age, the number of trees per hectare, earlier pruning system, and plant breeding methods determine the necessary number of buds after pruning. The highest yield was obtained from Perlette grape varieties with six buds per branch [2]. For this purpose, cane pruning is recommended for this variety. Grape is a shrub, which produces fruiting buds (producer of grape clusters). The buds would be more fruitful in most grape varieties when perennial branches are located on biennial branches.In another study, the effects of various levels of pruning on growth, quantity and quality of grapes were investigated in Perlette grape varieties. The results showed that perennial 36 branches with two-buds pruning compared to perennial 24 branches with three-buds pruning and perennial 18 branches with four-buds pruning had the greatest effect on increasing soluble solids, reducing sugars, reducing acidity and decreasing Shot berrys [3]. Another experiment was conducted on ruby grape in dry land condition. The results showed that quantity of product is affected by the number of perennial branches and the number of flowering buds on the branches. Presence of 28 buds on each plant is sufficient in dry land conditions (Tafazoli, et al., 1996). In another study, the effect of 14 and 44 branches with respectively 1 and 2 clusters were examined in each branch. The results showed that increased product reduces fruit quality and the number of branches per plant has greater impact on fruit water quality than the number of clusters per shoot [4]. Yield in perennial branch is determined by the number of nodes per branch. Yield in each branch is determined by the number of clusters and fruit set [5]. In another study, the relationship between the number of clusters and vegetative characteristics was investigated. Light penetration in crown of the plant stimulates vegetative and reproductive growth. Average number of clusters per branch is positively correlated with leaf area, leaf dry weight and leaf nitrogen content [6].

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In another research, effect of the number of clusters per plant on growth was examined. It was found out that plant growth decreases as the number of clusters per plant increases. Synthesis of color and soluble solids in the fruit decreases as products increase [7]. Another experiment showed that maximum yield was achieved in Sultan grape (30.4 ton per hectare) as the number of buds (light pruning) reached 105 buds per plant [8]. Another study was conducted on determining the location of fruitful buds and pruning method in various Iranian varieties. It was reported that fruitful buds mostly appeared between the second and eight buds in seeded varieties such as Sahebi, Rish Baba and Hosseini. The number of fruitful buds gradually decreased from the second bud to the lowest buds per branch. Fruitful buds are often located in middle branches in seedless varieties such as seedless white and red grapes. Most fruitful buds are located between the fourth and twelfth buds [9]. In another experiment, the effects of branch length and pruning period on cold resistance and increase or decrease in the Concord grape branches were examined. It was found out that bud resistance to cold winter had increased and early pruning seriously damaged the buds [10]. Selecting the best option to determine the appropriate number of buds per branch and the desired number of branches per plant in the scaffold system in Tayefi variety can effectively improve both quality and quantity of product. The necessity of this research lies in this issue. In this research, an appropriate method was identified in order to determine the number of necessary buds on each branch during pruning before and after the cold winter.

MATERIALS AND METHODS

This experiment was conducted on Tayefi grape varieties in Kamsamal region (4 kilometers near southeastern Kui Bish area or Abdurrahman Jami) in Khatlon Province in Tajikistan at 68 degrees and 85 minutes longitude and 37 degrees 99 minutes latitude during 2012 and 2013 in Mr. Abd Al-Rasoul Farm with 3-wire vertical growing system (3-wire cordon). Before pruning, the plants with the same age, size, growth point and uniformity were selected and marked. The collected data were subjected to analysis of variance as 2 x 3 factorial experiment based on randomized complete block. The first treatment consisted of maintaining 4, 8 and 12 buds per branch and removing the rest of buds, so that 80, 120 and 160 buds would remain on each plant. The second treatment included two periods of dry pruning. The first pruning was performed 20 days after fall of leaves in autumn before the cold winter (15 / Nov / 2012). The second pruning was performed after the cold winter (17 / Feb / 2013). Five replicates were also considered in this experiment. The experiment was conducted on three rows of matched 9-year-old trees grown by Cordon grown system. For this purpose, 30 plants per similar rows were selected among which five plant per 15 plants in the first treatment (pruning before cold winter) were randomly selected and pruned, so that 4 buds remained on each branch. In total, 80 buds remained per plant. In the next five plants, dry pruning was carried, so that 8 buds remained on each branch. In total, 120 buds remained on each plant. In the next five plants, 12 buds remained on each branch. In total, 160 buds were left on each plant. After cold winter, the remaining 15 plants were divided into three groups at 17.02.2013. Each group consisted of five plants. Three pruning styles as previous procedures were performed on each set of 5 plants. At the end of March, the number of branches with one cluster, two clusters and no clusters per bud was individually counted. Percent of clusters per buds was measured. Fruiting coefficient was calculated using the following formula: (number of clusters per plant / number of green buds) × 100. Analysis of variance was performed using MSTAT-C. Mean comparison was done by Duncan. Excel software was used to draw graphs and charts.

RESULTS AND DISCUSSION

In a perennial branch, location of fruiting buds depends on varieties. In some grape varieties, the lower buds are fruitful while relatively higher buds are fruitful in some other varieties. Accordingly, the relationship between green branches without cluster, with one cluster and with two clusters and the bud left on the branches after pruning was examined in order to determine the ratio of fruitful to unfruitful branches. The data relevant to Gulabi Tayefi varieties showed that both plant fertility status and distribution of clusters on branches would change by increasing the number of buds in pruning. Table 1 shows that, most clusters grow in the first bud during 4-buds and 8-buds pruning; however, clusters not only grow in the first bud but also in terminal buds in 12-buds pruning.

Table 1: Percent of the branches of grapes on each bud

TYPE OF PRUNING (NUMBER OF BUDS)	BUD 1	BUD 2	BUD 3	BUD 4	BUD 5	BUD 6	BUD 7	BUD 8	BUD 9	BUD 10	BUD 11	BUD 12
4-bud	62.5	25	6.25	6.25								
8-bud	62.5	12.5	0	0	12.5	12.5	0	0				
12-bud	13.64	9.1	0	0	0	0	9.1	13.64	9.1	18.18	22.73	4.55

It seems that Gulabi Tayefi varieties can adapt to different pruning conditions and types. This is because the number of clusters increases and clusters scatter among the buds as the number of buds increases.

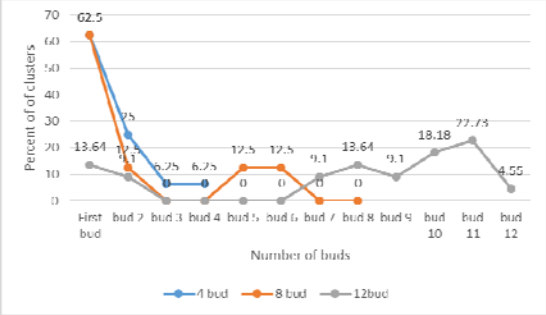

Figure 1: Percent of clusters appeared on each bud

This experiment also showed that maximum number of clusters (in terms of number not weight) grew in 12-buds pruning. Figure 2 shows 22 clusters grow averagely per plant in 12-buds pruning.

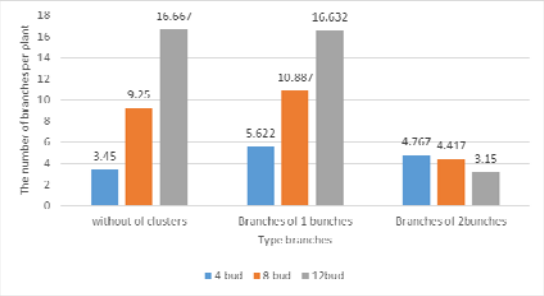

Figure 2: The relationship between the number of clusters and pruning

The number of clustered branches did not change before and after cold. Solely, the number of branches with no clusters changed before and after cold. Figure 3 shows the same number of lustered branches before and after cold; however, the number of branches with no cluster increased after pruning. The latter may be due to the impact of cold winter on buds, especially the terminal bud. On the other hand, the same number of clustered branches before and after cold suggests that the number of clusters is not affected by pruning and the plant can scatter the clusters on various buds considering the soil fertility and water content.

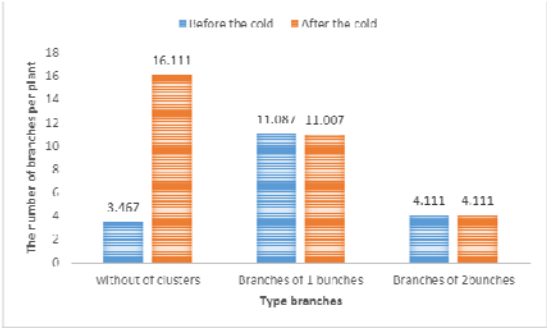

Figure 3: The relationship between the various branches and pruning time

The present study showed that type of pruning could also affect the number of branches. The branches with no cluster and with one cluster increased in a stepwise manner as the number of buds increased. However, the number of branches with two cluster did not change in terms of pruning type.

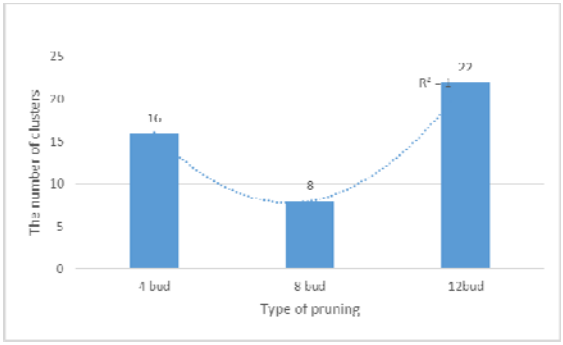

Figure 4: The relationship between the various branches and pruning type

In other words, the number of clusters only increases through increasing the number of branches with one clusters as the number of buds in pruning increases (light pruning style).

Data analysis showed that maximum number of green branches was observed in pruning after cold rather than before cold. These results are consistent with those obtained by IPGRI in 1997. The latter showed that cold winter reduces the terminal buds. IPGRI evaluated the effects of branch length and pruning period on cold resistance and increase or decrease in grape branches in Concord variety. He showed that bud resistance to cold winter increased and early pruning seriously damaged the buds.

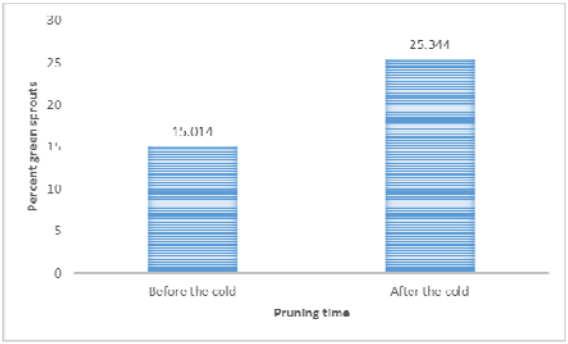

Figure5: Percent green shoots in two different pruning times

Although the percentage of green branches per plant relatively increased in different pruning conditions, no significant difference was observed. This can be due to two overlapping pruning periods. Therefore, the number of branches can be controlled by reducing the number of branches before cold in each treatment.

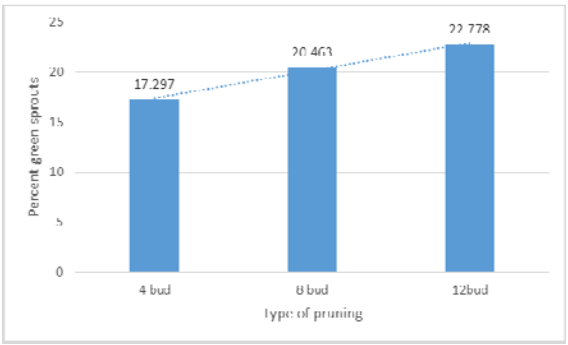

Figure 6: Correlation between green shoots of plant with the type of pruning

The fruiting coefficient and the percentage of clustered branches were compared at two different pruning periods. The results were very interesting. Both characteristics decreased after cold, which reflect that coldness has the greatest effect on vegetative growth rather than reproductive growth. Despite reduction in percentage of branches before cold, both clustered branches and fruiting coefficient increased. In other words, the number of non-fertile branches decreased due to severe cold winter.

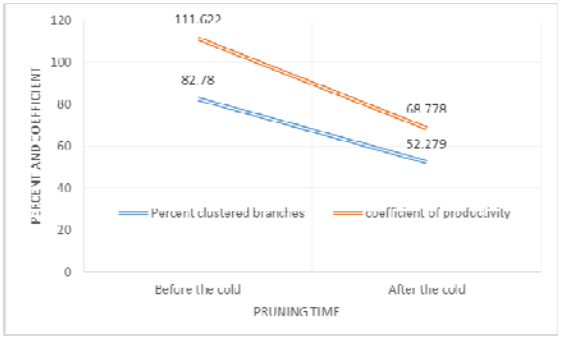

Figure 7: Correlation between the branches of cluster and factor productivity with pruning time

Both clustered branches and fruiting coefficient were significantly different in different pruning conditions. In other words, fruiting coefficient and clustered braches did not increase as the number of buds increased. This suggests that fruiting coefficient and clustered braches cannot be increased by increasing the number of buds. Four-buds pruning effectively increased the fruiting coefficient and clustered branches percentage in Tayefi Gulabi varieties. Further studies were conducted on the effects of pruning period on yield, which were investigated in another paper.

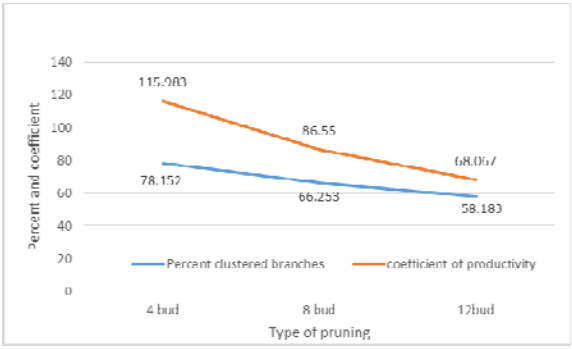

Figure 8: Effect of pruning on Percent clustered branches and coefficient of productivity

Figure 9 also shows the highest amount of both traits, i.e. clustered branches and fruiting coefficient, were observed in d1t1 or pruning before cold and four-buds pruning.

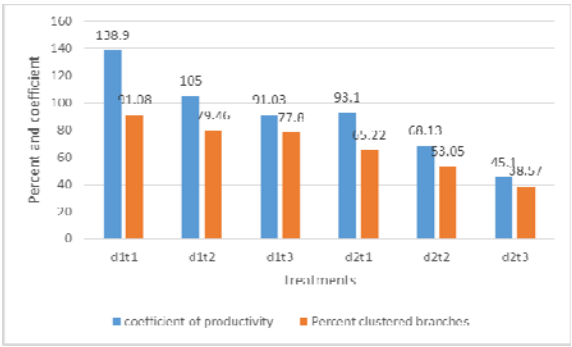

Figure 9: The interaction between the types and Times of pruning

It should be noted that pruning should be carried out after cold winter and frost in spring in very cold areas. However, pruning should not delayed in areas with average coldness and pruning should be carried out before cold winter. It should be noted that high-quality and high-quantity harvesting in a vineyard not only depends on leaving a large number of fruiting buds after pruning but also distribution of these buds on various branches of grapes.

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