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RESEARCH PAPER

Combined effect of irrigation and compost application on Montepulciano berry composition in a volcanic environment of Latium region (central Italy)

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Abstract

P. Cirigliano, M. V. Chiriacò, A. Nuňez, G. Dal Monte, and T. Labagnara. 2017. Combined effect of irrigation and compost application on Montepulciano berry composition in a volcanic environment of Latium region (central Italy). Cien. Inv. Agr. 44(2): 195-206. Montepulciano red grape is cultivated in the northern part of the Latium region, primarily for the production of DOC "Colli Etruschi Viterbesi" structured wines for aging. In Mediterranean areas, viticulture is closely influenced by vine water status. In this context, the practice of irrigation may alleviate water-stress-related reductions in plant development to guarantee grape quality, especially in semi-arid areas. The application of on-farm compost in a vineyard may affect grape quality without negative effects, thereby enhancing environmental sustainability. The aim of this work was to investigate the combined effect of irrigation and compost application on the Montepulciano variety in the volcanic environment of Latium region, thereby improving the polyphenol concentrations in the berries. The trial was conducted during three growing seasons (2011–2013). Irrigation was performed according to the protocol proposed by Ojeda and Saurin (2014). The pre-dawn leaf water potential (ψpd) from July to September was measured weekly for maintaining vine water status in the range between -0.4 and -0.6 Mpa. Irrigation (I) and irrigation plus compost application (IC) were compared to a non-irrigated control (C). Berry weight was not influenced by moderate irrigation, whereas titratable acidity and total soluble solids were negatively correlated to the increment of water dropped. The primary finding was a positive influence on polyphenol contents of the grapes at harvest. Best performance was highlighted in 2012 with 263 liter vine^{-1} of water supplied. Overall, the sustainable use of water and on-farm compost improved Montepulciano grape quality in this volcanic area, thereby enhancing the adaptation of Mediterranean viticulture to climate change conditions.

Keywords: climate change adaptation, compost on farm, polyphenols concentration, *Vitis vinifera* L.

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Introduction

Grape physiological and commercial maturity depends on plant genotype, as well as on environmental conditions that affect vine phenotype. The influence of plant nutrition (fertilization) and agricultural management (conventional, organic, biodynamic, integrate) contribute to differences in grape polyphenol content (Heimler *et al*., 2017). Cultural practices and environmental conditions, such as light, temperature and soil water status, can significantly affect grape biochemical composition from the pre-veraison to post-veraison periods (Chorti *et al*., 2010; Teixeira *et al*., 2013). In addition, climatic changes are particularly important for grapevine cultivation, in which certain environmental conditions, e.g., temperature, could dramatically affect polyphenol metabolism, as well as grape quality. In fact, many studies have reported how high temperatures had a detrimental effect on berry color (de Rosas, *et al*. 2017).

In Mediterranean areas, viticulture is strictly influenced by vine water status (Van Leeuwen *et al*., 2009). According to many authors, vine water status influences fruit growth, the concentration of total phenols and the wine's sensory attributes (Koundouras *et al*., 2006; Shellie, 2014; Van Leeuwen *et al.,* 2009; Acevedo-Opazo *et al*., 2010). Soil water scarcity can have negative impacts on plant growth and grape production, whereas irrigation practice can alleviate water-stress-related reductions in plant development, demonstrating the importance of cultural practice at the vineyard to guarantee grape quality, especially in semi-arid areas (Teixtera *et al*., 2013). Nevertheless, full irrigation is not recommended in vineyards since it increases berry size with a consequent decrease of the skin/pulp ratio, which negatively affects grape quality (Ruiz-Sanchez *et al*., 2010). The Montepulciano red variety is widespread in central Italy and particularly in the northern part of Latium region, where the volcanic environment is characterized by soil with low content of organic matter and moderate available water capacity. Montepulciano is the primary variety allowed in the production of the DOC "Colli Etruschi Viterbesi" wines. In this context, the variety is cultivated for the production of structured wines for aging.

In this work, grapevine water status and the application of compost were studied in order to assess the evolution in secondary metabolite compounds and improve Montepulciano wine quality. The model of irrigation utilized was first described by Ojeda H. (2008). According to the author, for more concentrated wines, moderate water stress should be applied in order to promote the concentration and synthesis of phenols, including anthocyanins. Vine water status, is generally measured with pressure chamber techniques (Van Leeuwen *et al*., 2009; Scholander *et al*., 1965) through the measurement of leaf water potential (ψ). Williams and Araujo (2002) reported the measurement of predawn leaf water potential as a good index of plant water status in *Vitis vinifera* L. Moderate water stress could be achieved by maintaining values of leaf water potential (ψpd) between -0.4 and -0.6 Mpa from veraison to harvest (Ojeda and Saurin, 2014).

The practice of organic fertilization represents another widespread technique applied in Italian viticulture to improve plant nutrition and grape quality. Compost obtained from the organic fraction of stalks, grape seeds, and pruning residues, primarily for organic farmsystems, represents an important substitute for chemicals in terms of sustainability. In fact, the application of compost may increase the organic matter in the soil and represents a source of nutrients for agricultural production (Scotti *et al*., 2015). The use of compost is also helpful for improving soil physical properties. In fact, increases in porosity, structural stability, and availability of water content have been demonstrated following organic fertilization (Morlat and Chaussod, 2008; Celik *et al*., 2004). According to Mugnai *et al.* (2012), the application of compost in a vineyard may affect grape production and chemical composition of berries, can be beneficial to soil characteristics and had no negative effects on plant growth and grape quality. In the present study, the combined effect of the irrigation strategy proposed by Ojeda and Saurin (2014) and the application of on-farm compost were thoroughly investigated in order to improve Montepulciano grape quality with particular attention to polyphenol content. The originality of this study is to propose an approach that could be useful and readily available for winegrowers, especially in the volcanic environment of the Latium region.

Materials and Methods

Experimental framework

The trial was conducted from veraison to harvest, during three consecutive growing seasons (from 2011 to 2013) in a 10-year-old organically managed vineyard (wine farm Trebotti) located in Castiglione in Teverina (42.63° N, 12.19° E, 260 a.s.l.) in the northern part of the Latium region (central Italy). The studied variety was Montepulciano on rootstock 420A with a plant density of 5,000 vines per ha (planting distance 2.5×0.90 m). Vines were trained to a lateral cordon, spur pruned, and shoot thinned to a shoot density of 10 shoots per linear meter of cordon. Minimum tillage was performed under the row for weed control and no chemical fertilization was applied to the vineyard.

The area of the experiment is located within the Vulsino volcanic apparatus of Central Italy where the geological formation consists of volcanoclastic deposits, predominantly ignimbrites composed of tuffs and lapilli (Peccerillo, 2005; Locardi *et al*., 1976). From the taxonomic point of view, the experimental plot consisted of Entisols, Xeropsamments group in Soil Taxonomy (USDA, 2010) with a xeric humidity regime. The properties of the soil in the study area were previously described by De Santis *et al.* (2017). Measurements were performed according to the official methodology for physical analysis of soil (Ministero delle politiche agricole, 1999). Measurements of soil water retention (pF) were carried out in a Stackman tank for matric potential points from 0 to 2,0 (Stackman *et al*., 1969), while a Richards pressure apparatus (1000 Membrane Extractor 15 Bar model, Soil Moisture) was utilized for points between 2.5 and 4.2 (Busoni and Mecella, 1997). Different soil conditions, such as saturated soil (the starting point), field capacity and wilting point, corresponded respectively to pF 0, pF 2 and pF 4.2. The Available Water Capacity (AWC) was calculated through the difference between the water content at the field capacity point and the wilting point. According to Seki *et al*. (2007), points pF 2.5 and pF 3.3 together relate the evolution of the water retention curve available for root absorption.

The meteorological data utilized in the experiment come from the nearest meteorological station, located at Orvieto (LAT 42° 43’ N, LON 12°09’ E, alt. 315 m a.s.l.) approximately 11 km away from the experimental fields. The meteorological station (Silimet, 3820 model) collects data automatically for the Umbria regional phytosanitary service. The climate of Orvieto, classified as Csa under the Köppen-Geiger classification (Geiger, 1954), is a typical Mediterranean climate characterized by hot dry summers and cool wet winters. According to Brunori *et al.* (2015), the values of the Huglin index and Cool night index in this area are, respectively, from 2100 to 3000 (warm-temperate warm climate) and ≥12 - ≤18 (cold-temperate night).

Experimental design

The block design consisted of a plot with 9 rows of 42 vines each for a total of 378 investigated vines; the experimental unit was a sub-plot of three consecutive rows of 42 vines each with a total of 126 vines per unit. To avoid bias due to external influences and ensure the representativeness of the data, only the central row in each unit was sampled for data collection. Three replicates for each unit were also performed on the same central row.

Irrigation regime and treatments

The irrigation strategy was applied from veraison to harvest in three growing seasons (2011–2013). Three different treatments were adopted: the first treatment consisted of irrigation under the conventional agricultural practices adopted at the farm, including under row tillage (I); the second treatment consisted of irrigation under no tillage and the distribution of a 6- to 8-cm-high layer of compost under the rows (IC). The two irrigation treatments were compared with the control (C) with no irrigation and no distribution of compost (Table 1). In the control C, the soil water content was only due to the natural rainfall.

Table 1. Irrigation scheme applied for each treatment; rainfall and water supplied with irrigation (total liter/vine) is per year from veraison to harvest. Rainfall in the months of July, August and September was evaluated directly in the vineyard through a rain gauge. The irrigation period was from 03/08 to 23/09 in 2011; from 16/7 to 06/10 in 2012 and from 12/7 to 3/10 in 2013. Evapotranspiration (ETO) was calculated with the Hargreaves-Samani formula and refers to the average monthly ETO of July and August. (C: control not irrigated, I: irrigation; IC: irrigation plus compost addition).

ETO	mm/day	6.45	6.65	6.10
Treatment	Water Amount (L /vine)	2011	2012	2013
	Irrigation	0	0	0
C	Rainfall	130	177	104
	Total	130	177	104
	Irrigation	250	263	582
I	Rainfall	130	177	104
	Total	380	440	686
	Irrigation	250	263	582
IC	Rainfall	130	177	104
	Total	380	440	686

The conventional agricultural practice adopted on the farm consisted of three-row wide mowing (from April to September) of natural permanent grass. A drip irrigation system was installed with integrated self-compensating emitters spaced 0.5 m and discharge of 2.2 L per h with a volumetric water meter to record the amount of water supplied. The irrigation was manually controlled, and it was applied approximately once a week at sunrise in order to maintain the leaf water potential (ψpd) between -0.4 and-0.6 Mpa. The amount of water dropped depended, consequently, on the vine water status as monitored through pre-dawn leaf water potential (ψpd) measurements(see paragraph below). The scheduled irrigation was applied starting on August 3rd in 2011, July 16th in 2012 and 15th July 2013 till the harvest (September 23rd in 2011, October 6th in 2012 and October 3rd in 2013) with the aim of keeping the defined vine water status (-0.4 and -0.6 Mpa ψpd) according to the model proposed by Ojeda and Saurin (2014). The amount of water distributed was 250, 263 and 582 L per vine in 2011, 2012 and 2013, respectively.

Compost production

The agricultural organic residues of the farm were composted directly on farm. Compost production consisted of the aerobic fermentation of grape stalks (13%), fresh marc and seeds (57%), pruning residues (28%) and only 2% of manure. The aerobic fermentation was carried out for 9 months (from October to June). The compost process was performed in three phases: latency, stabilization (70°C) and maturation. During this period, the compost was mixed and moistened in order to allow the natural biological process and maturation. A total of 2600 kg was produced. The main chemical elements of the compost produced are highlighted in Table 2. Compost was applied to one of the three experimental units (IC) tilled into the soil to a depth of 6 to 8 cm. The dose applied was 1.5 kg per vine.

Table 2. Main chemical parameters of the compost produced on farm.

Compost on farm: Chemical composition		
N	%	1,9
P_2O_5	% s.s	1,2
K_2O	% s.s	4,6
MgO	% s.s	0,6

Pre-dawn leaf potential measurements

Measurements of leaf water potential (ψpd) were carried out before and after the irrigation events in the threeyears of the trial from veraison until harvest with a pressure chamber (3115 SAPS II model, Soil moisture equipment corp. Santa Barbara, CA, USA) (Scholander et al., 1965). For each measurement, five representative leaves were randomly sampled among the central row vines for each replicate per treatment. In 2011, ψpd was measured on 11 dates: August 3rd, 9th, 12th, 22nd, 24th and 30th; September 3rd, 7th, 10th, 16th, and 23rd. In 2012, ψpd was measured on 13 dates: July 16th, 18th, 26th; August 1st, 3rd, 11th, 13th, 23rd, 27th and 29th; September 9th and 18th; in October, only one measurement was taken (the 6th). In 2013, ψpd was measured on 17 dates: July 15th, 19th, 22nd, 26th and 27th; August 3rd, 5th, 8th, 10th, 16th, 17th, 26th, 29th and 30th; in September 3rd, 5th and 11th. Figure 1 highlights the evolution of pre-dawn leaf water potential from post-veraison to harvest during the three years of the trial. Rainfall events and total irrigation volume applied are also evidenced. Briefly, leaf water potential was measured at sunrise and when ψpd was out of the range between -0.4 and -0.6 Mpa, irrigation was applied. After the irrigation treatment, ψpd was monitored, confirming values between -0.4 and -0.6 Mpa. Measurements were taken on five different representative leaves before and after the irrigation treatment for each replicate.

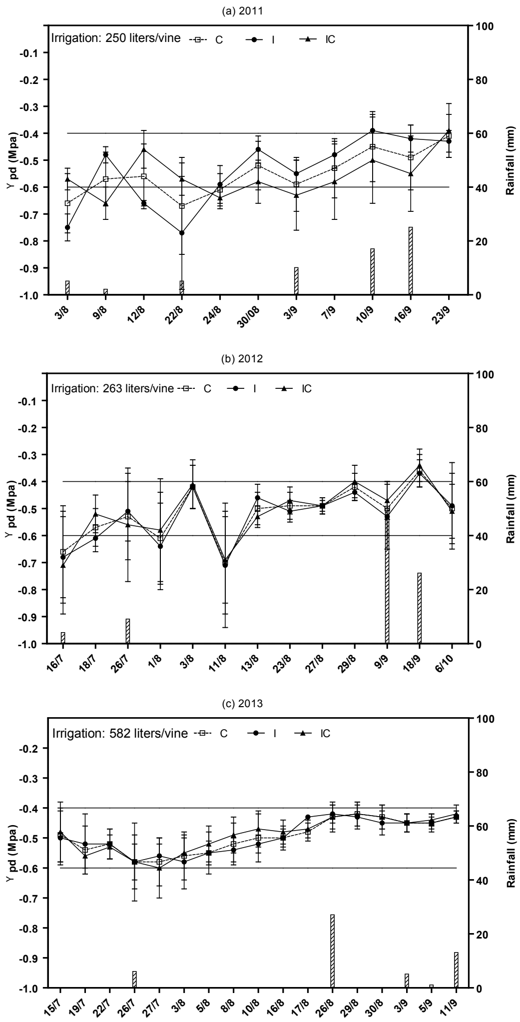

Figure 1. Evolution of pre-dawn leaf water potential (**ψpd**) from post-veraison to harvest during the three years of the experiment. Rainfall values (histograms) and total irrigation volumes applied are reported in the graph. (C: control not irrigated, I: irrigation; IC: irrigation plus compost addition).

Berry composition analysis

The central row of each experimental unit per treatment was individually harvested on September 23rd in 2011, October 6th in 2012 and October 3rd in 2013. Each harvested replicate, consisting of 3 kg of bunches, was immediately homogenized for laboratory analyses. Berry weight, total soluble solids and total acidity were evaluated. Total soluble solids in the juice of each sample was measured using a digital refractometer (LDR400 model, Silverado), whereas total acidity was determined using the method described by Zoeckleinet al. (2000). Anthocyanins were analyzed as reported in Ribéreau-Gayon and Stonestreet (1965). Total phenols and grapeseeds were evaluated according to the official methodology described by Waterhouse, (2002).

Statistical analysis Data obtained for each treatment, i.e., (I), (IC) and (C) were analyzed through two-way ANOVA. The Bonferroni Post Hoc test was applied when significant differences were found using SPSS 19.00 software. Linear correlation was performed with Graph Pad Prism software (version 5.03).

Results and Discussion

Climate and soil characteristics

Table 3 highlights the soil's hydrology with measurements of water retention capacity at different soil matric potential points (pF) performed on the investigated vineyard at the beginning of the trial. The values of AWC measured were very similar at the different soil depths with a range of variation between 21.4% and 23.6%. Figure 2 shows the pattern of air temperature and precipitation during the growing season of the study years in comparison with climatic values from 1961 to 1990. In general, during the years 2011–13, precipitation was significantly higher than climatic values (+55%); minimum temperatures were very close to climatic values, while maximum temperatures were constantly higher than normal. In more detail, in the veraison-harvest period (July 1st - September 30th), in 2013 the departures from normal were very small, while in 2011 and 2012, the highest temperatures and the highest positive anomalies from climatic values occurred: +3.1°C and +4.6°C in August and September 2011, respectively, +3.3°C and +4.0°C in July and August 2012. Significant anomalies in precipitation were recorded in July and September 2011, with +38 mm (+115%) and +95.2 mm (+117%), respectively. The rainfall was also recorded in the experimental plot; during the test period, the total amount of rainfall was 65, 43 and 41 mm in 2011, 2012 and 2013, respectively (see Figure 1). The reference evapotranspiration (ET_0) was also calculated with the Hargreaves-Samani equation (Hargreaves and Samani, 1982); the average values of ET_0 for the veraison-harvest period were 6.5, 6.7 and 6.1 $mmday^{-1}$ in 2011, 2012 and 2013, respectively.

Combined effect of irrigation and compost on berry quality

The results presented in this study highlight the evolution of polyphenols in Montepulciano grapes in response to the irrigation strategy proposed by Ojeda and Saurin (2014). Additionally, the indirect role of on-farm compost in promoting polyphenol synthesis was investigated. On-farm compost was utilized at the experimental site not only to enhance the soil's physical properties and

Table 3. Soil hydrology at different depths (P3 at 25 cm, P2 at 30 cm andP1 at 40 cm) and at different matric potential points. Measurements are presented in pF and bar. Values of AWC are expressed in percentage of soil volume. FC: Field Capacity; WP: Wilting point; AWC: Available Water Capacity.

Soilhydrology (% Volume)						
Samples	pF 0 bar 0	FC pF 2 bar 0,1	pF 2,5 bar 0,3	pF 3,3 bar 2	WP pF 4,2 bar 15	AWC
P3-25	62,2	31,2	25,0	15,7	9,8	21,4
P2-30	69,8	32,6	27,9	17,2	9,1	23,5
P1-40	60,1	33,1	28,7	17,8	9,5	23,6

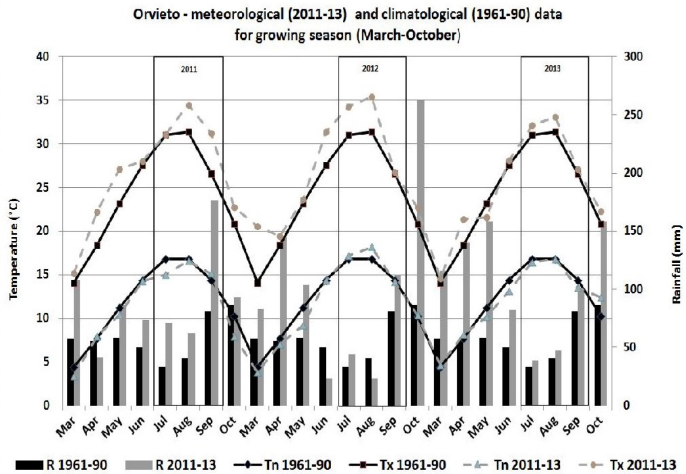

Figure 2. Monthly meteorological data 2011–2013 and climatic data 1961–90 on precipitation (R) and minimum (Tn) and maximum (Tx) air temperature during the growing season (March-October) from a proximal (Orvieto, central Italy) meteorological station. The veraison-harvest periods are highlighted.

as a source of nutrients but also to improve the water balance in the soil. In fact, Pinamonti (1997) reported that compost application also improves the permeability of water, improves water storage and, at the same time, reduces evaporation.

The results obtained during the three years of study reveal complex relationships among the right amount of water to be applied to improve the concentration of anthocyanins and phenols in the Montepulciano variety. The effect of irrigation applied in the vineyard on berry quality is still a discussed topic; however, it may represent an important precision farming tool in viticulture for directly manipulating and optimizing vine growth, crop yield and grape quality (Profitt and Gibberd, 2014). Furthermore, at present, in arid and semi-arid Mediterranean environments, irrigation has become an essential practice enhancing the adaptation of Mediterranean viticulture to climate change conditions. In fact, during the last years Mediterranean viticulture has been affected by an increase of temperature variability and warm extremes with increased summer precipitation variability and water deficit, especially in the period just before the grape harvest (Van Leeuwen and Darriet, 2016).

The results highlighted in Table 4 evidenced that irrigation plus compost addition (IC) promoted an increase of berry weight only in 2013. The average berry weight was influenced by the high amount

Table 4. Effect of irrigation on berry weight, total soluble solid accumulation and grape titratable acidity. Measures were taken at the harvest period. Means followed by different letters differ significantly at p‹0,05 by Bonferroni post hoc test after two way ANOVA.

Treatment	Berry weight (g)		Titratable acidity (g/L)		Total soluble solids (°Brix)	
C	2,39 ± 0,58		6,36 ± 0,15		23,98 ± 0,30	
I	2,3 ± 0,58		7,13 ± 0,94		23,21 ± 0,40	
IC	2,2 ± 0,52		6,47 ± 0,66		23,74 ± 1,63	
Season						
2011	2,19 ± 0,16	a	6,05 ± 0,23	a	24,50 ± 0,95	a
2012	1,80 ± 0,06	a	6,69 ± 0,47	b	23,45 ± 0,44	b
2013	2,90 ± 0,10	b	7,22 ± 0,75	b	22,68 ± 0,68	b

of water dropped (582 liter vine^{-1}). The effect of irrigation was evidenced in a progressive increase of titratable acidity against the accumulation of soluble solids during the three years, contrarily to many irrigation studies evidencing that changes of berry total acidity were not observed under moderate irrigation regimes (Matthews and Anderson, 1989). A negative correlation between total soluble solids and total acidity of Montepulciano was found (r=-0.9998, $p<0.05$) (Table 4 and Figure 3). However, no differences were found between the I and IC treatments (Table 4). In 2012 and 2013, the higher value of total acidity (6.69 in I and 7.22 in IC) and the lower value of total soluble solids (23.45 in I and 22.98 in IC) were both measured in the presence of the highest amount of irrigation in 2013. These observations reinforce what is reported in the literature (Ribèreau-Gayon *et al*., 2006) and confirm the direct correlation between irrigation and berry chemical composition (Intrigliolo and Castel, 2010).

Many authors have confirmed how the concentrations of anthocyanins and other phenols consistently increase in response to water deficit (Ojeda *et al*., 2002; Roby *et al*., 2004). Further, the grapevine's water status is one of the major factors known to affect anthocyanin accumulation in ripening berries (Ojeda *et al*., 2002). A positive influence of irrigation and an indirect effect of compost on

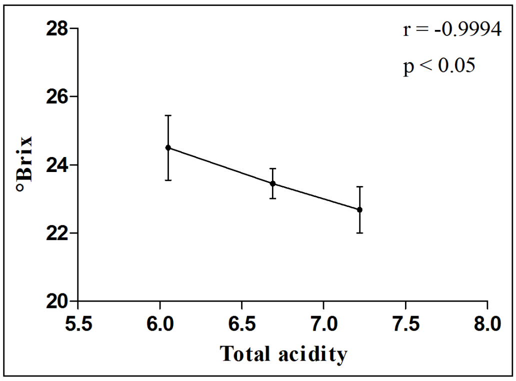

Figure 3. Linear correlation between total acidity and °Brix during the three years of the experiment. Pearson correlation (r) and statistical significance are highlighted in the figure.

the accumulation of phenols in Montepulciano were evidenced in this study (Table 5). Starting from the first year (2011), in the IC treatment, a significant accumulation of anthocyanins was observed. Total phenols increased with irrigation (I) and in the presence of compost (IC); moreover, the total phenols in grape seeds, even if significantly different from the control (C), were not influenced by the presence of compost (IC). An increase of 12% of total anthocyanins was found in IC in comparison to I treatment. Concerning the total phenols, an increase of 12% was registered in IC. Total water supply of 250 litervine^{-1} and the use of compost positively influenced the concentration of anthocyanins and phenol in Montepulciano in 2011. In the second year of the experiment (2012), the variety was characterized by a significant increment of total anthocyanins and total phenols in both irrigation treatments (I and IC). Moreover, the presence of compost was evidenced only in the total phenol content. The total anthocyanins concentration was 24% higher in I, but in IC, no increment was observed.

A different situation was found in the accumulation of phenols, where an increase of 8% was evidenced in the I treatment *versus* the control (C) and an increase of 13% in presence of compost (IC vs. C). During the third year of the experiment (2013), an increase of 17% of total anthocyanins was registered only in IC. The total phenolic content increased with a rate of 5.5 % in irrigated treatment (I) and in presence of compost (IC). For the first two years, the presence of compost had no influence on total phenolic grapeseeds, but in 2013, an increment was observed of 6 and 18%, respectively, in I and IC. The accumulation of anthocyanins and phenols was strictly associated with the volume of water dropped, and in many cases the presence of compost contributed positively. Where the total amount of irrigation was maintained within 250–263 liters vine^{-1}, positive accumulation was evidenced in anthocyanins and phenols, but when the irrigation increased (582 liters vine^{-1}), as from 2011 to 2013, their content

Table 5. Effect of irrigation on the evolution of Montepulciano anthocyanins and phenol content at plus compost addition harvest. (C: no control; I: irrigation; IC: Irrigation). Values followed by different letters indicate differences between treatments according to two way ANOVA and Bonferroni test (p≤0,05).

Year	Treatment	Total anthocyanins (mg/L^{-1})		Total phenols (mgL^{-1})		Total phenolic grapeseed(mg/L^{-1})	
2011	C	1311 ± 1	a	2246 ± 6	a	1022 ± 10	a
	I	1309 ± 71	a	2331 ± 64	b	1388 ± 88	b
	IC	1489 ± 38	b	2557 ± 46	c	1383 ± 49	b
2012	C	1342 ± 47	a	1703 ± 16	a	603 ± 57	a
	I	1785 ± 28	b	1851 ± 47	b	1091 ± 2	b
	IC	1739 ± 35	b	1967 ± 11	c	1093 ± 26	b
2013	C	801 ± 4	a	1437 ± 16	a	763 ± 21	a
	I	831 ± 11	a	1517 ± 3	b	812 ± 45	b
	IC	965 ± 28	b	1522 ± 27	b	940 ± 1	c

decreased to 50%. The results of this study suggest that the management of vine water status through moderate irrigation and compost application have a clear impact on Montepulciano polyphenol accumulation. Best performance was evidenced in 2012 with an optimum level of water vine^{-1} (263) supplied. Ojeda *et al.*, (2002) revealed how two types of berry responses to water deficit could be achieved: a positive effect on the concentration of phenolic compounds due to berry size reduction and direct action on biosynthesis that can be positive or negative, depending on the type of phenolic compound, period of application, and severity of water deficit. Therefore, water availability can inhibit or promote anthocyanin biosynthesis and polyphenol accumulation in grapevine berries. The observations in this work support the application of 250 to 263 liters vine^{-1} in this environment to ameliorate anthocyanins and phenols in the Montepulciano variety, enhanced by the use of compost, in order to achieve grape quality suitable for the production of red wine for aging. In this view, moderate irrigation and the use of on-farm compost represent an important tool to be applied for sustainable viticulture. Future research investigating properties of on-farm compost is necessary in light of the future prospect of limited water resources especially in the Mediterranean area. Because there was positivity evidenced in anthocyanin and phenol contents of mature Montepulciano berries (I and IC) in the present study, it can be assumed that water supply and compost application (I and IC) induced an improvement in grape quality of Montepulciano variety in this volcanic area of the Latium region.

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Resumen

P. Cirigliano, M. V. Chiriacò, A. Nuňez, G. Dal Monte, y T. Labagnara. 2017. Efecto combinado de la aplicación de riego y compost sobre la composición de la baya Montepulciano en un entorno volcánico de la región de Lacio (Italia central). Cien. Inv. Agr. 44(2): 195-206. Montepulciano cv. secrìa en el norte de la región Lazio de Italia para producìr vinos estructurados de la DOC "ColliEtruschiViterbesi". En el contexto Mediterraneo la viticultura es estrechamente influenciada del estado hìdrico medioambiental. La pràctica de riego puede desminuìr el estrèshìdrico relacionado a la produciòn, y garantizar calidad de la uva. El uso del compost autoproducido puede favorecer la calidad de la uva mejorando la sostenibilidad. El objetivo de este trabajo fuèenvestigar el efecto del riego junto la aplicaciòn del compost, en la cv. Montepulciano en àreavolcànica de esa regiòn, para mejorar los polifenoles de las bayas. El proceso fuè conducido desde el 2011 hasta el 2013. El riego se realizò con arreglo al protocol de Ojeda y Saurin (2014). El potentialhìdrico de la hoja antes de amanecer (ψpd), desde Julio hasta Septiembre, fuè medido semanalmente para mantenerse en la gama -0.4 y 0.6 Mpa. Las tesis experimentales regadas (I) y (IC), fueron comparadas con la tesi de Control (C). El peso de la baya no fuè influenciado con riego moderado; al contrario l'acidez y los sòlidossolubile han tenido una correlaciòn negativa con el incremento de agua. Es clara la influencia positiva para los polifenoles de la uva a la cosecha. La mejor actuaciònfuè del 2012 con 263 l/cepaje. En general el uso sostenible de agua y compost mejorò la calidad de la uva en este contexto volcanico, aumentando la adaptaciòn de la viticultura mediterranea a las condiciones del cambio climatico.

Palabras claves: Adaptación al cambio climático, compost de finca, contenido de polifenoles.

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