



Biological manifestations of the local Bulgarian variety Pamid in the conditions of a changing climate

Anelia POPOVA¹, Veselin IVANOV¹

¹Agricultural University of Plovdiv, Faculty of Viticulture and Horticulture, Department of Viticulture and Fruit Growing, Plovdiv, Bulgaria

Abstract: The aim of the research work is to analyze the biological manifestations of the local Bulgarian variety Pamid grown in the South central region. The experiment was conducted during the period 2022-2024. The duration of the main phenological phases in days during the vegetation of the vines was monitored (bud burst-first leaf, first leaf-flowering, flowering-pea size, pea size-veraison, veraison-technological ripeness, bud burst-technological ripeness). Emphasis is also placed on agrobiological indicators, in order to determine the reproductive variety potential, giving an overall assessment of its economic efficiency. High values of developed buds (84.63%) and a relatively high percentage of fruiting shoots (73.86%) were established, which contributes to the formation of a sustainable yield. The coefficient of actual fertility varies depending on climatic conditions, remaining within the limits for the variety (1.28) and reflecting the influence of the environment on the fruiting processes. The obtained average yield per vine (3.35 kg) and per hectare (10486.95 kg) shows relative stability even in the presence of climatic changes. Variety Pamid exhibits good adaptability to variations in temperature regime and water deficit. The study contributes to a better understanding of the response of local grape varieties to environmental changes and their role in the future development of the viticulture and wine sector. The obtained results confirm the importance of the variety Pamid as an adaptive local genotype with potential for sustainable viticulture, provided that appropriate agrotechnical practices are applied.

Keywords: bud burst, climatic conditions, coefficient of actual fertility, fruiting shoots, variety Pamid, yield

• Introduction

Biological manifestations of grape varieties represent a complex of morphological, physiological and productive characteristics that determine adaptability to environmental conditions and their economic value (Jackson, 2020). The study of these manifestations is of great importance for optimizing agricultural techniques, selection and yield management. The main aspects include phenological development, agrobiological indicators, reproductive potential and yield (Keller, 2020). Agrobiological indicators, such as the percentage of fruiting shoots, fertility coefficient and bunch mass, are strongly dependent on both the genetic characteristics of the variety and agroecological conditions (Reynolds, 2015). Disturbances in reproductive processes (adverse climatic conditions during flowering) can lead to a yield reduction. Yield is determined by the number of bunches per vine, the average bunch mass, the planting density (Poni et al., 2006) and represents the amount of grapes produced per unit area or per vine and is the result of the interaction of all biological processes (Reynolds, 2015). According to Van Leeuwen et al. (2004), the water regime is an important factor for the growth and productivity of the vine.

• Material and method

Pamid variety is a late-ripening wine variety in the second half of September. The vines are characterized by vigorous growth, upright shoots and hard wood. The bunch is medium-sized, cylindrical-conical, semi-compact to loose (Figure 1). The berries are medium-large, rounded, weakly attached to the stalk. The skin is red, in some variations dark red, thin, fragile, covered with a waxy coating. The consistency of the mesocarp is juicy and crunchy. The taste is sweet, harmonious and neutral. Pruning is carried out mainly on short fruiting units - spurs with 2-3 buds, but if necessary, long fruiting units - arrows are also left. The variety is not resistant to diseases and pests. In Bulgarian climatic conditions, it rarely suffers from low winter temperatures and is used to make light, red or rosé wines with a pleasant taste. The grapes are also preferred for fresh consumption. The variety was included in the official list of Republic of Bulgaria in 2010 (Roychev, 2014).

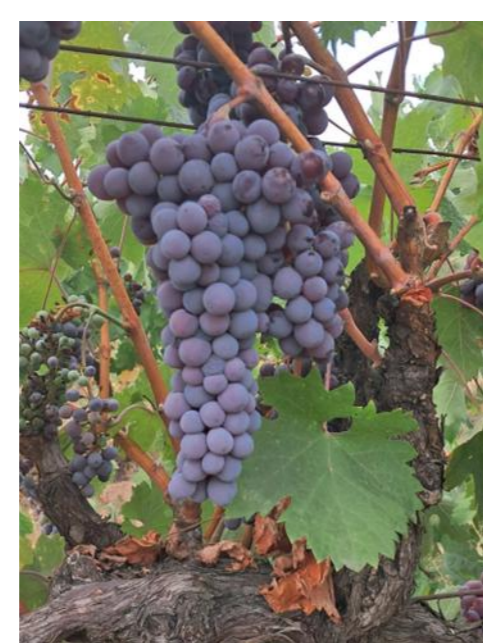


Figure 1. Bunch of Pamid

The duration of main phenological phases in days is presented: sap flow - bud burst, bud burst - first leaf appearance, first leaf - flowering, flowering - pea size, pea size - veraison, veraison - technological ripeness, bud burst - technological ripeness.

Included indicators characterizing the actual fertility and grape yield: developed buds (%), fruiting shoots (%), coefficient of actual fertility /Kr/, average yield from per vine (kg), average yield per ha (kg), determined according to the generally accepted methodology of Roychev, (2014).

The data on the climatic indicators: average monthly air temperature (°C) and amount of precipitation (mm), were taken from the meteorological station located in the experimental vineyard (Figure 2 and 3).

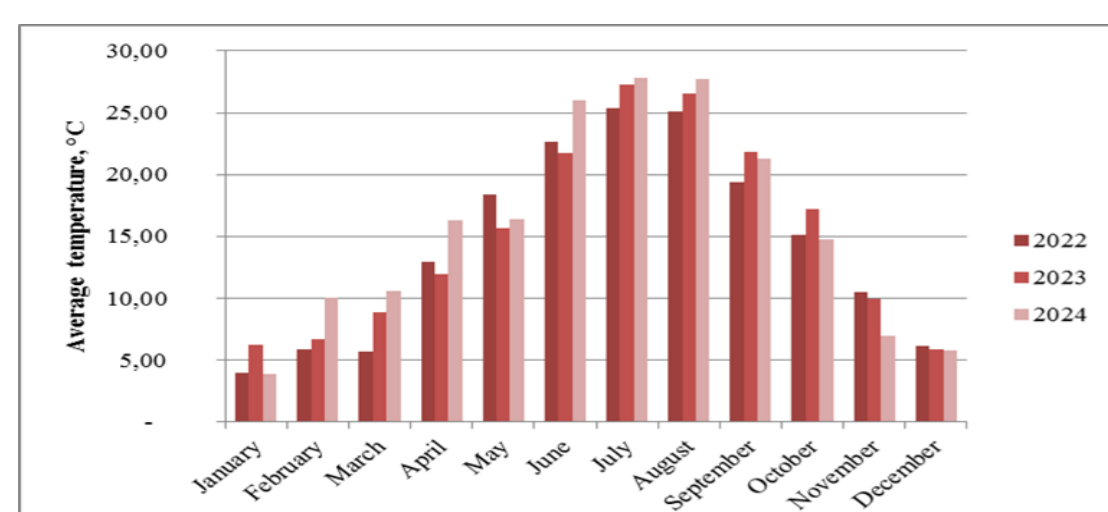


Figure 2. Average monthly air temperature, 2022-2024

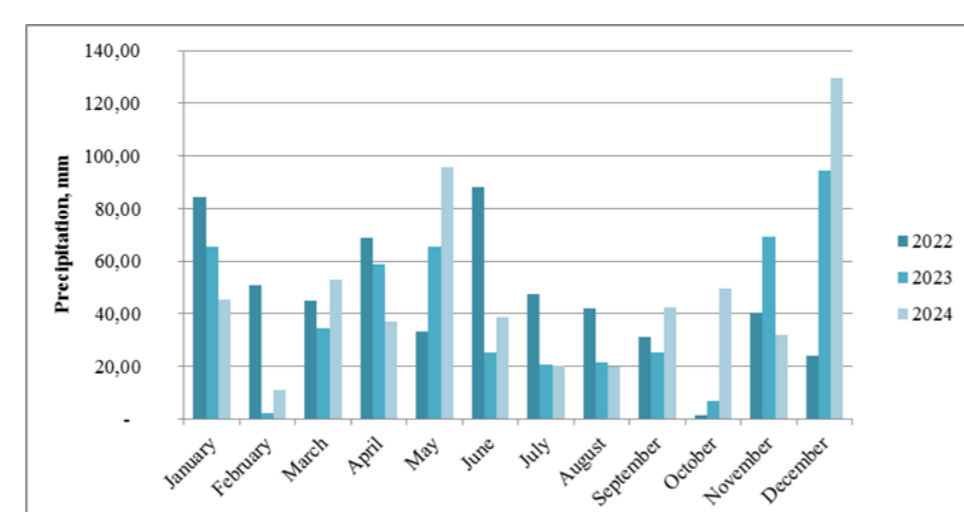


Figure 3. Precipitation, 2022-2024

• Results and discussions

The results obtained for the duration of phenophases in days during the period 2022-2024 show a clear dependence on climatic conditions during the individual growing seasons (Table 1). The observed variations between years are mainly due to the temperature regime and water status of the plants.

Table 1. Duration of phenophases in days during the period 2022 - 2024

Year	SAP flow to bud burst	Bud burst to first leaf appearance	First leaf to flowering	Flowering to pea size	Pea size to veraison	Veraison to technological ripeness	Bud burst to technological ripeness
2022	13 a	9a	41a	26a	43b	51b	159a
2023	12 a	12b	46a	30b	35a	45a	165a
2024	12 a	11a	48b	29a	34a	40a	158a
Average	12,33	10,66	45,00	28,33	37,33	45,33	160,66

* Mean values denoted by different letters differ statistically significantly at $p < 0.05$ (one-way ANOVA)

The results obtained for the actual fertility and yield of the Pamid variety during the period 2022-2024 show distinct interannual variability, mainly determined by climatic conditions during the growing season (Table 2).

Table 2. Actual fertility and grape yield during the period 2022 - 2024

Year	Developed buds %	Fruiting shoots, %	Coefficient of actual fertility Cf.	Average yield per vine, (kg)	Average yield per ha (kg)
2022	86,40a	78,70b	1,32b	3,74b	11680,75b
2023	84,70a	72,40a	1,28a	3,36a	10500,00a
2024	82,80a	70,50a	1,25a	2,97a	9280,12b
Average	84,63	73,86	1,28	3,35	10486,95

* Mean values denoted by different letters differ statistically significantly at $p < 0.05$ (one-way ANOVA)

The lowest values of all studied indicators were recorded in 2024 - both for developed buds (82.80%) and fruiting shoots (70.50%), as well as for the coefficient of actual fertility (1.25) and yield (2.97 kg per vine and 928.12 kg per ha). The established statistically significant differences in yield indicate a clear deterioration in productivity. This is probably due to the combined influence of unfavorable climatic conditions - weaker fruit bud setting in the previous season and stress factors during the current vegetation (drought, high temperatures), which limited the development and yield realization.

• Conclusions

Pamid variety exhibits variability in phenological development, fertility and yield, determined by climatic conditions. The average duration of the period from bud burst to technological ripeness is 160.66 days, with the longest in 2023 (165 days) and the shortest in 2024 (158 days).

Actual fertility varies from 1.25 to 1.32, with the highest in 2022 (1.32), accompanied by the highest percentage of fruiting shoots (78.70%) and the highest yield - 3.74 kg per vine and 11680.75 kg per ha. In 2024, the lowest values were recorded for both fertility (1.25) and yield (2.97 kg per vine and 9280.12 kg per ha).

A direct relationship were established between the duration of the phenological phases, the level of fertility and yield, with a more balanced course of vegetation in 2022 ensuring higher productivity, while deviations in the temperature and water regime during the study period led to a yield reduction.

The Pamid variety demonstrates good biological resistance and relatively stable development, but its productivity is sensitive to changes in climatic conditions. The results obtained emphasize the need to optimize agrotechnical measures and implement adaptive practices in order to maintain stable yields in conditions of climatic variability.