

Supplementary Materials

Table S1. Soil physical and physicochemical analyses in Vineyard 1 and Vineyard 2, before experiment implantation (August 2020) and after three years of application (April 2023) of the following treatments: control (C), grape pomace vermicompost (VC), and grape pomace compost (CO).

	Clay (%)	pH	Exchang. K (mg dm ⁻³)	Available P (mg dm ⁻³)	Exchang. Ca (cmol _c dm ⁻³)	Exchang. Mg (cmol _c dm ⁻³)
2020						
Vineyard 1	33	6.7	229	26.29	10.85	1.87
Vineyard 2	30	5.3	137	4.48	4.74	1.35
2023						
Vineyard 1						
C		6.04	87.84	20.52	8.88	1.81 b ²
VC	NA	6.19	93.90	31.93	7.63	1.67 ab
CO		5.93	90.53	19.59	8.40	2.16 a
P-value ¹		0.456	0.432	0.320	0.396	0.040*
Vineyard 2						
C		4.71 b ²	101.59	10.66	5.91	2.50
VC	NA	5.52 a	115.59	20.03	4.76	1.92
CO		5.35 ab	100.02	15.74	4.95	1.86
P-value ¹		0.816	0.778	0.066	0.832	0.708

¹ P-values of Anava at $\alpha = 5\%$, * indicates different means. ² Different lowercase letters indicate different means among organic fertilizers application (Tukey test, $\alpha = 5\%$). NA = not assessed

Table S2. Soil extracted concentration of micronutrients in Vineyard 1 and Vineyard 2, before experiment implantation (August 2020) and after three years of treatment application (April 2023). The treatments were as follows: control (C), grape pomace vermicompost (VC), and grape pomace compost (CO), with and without mineral fertilization (-MF and +MF, respectively, involving natural phosphate and potassium sulfate).

	Exchang. Cu (mg dm ⁻³)	Exchang. Zn (mg dm ⁻³)	Exchang. Fe (mg dm ⁻³)	Exchang. Mn (mg dm ⁻³)
2020				
Vineyard 1	15.66	5.26	NA	0.20
Vineyard 2	4.92	1.64	NA	24.8
2023				
Vineyard 1 ('Isabella')				
C	185.06	14.82	126.12 A ³	81.35
VC	95.70	10.00	142.95 A	75.77
CO	133.73	11.53	101.27 A	77.14
C + MF	113.04	8.24	100.34 B	68.97
VC + MF	80.27	8.60	96.86 B	59.41
CO + MF	154.90	9.80	93.93 B	65.09
<i>P-values</i> ²				
OF ¹	0.14338	0.40756	0.14532	0.12154
MF	0.13721	0.05026	0.01413*	0.05326

OF * MF	0.06701	0.27784	0.20334	0.94264
Vineyard 2 (‘Chardonnay’)				
C	12.05	49.08	118.32	83.12
VC	11.39	37.07	195.68	78.25
CO	11.60	24.22	175.84	80.55
C + MF	10.15	23.44	166.84	78.86
VC + MF	37.05	54.18	192.96	67.53
CO + MF	12.69	31.86	163.08	81.67
<i>P-values</i> ²				
OF ¹	0.4054	0.5995	0.3456	0.5351
MF	0.3137	0.9673	0.4648	0.6846
OF * MF	0.3293	0.1038	0.2429	0.9064

¹ Organic fertilizers factor; ² P-values of Anava at $\alpha = 5\%$, * indicates different means. ³ Different uppercase letters indicate different means between -MF and +MF (t-lsd test, $\alpha = 5\%$).

Table S3. Elementary composition and C:N ratio of grape pomace vermicompost and grape pomace compost.

	Grape Pomace Vermicompost	Grape Pomace Compost
N (g kg ⁻¹)	5.68	10.24
P (g kg ⁻¹)	2.59	6.84
K (g kg ⁻¹)	8.61	23.73
Ca (g kg ⁻¹)	1.74	0.31
Mg (g kg ⁻¹)	1.59	1.29
Cu (mg kg ⁻¹)	49.88	120.35
Zn (mg kg ⁻¹)	47.78	4.70
C:N ratio	14.86	29.91

Figure S1. Illustrated experimental setup for Vineyards 1 and 2.

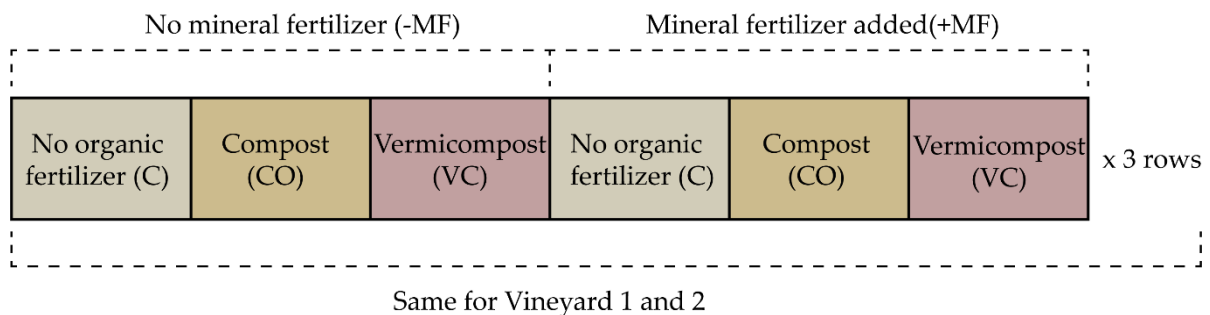


Table S4. Summary of response variables and their significance levels in ANOVA tests, where: * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.001$; Ns = not significant, in Vineyard 1 ('Isabella' grapevines) and Vineyard 2 ('Chardonnay' grapevines).

Response-variables	Factor 1 (organic fertilizers)	Factor 2 (mineral fertilizers)	Interaction
Leaf nutrient content			
Flowering			
Vineyard 1 – 'Isabella'			
Nitrogen	Ns	Ns	Ns
Potassium	Ns	Ns	Ns
Phosphorus	Ns	***	*
Vineyard 2 – 'Chardonnay'			
Nitrogen	Ns	Ns	Ns
Potassium	Ns	Ns	Ns
Phosphorus	Ns	Ns	Ns
Veraison			
Vineyard 1 – 'Isabella'			
Nitrogen	Ns	Ns	Ns
Potassium	Ns	Ns	Ns
Phosphorus	Ns	Ns	Ns
Vineyard 2 – 'Chardonnay'			
Nitrogen	Ns	Ns	Ns
Potassium	Ns	Ns	Ns
Phosphorus	Ns	Ns	Ns
SPAD index			
Flowering			
Vineyard 1	Ns	Ns	Ns
Vineyard 2	Ns	Ns	**
Veraison			
Vineyard 1	Ns	Ns	Ns
Vineyard 2	Ns	Ns	Ns
Grape yield			
Vineyard 1 – 'Isabella'			
2020/21	**	**	**
2021/22	Ns	Ns	Ns

Table S4. (Continued)

Response-variables	Factor 1 (organic fertilizers)	Factor 2 (mineral fertilizers)	Interaction
2022/23	Ns	Ns	**
Three seasons	*	Ns	**
	Vineyard 2 – ‘Chardonnay’		
2020/21	Ns	Ns	Ns
2021/22	Ns	Ns	Ns
2022/23	Ns	Ns	Ns
Three seasons	Ns	Ns	Ns
Grape Quality and Must Chemical Composition			
Vineyard 1 – ‘Isabella’			
2020/21			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
TA	Ns	Ns	Ns
TPI	Ns	Ns	Ns
2021/22			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
TA	Ns	Ns	Ns
TPI	Ns	Ns	Ns
2022/23			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
TA	Ns	Ns	Ns
TPI	Ns	Ns	Ns

Table S4. (Continued)

Response-variables	Factor 1 (organic fertilizers)	Factor 2 (mineral fertilizers)	Interaction
Three seasons			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
TA	Ns	**	Ns
TPI	Ns	Ns	Ns
Vineyard 2 – ‘Chardonnay’			
2020/21			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
2021/22			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
2022/23			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
Three Seasons			
TSS	Ns	Ns	Ns
TTA	Ns	Ns	Ns
TSS/TTA	Ns	Ns	Ns
pH	Ns	Ns	Ns
Soil nutrients			
Vineyard 1 – ‘Isabella’			
Ca	Ns	*	*
Mg	*	Ns	Ns

Table S4. (Continued)

Response-variables	Factor 1 (organic fertilizers)	Factor 2 (mineral fertilizers)	Interaction
P (0 – 0.1 m)	Ns	**	Ns
P (0 – 0.2 m)	Ns	Ns	Ns
K (0 – 0.1 m)	Ns	Ns	Ns
K (0 – 0.2 m)	Ns	Ns	Ns
Vineyard 2 – ‘Chardonnay’			
Ca	Ns	Ns	Ns
Mg	Ns	Ns	Ns
P (0 – 0.1 m)	Ns	Ns	*
P (0 – 0.2 m)	Ns	Ns	*
K (0 – 0.1 m)	Ns	*	Ns
K (0 – 0.2 m)	Ns	Ns	Ns