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BUNCH THINNING AND ITS INFLUENCE ON THE SHOOTS GROWTH DYNAMICS IN SOME SYRAH WINE VARIETY CLONES

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Abstract

During the period 2020-2022, an experiment was conducted in the experimental vineyard of the Agricultural University - Plovdiv, and four clones of the wine variety Syrah, numbered 100, 174, 470 and 524, grafted on the SO4 rootstock were selected as the study object. During the "pea size" phase, the green pruning operation – bunch thinning was applied. The shoots growth starts from the vegetation phase "first leaf appearance" and ends at the "veraison". The average duration is about 100 days, covering the period of May, June and July.

It was found that the vine shoots from a clone 470 reached the greatest average length, V3 - 285, 265, 290 cm and V7 - 359, 336, and 380 cm, and those from a clone 100 were distinguished by the weakest growth, V1 - 197, 203 and 205 cm and V5 - 240, 228 and 245 cm. Differences were proven between the variants, both in the non-reduced (V1, V2, V3, and V4) and in those with reduced yields (V5, V6, V7, and V8), as after reducing the number of bunches, the length of the shoots was longer - high in all vines from the used Syrah clones. This study provides information on the relationship between the applied green pruning operation (bunch thinning) during the growing season and its effects on the vegetative growth.

Balancing the vines bud load by controlling yield during the growing season is a preferred viticultural practice for increasing the grape quality.

Keywords: Clones, Syrah, green pruning, bunch thinning, shoot growth

INTRODUCTION

The clonal selection is an important tool for genetic improvement in viticulture and production of high quality vines (Popova, 2023). The diversification of the vineyard collection is achieved on the basis of clone selection with high levels of realization of the biological potential, economic productivity and quality indicators of grapes and wine (Meneghetti et al., 2010).

The existence and development of modern viticulture is unthinkable without suitable rootstocks resistant to vine phylloxera (Stalev et al., 2016).

In world viticulture, the rootstock provides the vine with some adaptation to soil conditions, which can affect the physiology of the vine plant (Heller-Fuenzalida et al., 2023). In all world areas where phylloxera develops, new vineyards are planted with grafted vines from phylloxera-resistant rootstocks (Angelov et al, 2016). When the graft is perfect and the two components involved in grafting complement each other, there is an improvement in the overall vegetative growth, resulting in higher nutrient accumulation and more plant biomass (Popova, 2021).

The choice of variety and rootstock, pruning, application of various operations to the green parts of the plants, play a key role in the growth, development and grapes quality (Winkler, 1974).

Soil and atmospheric droughts cause disturbances in physiological and biochemical processes that can have significant consequences on the ultrastructure and physiological processes in cells (Jităreanu et al, 2010). The first physiological response to mild stress caused by water deficit is the reduction of shoot growth, which mainly affects those of the second order before the growth of the main shoot is reduced (Scholasch & Rienth, 2019).

Vines vary spatially with respect to soil and nutrition, vegetative growth, yield and fruit composition (Popova, 2023). Summer pruning or green pruning covers any manual or mechanical operation carried out in the vines when even a minimal sign of vegetative growth is visible in the crown (Poni et al., 2023).

Applying a green pruning operation (bunch thinning), during the vine growing season, is a measure affecting the quality of grapes and wine, which corrects the load on the vines and normalizes the number of bunches (Popova&Angelov, 2023). The different levels of bud load and bunch thinning affect grape yield and quality (Dintchev&Ivanov, 2022).

Grape thinning is a widespread technological practice in vineyards, improving grape and wine quality depending on the time and intensity of its application (De Bei, et al., 2022).

The timing varies from pre-flowering, flowering to maturity and is often aimed at leaving one cluster per shoot (Wolpert et al., 1983). Naor et al. (2002), have suggested that early thinning may increase shoot growth due to lack of competition from developing bunches. Other studies found no relationship between bunch number and its effect on vegetative growth (Smithyman et al., 1998). When thinning is applied at ripening, it does not affect shoot growth and leaf area development (Reynolds et al., 1994; Valdés et al., 2009), but has been reported to accelerate ripening (Nuzzo & Matthews, 2006). Preszler et al. (2013) applied a reduction of the number of bunches up to 66 %, the effect on yield components being correlated with the intensity of thinning. In recent years, the viticulture sector has faced several challenges that have and will continue to affect the economic sustainability of grape growing. Increased climate instability (Webb et al., 2012), the implementation of sustainable management practices (Daane et al., 2018) and the increase in the price of raw materials are a test of the sustainability of the viticulture sector and the sustainability in its development. Due to the complexity of vine physiology, the effect of these practices on productivity can vary widely, and the results in yield parameters and fruit composition are determined by variety and location (Palliotti et al., 2014).

Shoot growth is also related to polarity. In the natural vertical position, the shoot growth is the strongest. As this direction changes, it weakens. (Popova, 2023).

The aim of the present study is to investigate the application of the green pruning operation – bunch thinning in the "pea size" phase and its effect on shoot growth, in some Syrah variety clones.

MATERIALS AND METHODS

The experiment was carried out during the period 2020-2022, in the Educational and experimental vineyard of the Agricultural University - Plovdiv, located near the village of Brestnik.

Four clones of the Syrah variety - 100, 174, 470 and 524, grafted on the SO4 rootstock were used for the study. The vines were planted in 2011. The planting pattern is 3.0 m between rows and 1.00 m between vines in the row (3330 vines/hectare). Winter pruning in all three experimental years was carried out in the month of February. The plants were formed high-stemmed bilateral cordon. A short pruning system was applied, leaving plugs with two winter eyes each, a total of 6 plugs (12 winter eyes) per vine.

The inter-rows were grassed, the soil surface between the vines was kept clean by applying herbicides. The direction of the rows in the vineyard is northwest - southeast, with a slope of the terrain to the east - 3.2% /1.8°/ and an average altitude of 194 m.

Figure 1. Syrah clones

The experimental work included 8 variants:

V1 - Syrah variety, clone 100 - non-reduced yield

V2 - Syrah variety, clone 174 - non-reduced yield

V3 - Syrah variety, clone 470 - non-reduced yield

V4 - Syrah variety, clone 524 - non-reduced yield

V5 - Syrah variety, clone 100 - reduced yield with 8 bunches per vine

V6 - Syrah variety, clone 174 - reduced yield with 8 bunches per vine

V7 - Syrah variety, clone 470 - reduced yield with 8 bunches per vine

V8 - Syrah variety, clone 524 - reduced yield with 8 bunches per vine

In each variant, 60 vines were included (4 repetitions x 15 vines).

The bunch thinning (yield reducing) was done manually, in the "pea size" phase. In the reduced variants (V5, V6, V7, and V8), 8 clusters were left per vine, and in the non-reduced variants (V1, V2, V3, and V4) the yield was not touched. The shoots growth dynamics was recorded during the months of May, June and July, at an interval of one week by measuring the length in cm. For this purpose, 20 vines per variant were used, on which the pre-selected and marked shoots, with different exposure, developed from the first winter bud of a spur (fruiting unit).

RESULTS AND DISCUSSION

The first signs of growth in vine are manifested by budding. In spring, when the temperature remains above 10ºC, the buds quickly begin to increase in volume, as a result of the intense division of cells in the upper meristem of the embryonic shoot. The shoot grows in length mainly due to the intercalary growth of the upper 6-8 internodes. The growth strength of the shoots depends on the biological characteristics of the variety (clone), as well as on the substrate on which the vines are grafted (Popova, 2023).

The studied Syrah clones were grafted on Berlandieri x Riparia SO4, which is distinguished by a significantly more vigorous shoot growth. It is believed that it gives strong growth and rapid development to the vines grafted on it, during the first ten years after their planting (Roychev, 2012).

In the first year of our study (2020) in all variants, the shoot growth began in the last ten days of April. At first, it was weak and smooth, but as the vegetation progressed, it gradually accelerated. Thus, by the end of May, the shoots had an increase of 130 - 150 cm. During flowering, when the optimal temperature reaches 28-30ºC (Popova, 2023), the most intensive growth is observed, and on average for the period of one week, we have an increase around and above 40 cm. In the case of the non-reduced variants (V1, V2, V3, and V4), from the end of June to the middle of July, a smooth growth stoppage began (Figure 2).

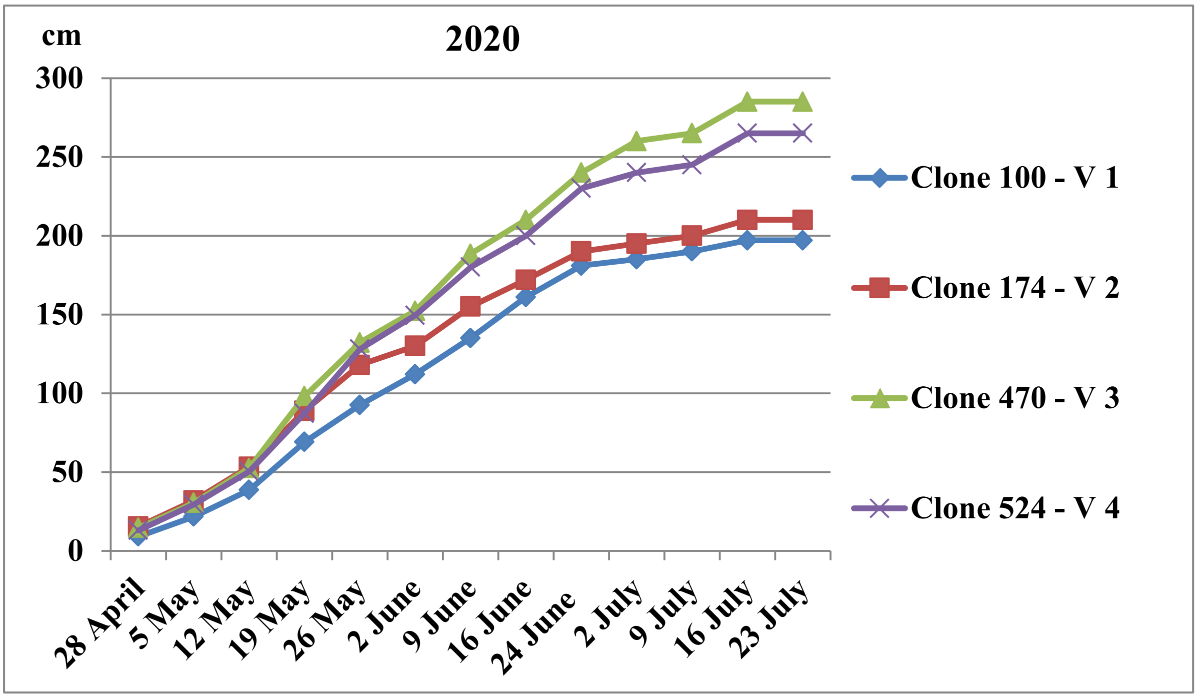

Figure 2. Shoots growth dynamics in non-reduced variants, 2020, cm.

The vines from clone 470 (V3) had the strongest growth, reaching a shoot length of 285 cm. After them, the vines from clone 524 (V4) -265 cm were arranged, and the vines from clone 100 (V1) - 197 cm had the weakest growth.

In the reduced variants (V5, V6, V7, and V8), from the "pea size" stage to the "veraizon", the shoot growth reached a greater length, compared to the non-reduced variants (Figure 3).

Clone 470 (V7) was distinguished by the longest average shoot length - 359 cm, and the vines from clone 100 (V5) had the smallest one - 240 cm. In 2021, the growth in all variants began at the beginning of May, which was also related to the later start of the growing season.

The shoot growth in the non-reduced variants (V1, V2, V3, and V4), in the second year (Figure 4), reached its maximum at the beginning of June. Under ideal climatic conditions, vines reach an average height of 120 - 140 cm. From the second ten days of the same month, grain thickening began, when in the "pea size" phase, in the variants - V5, V6, V7, and V8, bunch thinning was carried out. From the end of June to the mid July, the shoot growth in the reduced variants (Figure 5) reached higher values compared to the non-reduced ones (Figure 4).

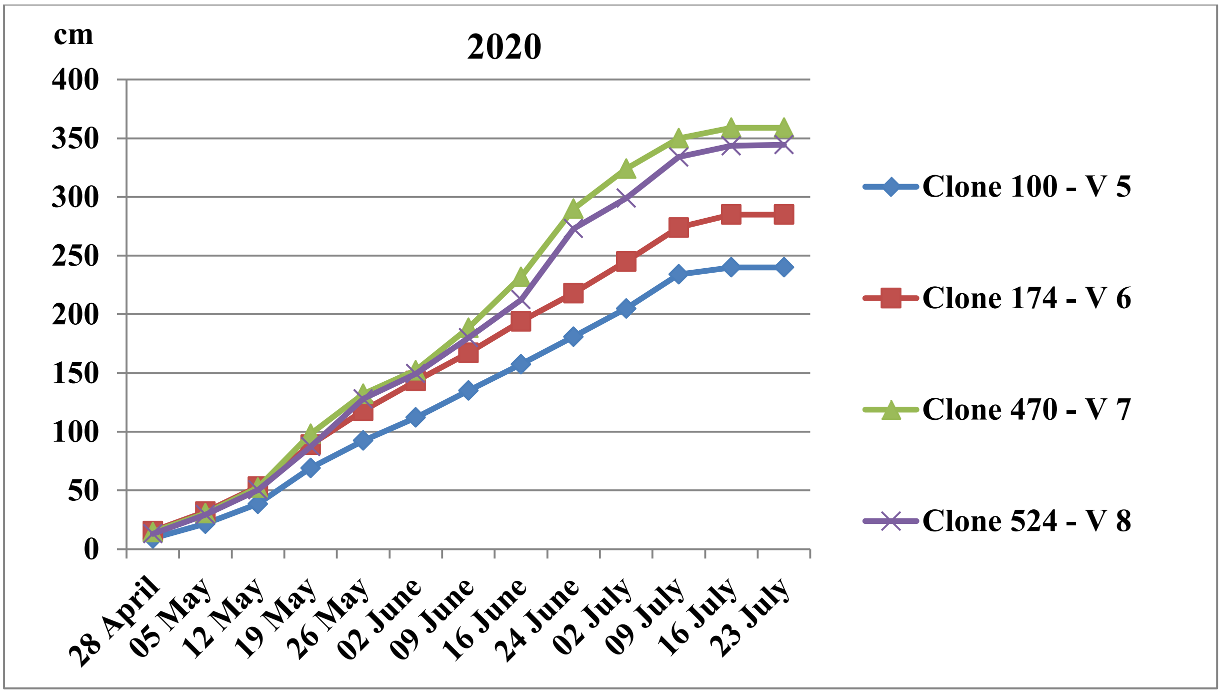

Figure 3. Shoots growth dynamics in reduced variants, 2020, cm.

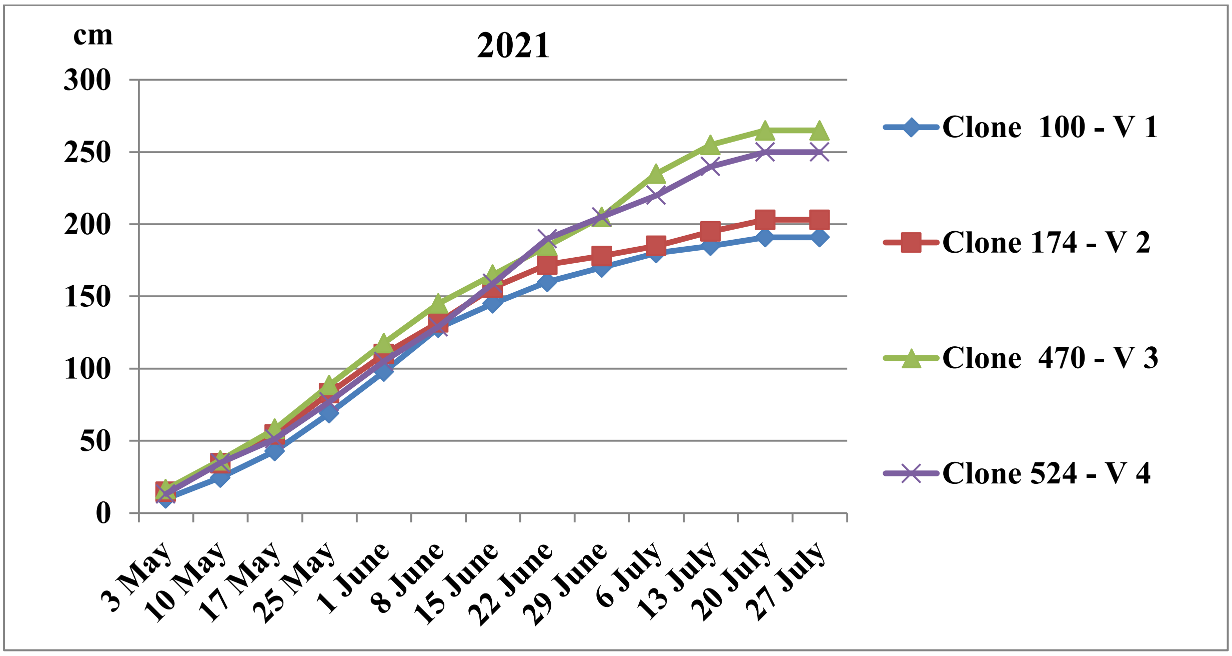

Figure 4. Shoots growth dynamics in non-reduced variants, 2021, cm.

The clone 470 vines had the strongest growth in 2021, reaching lengths of V3 - 265 cm and V7 - 336 cm, respectively. Following them were the vines from clone 524, with V4 - 250 cm and V8 - 330 cm (Figure 5). The vines from clone 100 had the weakest growth dynamics (V1 -191 cm and V5 - 228 cm).

In 2022, the vines from clone 470 reached the longest shoot length, respectively V3 - 290 cm (Figure 6) and V7 - 380 cm (Figure 7), whose length had the highest values, compared to the previous two years.

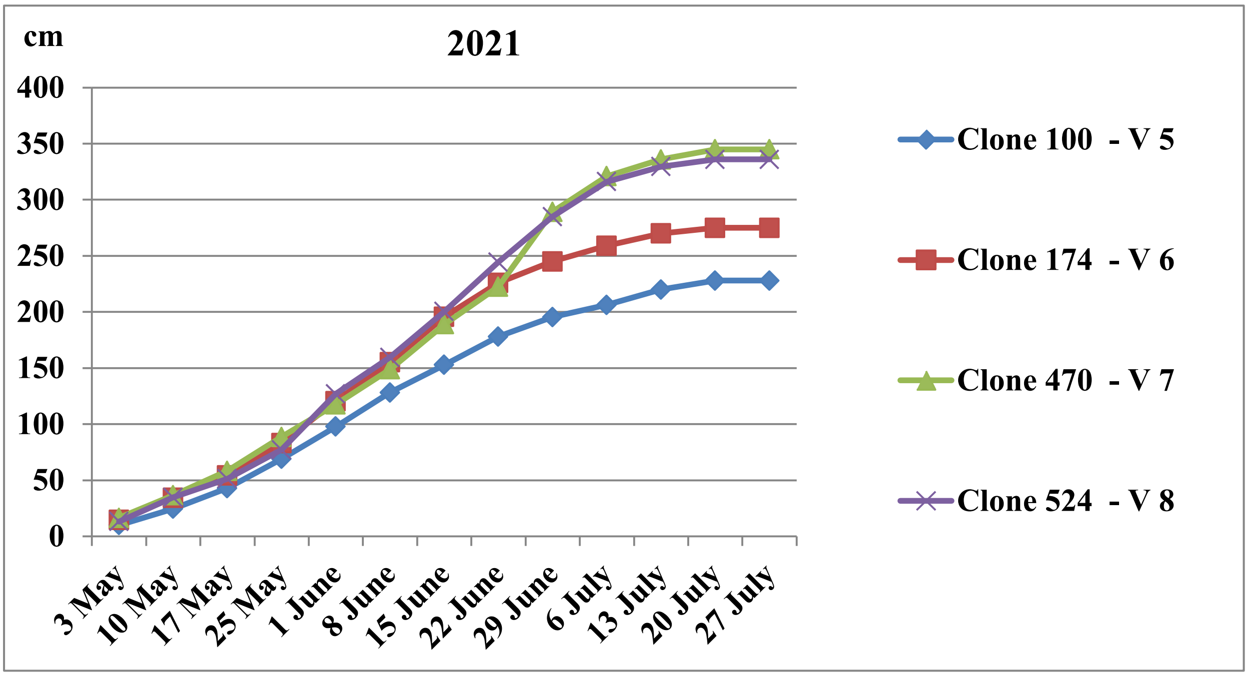

Figure 5. Shoots growth dynamics in reduced variants, 2021, cm.

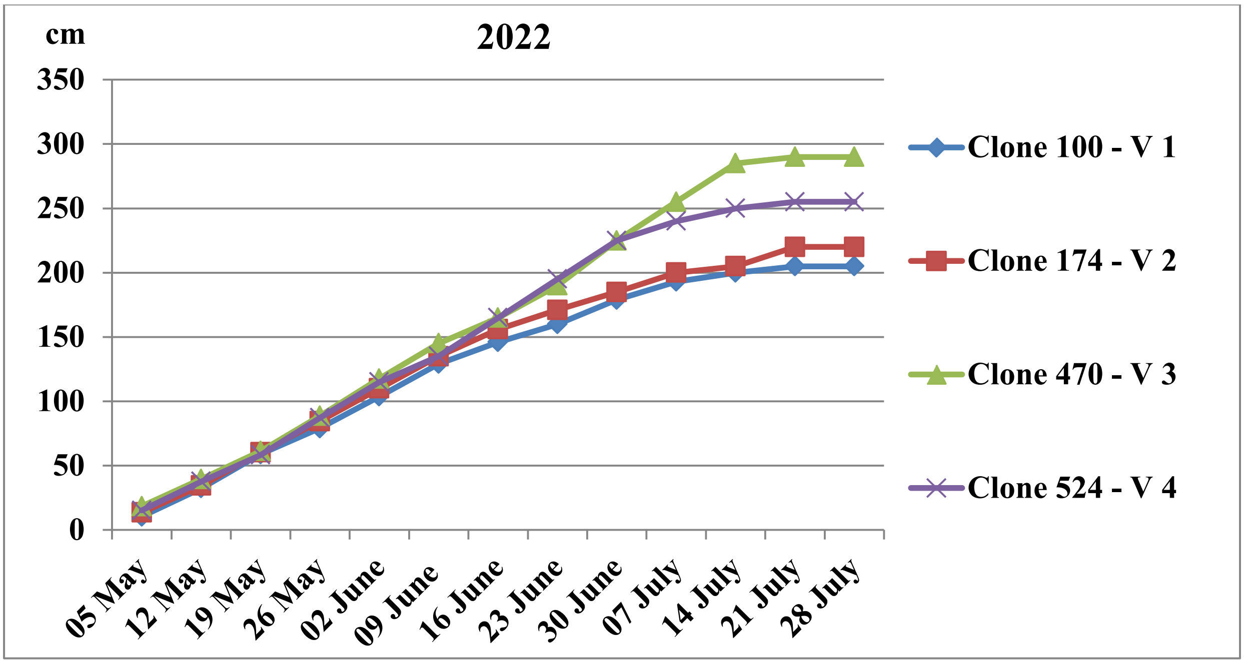

Figure 6. Shoots growth dynamics in non-reduced variants, 2022, cm.

In the variants with reduced yield (V5, V6, V7, and V8), the shoot length was greater after thinning. The greatest growth vigor was again observed in the vines from clone 470 - 380 cm, followed by clone 174 - 295 cm and clone 524 - 340 cm, and with the smallest shoot length was clone 100 - 245 cm, (Figure 7). During the experiment, a smooth increase in the shoot length during the vegetation period was observed. At first, the growth of the shoot was weak, it gradually increased and reached its maximum during the flowering phase when the daily growth was 6-10 cm. During the second ten days of July, the growth had decreased and stopped at the end of the same month.

The shoot growth has an average duration of about 100 days. During this period, three phases of growth intensity are distinguished. The first phase starts from the first leaf appearance (beginning of May) and continues until the flowering phase (end of May) - there is a slow growth of the shoots (3-4 cm/day) observed.

In the second phase after the flowering to the "pea size" stage, the shoots have the most intensive growth (7-8 cm/day). The third phase covers the period from the "pea size" phase to the beginning of veraison when a gradual cessation of the growth begins.

In the experiment course, it was found that in the vines with a ratio of 8 bunches per vine (V5, V6, V7, and V8), the second phase had a longer duration. The intensity of shoot growth remained strong for up to two weeks after the bunches werew removed, and the third phase was of a shorter duration. In all variants, the shoot growth stopped at the end of July, when the ripening began.

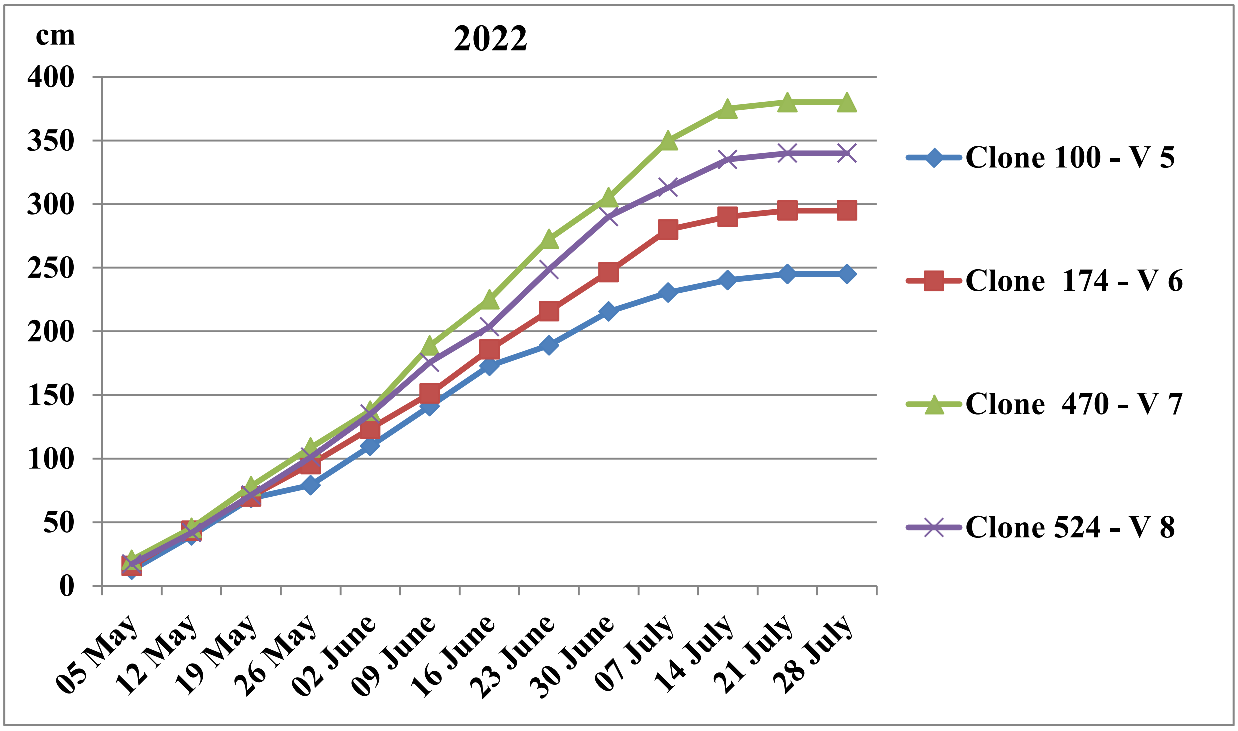

Figure 7. Shoots growth dynamics in reduced variants, 2022, cm.

CONCLUSION

The studied Syrah clones were grafted on Berlandieri x Riparia SO4, distinguished by a significantly more vigorous shoot growth. By maintaining the biological balance in the growth and development of individual vegetative and generative organs, a certain productivity of the plant was formed.

The obtained results from three experimental years prove that clone 470 was the most vigorous growing, reaching the greatest average shoot length. For the V7 variant with reduced yield - 359 cm, 336 cm, and 380 cm, as well as for the vines with non-reduced yield V3 - 285 cm, 265 cm, 290 cm.

The weakest growth was observed in the vines from clone 100, with an average length in V1 -197 cm, 203 cm and 205 cm and V5 - 240 cm, 228 cm and 245 cm.

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