Phenotipic responses of *Vitis vinifera* L. to a changing climatic scenario.

Vitale NUZZO[1], Egidio LARDO[1], Giuseppe CELANO[1], Emanuele SCALCIONE[2]

[1]Dipartimento di Scienze dei Sistemi Colturali, Forestali e dell'Ambiente, Università degli Studi della Basilicata, Viale dell'Ateneo Lucano 10 - 85100, Potenza, Italy

[2]Agenzia Lucana di Sviluppo ed Innovazione in Agricoltura, Viale C. Levi, 6/I – 75100, Matera, Italy

Corresponding author: Vitale, NUZZO, vitale.nuzzo@unibas.it, 0971 205263, 329 3606254, 0971 205378.

Background: Nowadays there is much discussion on climate change and its effects on both human activities and natural organisms. In cultivated plants the actions and interactions of climatic factors and mankind-induced changes in vegetative and reproductive structures are very complex and in grapevines have largely been ignored [2,4]. In particular, premium wine production is limited to regions climatically conducive to growing grapes with balanced composition and varietal typicity. For these high quality grapes production the required climatic conditions can be summarized: (i) an adequate range of temperature, without risk of frost damage or extreme heat events; and (ii) a good precipitation distribution of adequate intensity in winter and along the growing season.

Aims: in this abstract, we briefly discuss some consequences on yield and grape quality of the changing climatic context in a warm and arid area of the South of Italy.

Methods: Meteorological data were measured by an automatic weather station with sensors exposed in the standard position as recommended by the World Meteorological Organization [5]. The weather station belongs to the *Servizio Agrometeorologico Lucano* (ALSIA) and is sited in Metaponto (N 40° 20', E 16° 48'). The effects of water availability on yield and grape quality was carried out in a five-years-old vineyard (*Vitis vinifera* L., cv. Aglianico) located in Montegiordano Marina (42°02' N, 16°35' E). Half of the plants (IRR) were fully irrigated, whereas the other half were not irrigated (N-IRR). In both the treatments, plant water status, gas exchange, photosynthetic efficiency and productive performance were determined.

Results: Within the last 30 years the annual average of the daily maximum and mean temperature increased of about 2°C, a breaking point can also be observed around the 1996 when temperature start to increment until another quite stable value (Figure 1).

The impact of high temperature was found to be negative in both productivity and grape composition in several varieties, even if the relationship between winegrape quality and thermal behaviour may differs by variety [2,4].In the vineyard, the berry temperature, is not just a function of air temperature, but it is more dependent by the absorbed solar radiation and convective heat loss. For example, dark berries in the sun and under low wind conditions can be up to 10-15 °C above air temperature. Sunburn is the most obvious sign of damage soon after a heatwave event and can drastically reduce yield and fruit quality in

many fruit tree species and vegetables [2,4]. In field conditions grape berries of Chardonnay cultivar showed the first symptoms of sunburn necrosis two days after 5 of exposure at 40-43 °C and 43-45 °C and treated berries reached the maximum level of damage after 4 days from the treatment when about the 12.4% of cells died [1].

Annual precipitation also increased of about 100 mm, while the contribution to the annual rainfall of the winter season decreased of about 10% (Figure 1). Grapevine responds to arid condition through a decreases of stem water potential (N-IRR vines reached a minimum value of -1.52 MPa), yield per plant, cluster weight and total berry weight were also significantly lower in N-IRR vines respect to IRR ones. Moreover, the lower soil water availability determined a marked shift toward the lighter and smaller berries volumes, and induced significant changes in other morphometric berry parameters. Total anthocyanins extracted from berry skins were significantly higher in N-IRR than in IRR (12301.53 and 9585.52 mg kg-1 fresh berry skin, respectively) and appeared to be positively related to berry weight, whereas total flavonols were not significantly different between the two treatments. These results highlighted that drought stress did not determine decreases in grape quality but have a significant impact on yield. Such data can be of primary importance in environments where water availability is by far the most important limiting factor for plant growth [3].

Conclusions: In the Metaponto area the eleven warmest years of the 30 years records have all occurred since 1996, indicating a rapid warming trend. In the South of Italy, continued warming will increase the uncertainty of suitability for high quality grape production and may alter grape and wine quality. Changing precipitation patterns could aggravate the problem of drought and thermal stress on grapevine and soil salinity.

Keywords: Grapevine, grape yield, grape quality, water stress, berries sunburn.

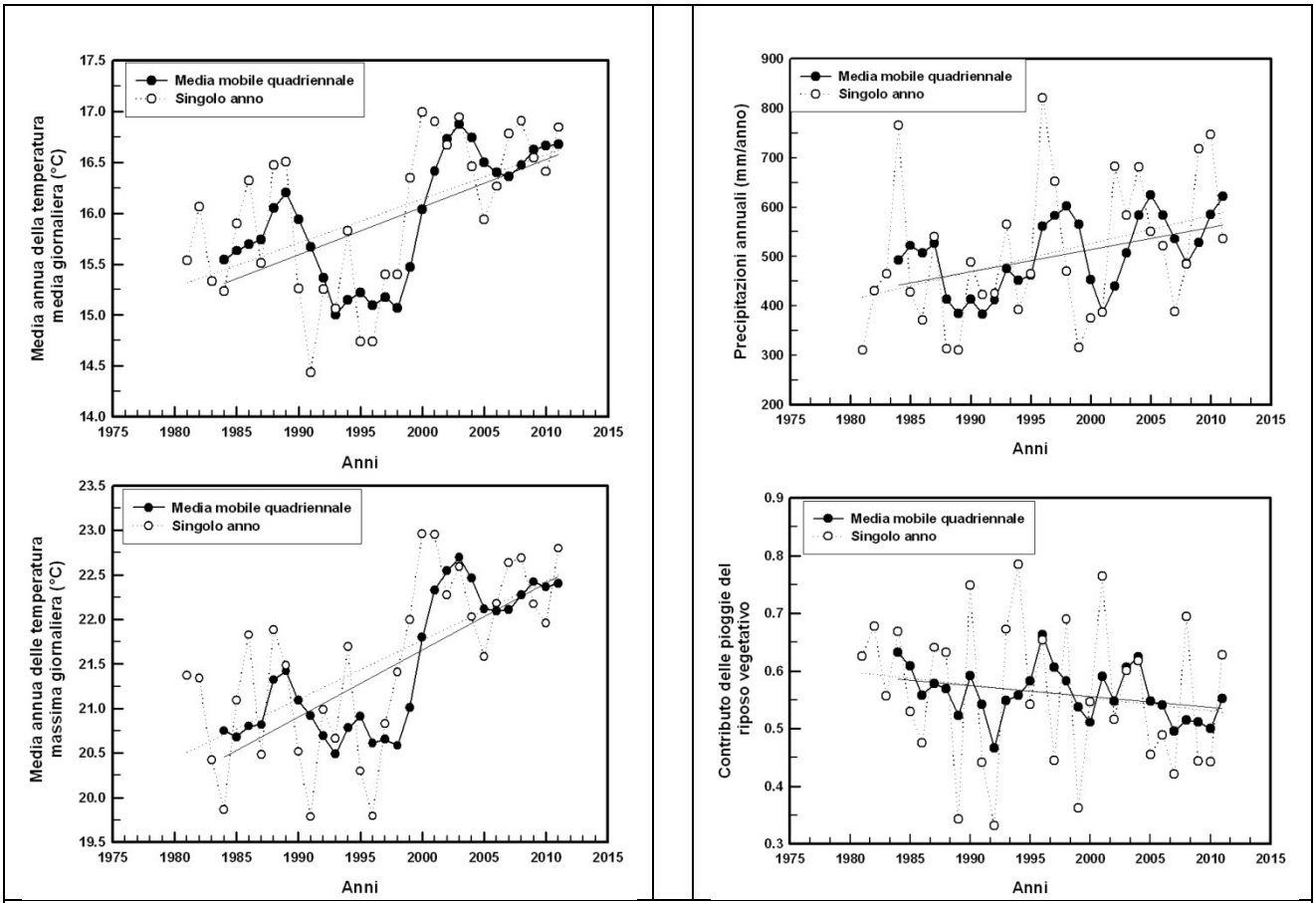

Figure 1. On the left, annual average of maximum and mean air temperature and, on the right, the annual rainfall of the 1981-2011 period measured in Metaponto.

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