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Research on the fertilization management influence on physiological, agricultural productivity indicators and the retail price of grapes

Nan Roxana[1], Borca F.[1], Dobrei Alina[1*], Nistor Eleonora[1], Dobrei A.[1]

[1]Banat University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania", Faculty of Horticulture and Forestry, 119 Aradului Street, 300645 Timisoara, Romania

*Corresponding author email: ghitaalina@yahoo.com

Abstract The research was carried out during 2016-2017 in an eight years old vineyard located in the Recas Vineyards and was analyzed different organic fertilization variants compared to the conventional variant in which complex chemical fertilizers were used. Five varieties of wine grapes with different agrobiological characteristics to provide accurate results were investigated. During research and along growing seasons climate variability was recorded. Year 2016 was described by excess rainfall over almost the entire grapevine growing season, with unfavourable conditions for grape growing and development, while 2017 was drought and rich in insolation with positive influence on grape berry development. The experimental variants were: V1 Conventional (MT); V2 Green manure; V3 Fertilpolina; V4 Humus Vita Stallatico; V5 Fertilpolina + Cropmax. Observations and determinations were made regarding the leaf area, the photosynthetic performance, grape yield, the must sugar and acidity and the indicators of economic efficiency were calculated. The results for the experimental variants with organic fertilization were near similar to the control regarding the photosynthetic performance, although the values of the leaf area were lower compared to the plots with chemical fertilization. Concerning the grape yield and the sugar content, the organic fertilization variants registered values close to the control, but still slightly inferior in both years of research. However, due to the higher market price of the grapes, the profit was higher compared to the control variant in both years of research.

Key words

fertilization system, production, quality, photosynthetic yield, profit, grapevine

Vineyards fertilization is a complex and expensive work in the management chain [1]. Fertilization costs have decisive influence on grape/wine cost price, total costs and economic efficiency. At the same time, fertilization has a major influence on grape yield and quality, but especially on the sustained grape yield in the vineyard [2]. Fertilization must be permanently correlated with the pedoclimatic resources in the area, with the climate during growing season and from the previous year, with the financial possibilities of each vineyard and last but not least with the destination of the grapes/wine [3]. In recent years, the possibilities to choose an appropriate fertilization option have been greatly diversified due to the expansion of the range of fertilizers and the increasingly serious emergence of precision viticulture that have made possible a more efficient fertilization, better use of fertilizers and a necessary anticipation of the needs and the optimal moment for consumption [4]. However, this diversification must be capitalized very well through real experiments in the field through the multitude of existing variants [5]. The intensification of concerns about organic viticulture has lead to a reorientation of the fertilization system from the conventional one, based mostly on the use of complex chemical fertilizers and very rarely manure, to a fertilization that mainly uses fertilizers accepted by the organic viticulture, mainly organic fertilizers with low volume [6].

Material and Method

The research took place during 2016 and 2017, in an eight years old vineyard located in the Recas Vineyards, Timis County in the west area of Romania. In growing season from 2016 were registered many heavy rainfall days with unfavourable conditions for berry grapes growth and development, while 2017 was drought with a lot of insolation that provided very good conditions for grapes growing and development. The planting distances were 2.2 m interrows and 1 m between vines per row, resulting in a density of 4545 vines / ha; the training system was Guyot with vertical shoot positioning. The research focused on different fertilization variants (V1 Conventional (MT); V2 Green Fertilizers; V3 Fertilpolina; V4 Humus Vita Stallatico; V5 Fertilpolina + Cropmax) carried out on

five varieties of wine grapes (Italian Riesling, Chardonnay, Feteasca neagra, Cabernet Sauvignon and Pinot Noir). Comparative observations and determinations were made regarding the leaf area, photosynthetic performance, grape yield, must sugar and acidity. Also, economic efficiency indicators were calculated (production costs, production value, cost price and profit). The chosen varieties have different characteristics, biological peculiarities and technological properties in order to have a higher accuracy of the research results.

Results and Discussions

In table 1 are presented the results regarding the influence of fertilization variants on the physiological indicators in the five studied varieties. In 2016, the organic fertilization variants registered values of the leaf area inferior compared to chemical fertilization from conventional varieties.

Table 1

The influence of the fertilization on the leaf area and the photosynthetic performance in 2016

Variety	Fertilization	Leaf area (m^2 vine)	Photosynthetic performance		Difference to control	Significance
			Leaf area /kg grapes (m^2)	Leaf area /kg sugar (m^2)		
Italian Riesling	Conventional (C)	4.22	1.947	13.81		-
	Green manure	3.67	2.065	15.29	1.49	0
	Fertilpolina	3.82	2.047	14.83	1.03	-
	Humus Vita Stallatico	3.74	2.067	15.06	1.25	-
	Fertilpolina+Cropmax	4.03	1.934	13.86	0.05	-
Chardonnay	Conventional (C)	4.05	2.096	14.40		-
	Green manure	3.59	2.290	16.42	2.01	0
	Fertilpolina	3.75	2.350	16.67	2.26	0
	Humus Vita Stallatico	3.58	2.202	15.70	1.29	-
	Fertilpolina+Cropmax	3.85	2.055	14.35	-0.06	-
Feteasca neagra	Conventional (C)	5.47	3.016	19.91		-
	Green manure	4.71	3.224	23.11	3.21	0
	Fertilpolina	4.99	3.129	21.18	1.27	-
	Humus Vita Stallatico	4.73	3.065	21.07	1.16	-
	Fertilpolina+Cropmax	5.13	3.064	20.53	0.62	-
Cabernet Sauvignon	Conventional (C)	5.26	2.840	19.12		-
	Green manure	4.48	2.962	21.46	2.34	0
	Fertilpolina	4.66	2.816	19.56	0.43	-
	Humus Vita Stallatico	4.46	2.799	20.06	0.94	-
	Fertilpolina+Cropmax	4.84	2.809	19.11	-0.02	-
Pinot noir	Conventional (C)	3.76	2.420	15.58		-
	Green manure	3.36	2.852	19.70	4.12	00
	Fertilpolina	3.53	2.618	17.36	1.78	-
	Humus Vita Stallatico	3.33	2.628	17.70	2.12	0
	Fertilpolina+Cropmax	3.58	2.551	16.76	1.17	-

DF Riesling Italian	5%	1.38	1%	2.62	0.1%	4.111
DF Chardonnay	5%	1.42	1%	2.75	0.1%	4.22
DF Feteasca neagra	5%	1.83	1%	3.44	0.1%	5.77
DF Cabernet Sauvignon	5%	1.78	1%	3.27	0.1%	5.23
DF Pinot noir	5%	1.87	1%	3.52	0.1%	5.84

Regarding the photosynthetic performance - the necessary of leaf area to obtain a kilogram of grapes respectively, or a kilogram of sugar, most of the variants required an extra leaf area compared to the control, excepting for the Fertilpolina + Cropmax variants in the case Italian Riesling and Chardonnay varieties.

The exception was the Cabernet Sauvignon variety, in which the organic fertilization variants Fertilpolina, Humus Vita Stallatico and Fertilpolina + Cropmax, registered superior photosynthetic performance for the required leaf area per kilogram of grapes compared to the control.

Regarding the leaf area needed for the accumulation of one kilogram of sugar, the variants organic fertilized required an extra leaf area compared with the control. The only variant that had a better efficiency than the control was Fertilpolina + Cropmax in Chardonnay and Cabernet Sauvignon varieties.

Table 2

The influence of the fertilization on the leaf area and the photosynthetic performance in 2017

Variety	Fertilization	Leaf area (m^2 vine)	Photosynthetic performance		Difference to control	Significance
			Leaf area /kg grapes (m^2)	Leaf area /kg sugar (m^2)		
Italian Riesling	Conventional (C)	4.1	1.509	9.81		-
	Green manure	3.5	1.504	9.93	0.12	-
	Fertilpolina	3.7	1.532	9.97	0.04	-
	Humus Vita Stallatico	3.6	1.526	10.12	0.16	-
	Fertilpolina+Cropmax	3.9	1.480	9.58	-0.54	**
Chardonnay	Conventional (C)	3.9	1.572	9.89		-
	Green manure	3.4	1.606	10.39	0.51	0
	Fertilpolina	3.6	1.678	10.65	0.26	-
	Humus Vita Stallatico	3.4	1.562	9.96	-0.69	**
	Fertilpolina+Cropmax	3.7	1.526	9.64	-0.32	*
Feteasca neagra	Conventional (C)	5.3	2.244	13.24		-
	Green manure	4.6	2.290	14.82	1.58	0
	Fertilpolina	4.8	2.235	13.80	-1.02	*
	Humus Vita Stallatico	4.6	2.196	13.55	-0.24	-
	Fertilpolina+Cropmax	5.0	2.246	13.55	-0.01	-
Cabernet Sauvignon	Conventional (C)	5.1	2.122	12.92		-
	Green manure	4.3	2.085	13.56	0.64	-
	Fertilpolina	4.5	2.041	12.72	-0.84	*
	Humus Vita Stallatico	4.3	2.005	12.98	0.26	-
	Fertilpolina+Cropmax	4.7	2.066	12.63	-0.34	-
Pinot noir	Conventional (C)	3.6	1.709	10.04		-
	Green manure	3.2	1.851	11.64	1.60	0
	Fertilpolina	3.4	1.790	10.75	-0.89	-
	Humus Vita Stallatico	3.2	1.760	10.81	0.06	-
	Fertilpolina+Cropmax	3.4	1.740	10.45	-0.36	-

DF Riesling Italian	5%	0.3	1%	0.52	0.1%	1.12
DF Chardonnay	5%	0.32	1%	0.63	0.1%	1.23
DF Feteasca neagra	5%	0.79	1%	1.62	0.1%	3.01
DF Cabernet Sauvignon	5%	0.65	1%	1.33	0.1%	2.62
DF Pinot noir	5%	0.92	1%	1.73	0.1%	3.21

The favourable growing season from 2017, led to an improvement of the physiological indicators. Although the values of the leaf area in the case of all varieties and all variants were slightly lower than the previous year, the photosynthetic performance regarding the leaf area requirement per kilogram of grapes, respectively per kilogram of sugar, was more efficient.

The leaf area, for all varieties and variants had a similar ranking like in the previous year; all variants registering lower values than the control. For photosynthetic performance, the variants ranking was different depending on the variety [7]. In Pinot noir variety, all the experimental variants needed more leaf area to produce one kg of grapes, respectively one kg of sugar, so the yields were lower than the control.

In the Italian Riesling variety, the only variant that had a higher yield than the control was fertilized with Fertilpolina + Cropmax, while in the Chardonnay variety, the Fertilpolina + Cropmax and Humus Vita Stallatico fertilized variants registered superior yields. In the Feteasca neagra variety, no variant was more efficient than the control for photosynthetic performance per kg of sugar; the Fertilpolina and Humus Vita Stallatico variants had higher yields than the control for one kilogram of grapes.

In the Cabernet Sauvignon variety, all the experimental variants registered superior yields compared to the control for the production of one kilogram of grapes, while the Fertilpolina and Fertilpolina + Cropmax variants exceeded the control for the performance to produce one kg of sugar.

Table 3

The influence of the fertilization system on the grapes yield and quality in 2016

Variety	Fertilization	Yield (kg/ha)	Acidity (g/l H_2SO_4)	Sugar (g/l)	Sugar (kg/ha)	Difference to control	Significance
Italian Riesling	Conventional (C)	9851	5.7	188	1388.99		-
	Green manure	8079	6.6	180	1090.67	-298.33	00
	Fertilpolina	8481	5.9	184	1170.38	-218.61	0
	Humus Vita Stallatico	8224	6.2	183	1128.74	-260.25	0
	Fertilpolina+Cropmax	9471	6	186	1321.20	-67.79	-
Chardonnay	Conventional (C)	8783	5.5	194	1277.93		-
	Green manure	7125	6	186	993.94	-283.99	00
	Fertilpolina	7253	5.8	188	1022.67	-255.25	0
	Humus Vita Stallatico	7390	5.7	187	1036.45	-241.48	0
	Fertilpolina+Cropmax	8513	5.5	191	1219.49	-58.44	-
Feteasca neagra	Conventional (C)	8244	5	202	1248.97		-
	Green manure	6640	6	186	926.28	-322.69	00
	Fertilpolina	7249	5.2	197	1071.04	-177.93	0
	Humus Vita Stallatico	7014	5.6	194	1020.54	-228.43	0
	Fertilpolina+Cropmax	7610	5.1	199	1135.79	-113.17	-
Cabernet Sauvignon	Conventional (C)	8418	5	198	1250.07		-
	Green manure	6875	5.6	184	948.75	-301.32	00
	Fertilpolina	7520	5.3	192	1082.88	-167.19	-
	Humus Vita Stallatico	7243	5.6	186	1010.40	-239.67	0
	Fertilpolina+Cropmax	7832	5.1	196	1151.30	-98.77	-
Pinot noir	Conventional (C)	7063	4.6	207	1096.53		-
	Green manure	5354	5.3	193	774.99	-321.54	00
	Fertilpolina	6129	5	201	923.95	-172.58	-
	Humus Vita Stallatico	5758	5	198	855.06	-241.47	0
	Fertilpolina+Cropmax	6378	4.7	203	971.05	-125.48	-

DF Riesling Italian	5%	164.2	1%	283.3	0.1%	362.4
DF Chardonnay	5%	153.6	1%	274.8	0.1%	353.2
DF Feteasca neagra	5%	175.4	1%	290.1	0.1%	373.2
DF Cabernet Sauvignon	5%	169.2	1%	284.3	0.1%	370.1
DF Pinot noir	5%	176.1	1%	290.8	0.1%	374.5

The climate conditions of 2016 year negatively influenced the grape yield and quality in all varieties and experimental variants; grape yield was relatively low but still acceptable in the given conditions. None of the experimental variants exceeded the control regarding the grape yield. However the yield in the Fertilpolina + Cropmax variant, for the Italian Riesling and Chardonnay varieties was very close to the control. There were not very high differences between the variants, for the sugar content (g/ l); however in all varieties, the control plot registered superior values and the closest to the control was the Fertilpolina + Cropmax variant followed by the Fertilpolina variant.

The much more favourable climate from 2017 positively influenced both the grape yield and quality for all varieties and experimental variants. The obtained productions were larger and of higher quality compared to the previous year. The ranking of the experimental variants was similar to 2016. Also this year, no variant could surpass the control for production level, but the Fertilpolina + Cropmax variant recorded in all varieties values of production close to the control. Regarding the accumulated sugar concentrations, the differences between the experimental and control variants were much less obvious, and in the Italian Riesling variety, the Fertilpolina + Cropmax variant even exceeded the control sugar concentration. Garcia-Orenes et al. (2016) [8] found in their research, that inorganic and organic fertilization produced similar grapevine yields. Similar results were reported by Eman Abd El-Monem et al. (2008) [9] after two growing season's research; the grape yield per vine in Thompson seedless variety was not significant influenced after fertilization with mineral nitrogen fertilization and organic fertilizers. Organic compost and three different biofertilizers were studied by Hegazi et al. (2014) [10] in Flame seedless grapevine and their results revealed that both type of fertilizers were very efficient and increased yield per vine, the cluster number per vine and berry quality. However, Döring et al. (2015) [11] reported that the grape yields after organic and biodynamic treatments decreased due to the downy mildew higher incidence.

Table 4

The influence of the fertilization system on the grapes yield and quality in 2017

Variety	Fertilization	Yield (kg/ha)	Acidity (g/l H_2SO_4)	Sugar (g/l)	Sugar (kg/ha)	Difference to control	Significance
Italian Riesling	Conventional (C)	12352	5.4	205	1899.12		-
	Green manure	10576	6.1	202	1602.26	-296.86	00
	Fertilpolina	10975	5.7	205	1687.41	-211.71	0
	Humus Vita Stallatico	10720	5.9	201	1616.04	-283.08	0
	Fertilpolina+Cropmax	11975	5.4	206	1850.14	-48.98	-
Chardonnay	Conventional (C)	11275	5.1	212	1792.73		-
	Green manure	9623	5.7	206	1486.75	-305.97	00
	Fertilpolina	9752	5.2	210	1535.94	-256.79	0
	Humus Vita Stallatico	9895	5.4	209	1551.04	-241.68	0
	Fertilpolina+Cropmax	11023	5	211	1744.39	-48.34	-
Feteasca neagra	Conventional (C)	10735	4.6	226	1819.58		-
	Green manure	9130	5.5	206	1410.59	-409.00	00
	Fertilpolina	9759	5	216	1580.96	-238.62	0
	Humus Vita Stallatico	9521	5.1	216	1542.40	-277.18	0
	Fertilpolina+Cropmax	10120	4.6	221	1677.39	-142.19	-
Cabernet Sauvignon	Conventional (C)	10923	4.5	219	1794.10		-
	Green manure	9375	5.3	205	1441.41	-352.70	00
	Fertilpolina	10019	4.8	214	1608.05	-186.05	0
	Humus Vita Stallatico	9746	5.2	206	1505.76	-288.35	00
	Fertilpolina+Cropmax	10341	4.7	218	1690.75	-103.35	-
Pinot noir	Conventional (C)	9572	4.3	227	1629.63		-
	Green manure	7858	4.9	212	1249.42	-380.21	00
	Fertilpolina	8632	4.6	222	1437.23	-192.41	0
	Humus Vita Stallatico	8264	4.6	217	1344.97	-284.67	0
	Fertilpolina+Cropmax	8881	4.3	222	1478.69	-150.95	-

DF Riesling Italian	5%	166.8	1%	288.4	0.1%	370.5
DF Chardonnay	5%	154.7	1%	276.9	0.1%	360.8
DF Feteasca neagra	5%	177.2	1%	291.4	0.1%	410.3
DF Cabernet Sauvignon	5%	171.1	1%	286.5	0.1%	372.7
DF Pinot noir	5%	178.3	1%	293.4	0.1%	382.4

The sugar concentrations, the differences between the experimental and control variants were much less obvious, excepting the Italian Riesling variety fertilized with Fertilpolina + Cropmax which exceeded the control.

In tables 5 and 6 are presented data concerning the expenses and the cost of production per ton of grapes. The climate was unfavourable in 2016, leading to higher total expenditures per hectare for all varieties [12]. The organic fertilization variants, excepting for the Humus Vita Stallatico variant, had higher costs than the control; the most expensive were the variants fertilized with Fertilpolina + Cropmax, followed by variant fertilized with green manure, for all wine grape varieties.

In years with favourable climate during grapevine growing season such as 2017 (table 6), both the total expenses per hectare and the production costs per ton of grapes decreased for all varieties in all experimental variants [13]. The experimental variants ranking was absolutely identical to the previous year.

The higher prices of grapes and wine obtained from the organic fertilized variants (Table 7), show higher profit in all the experimental variants compared to the control, excepting the variant with green fertilizers in the Pinot noir variety. The most profitable in all grape varieties, was the experimental variant with Fertilpolina + Cropmax followed by the Humus Vita Stallatico variant. In 2017 the profit obtained was higher compared to the previous year for all varieties and for all experimental variants (Table 8); the variants ranking was identical to the previous year, but the profit differences between the experimental and control variants was higher than in 2016 in all varieties.

The results of Miele (2016) [14] after three year of research in Isabel grape variety (Brazil), show that under organic system, grape yields were 50% lower than conventional one, and the cost/kg of grapes were much higher, but the grapes were sweeter and less acid with a desirable sugar/acid balance.

Table 5

The influence of the fertilization system on the grapes cost price in 2016

Variety	Fertilization	Yield (kg/ha)	Experimental variety cost price (lei/ha)	Total costs (lei/ha)	Production cost (lei/ton of grapes)	Difference to the control
Italian Riesling	Conventional (C)	9851	1650	9350	949.1	-
	Green manure	8079	2200	9900	1225.4	276.3
	Fertilpolina	8481	2000	9700	1143.7	194.6
	Humus Vita Stallatico	8224	750	8450	1027.5	78.3
	Fertilpolina+Cropmax	9471	2600	10300	1087.5	138.4
Chardonnay	Conventional (C)	8783	1650	9350	1064.6	-
	Green manure	7125	2200	9900	1389.5	324.9
	Fertilpolina	7253	2000	9700	1337.4	272.8
	Humus Vita Stallatico	7390	750	8450	1143.4	78.9
	Fertilpolina+Cropmax	8513	2600	10300	1209.9	145.4
Feteasca neagra	Conventional (C)	8244	1650	9350	1134.2	-
	Green manure	6640	2200	9900	1491.0	356.8
	Fertilpolina	7249	2000	9700	1338.1	204.0
	Humus Vita Stallatico	7014	750	8450	1204.7	70.6
	Fertilpolina+Cropmax	7610	2600	10300	1353.5	219.3
Cabernet Sauvignon	Conventional (C)	8418	1650	9350	1110.7	-
	Green manure	6875	2200	9900	1440.0	329.3
	Fertilpolina	7520	2000	9700	1289.9	179.2
	Humus Vita Stallatico	7243	750	8450	1166.6	55.9
	Fertilpolina+Cropmax	7832	2600	10300	1315.1	204.4
Pinot noir	Conventional (C)	7063	1650	9350	1323.8	-
	Green manure	5354	2200	9900	1849.1	525.3
	Fertilpolina	6129	2000	9700	1582.6	258.8
	Humus Vita Stallatico	5758	750	8450	1467.5	143.7
	Fertilpolina+Cropmax	6378	2600	10300	1614.9	291.1

Table 6

The influence of the fertilization system on the grapes cost price in 2017

Variety	Fertilization	Yield (kg/ha)	Experimental variety cost price (lei/ha)	Total costs (lei/ha)	Production cost (lei/ton of grapes)	Difference to the control
Riesling italian	Conventional (C)	12352	1650	8850	716.5	-
	Green manure	10576	2200	9400	888.8	172.3
	Fertilpolina	10975	2000	9200	838.3	121.8
	Humus Vita Stallatico	10720	750	7950	741.6	25.1
	Fertilpolina+Cropmax	11975	2600	9800	818.4	101.9
Chardonnay	Conventional (C)	11275	1650	8850	784.9	-
	Green manure	9623	2200	9400	976.8	191.9
	Fertilpolina	9752	2000	9200	943.4	158.5
	Humus Vita Stallatico	9895	750	7950	803.4	18.5
	Fertilpolina+Cropmax	11023	2600	9800	889.1	104.1
Feteasca neagra	Conventional (C)	10735	1650	8850	824.4	-
	Green manure	9130	2200	9400	1029.6	205.2
	Fertilpolina	9759	2000	9200	942.7	118.3
	Humus Vita Stallatico	9521	750	7950	835.0	10.6
	Fertilpolina+Cropmax	10120	2600	9800	968.4	144.0
Cabernet Sauvignon	Conventional (C)	10923	1650	8850	810.2	-
	Green manure	9375	2200	9400	1002.7	192.4
	Fertilpolina	10019	2000	9200	918.3	108.0
	Humus Vita Stallatico	9746	750	7950	815.7	5.5
	Fertilpolina+Cropmax	10341	2600	9800	947.7	137.5
Pinot noir	Conventional (C)	9572	1650	8850	924.6	-
	Green manure	7858	2200	9400	1196.2	271.7
	Fertilpolina	8632	2000	9200	1065.8	141.2
	Humus Vita Stallatico	8264	750	7950	962.0	37.4
	Fertilpolina+Cropmax	8881	2600	9800	1103.5	178.9

Table 7

The influence of the soil fertilization system on the profit in 2016

Variety	Fertilization	Yield (kg/ha)	Production value	Profit	Difference to the control
Italian Riesling	Conventional (C)	9851	19702	10352	-
	Green manure	8079	24237	14337	3985.0
	Fertilpolina	8481	25443	15743	5391.0
	Humus Vita Stallatico	8224	24672	16222	5870.0
	Fertilpolina+Cropmax	9471	28413	18113	7761.0
Chardonnay	Conventional (C)	8783	17566	8216	-
	Green manure	7125	21375	11475	3259.0
	Fertilpolina	7253	21759	12059	3843.0
	Humus Vita Stallatico	7390	22170	13720	5504.0
	Fertilpolina+Cropmax	8513	25539	15239	7023.0
Feteasca neagra	Conventional (C)	8244	24732	15382	-
	Green manure	6640	26560	16660	1278.0
	Fertilpolina	7249	28996	19296	3914.0
	Humus Vita Stallatico	7014	28056	19606	4224.0
	Fertilpolina+Cropmax	7610	30440	20140	4758.0
Cabernet Sauvignon	Conventional (C)	8418	25254	15904	-
	Green manure	6875	27500	17600	1696.0
	Fertilpolina	7520	30080	20380	4476.0
	Humus Vita Stallatico	7243	28972	20522	4618.0
	Fertilpolina+Cropmax	7832	31328	21028	5124.0
Pinot noir	Conventional (C)	7063	21189	11839	-
	Green manure	5354	21416	11516	-323.0
	Fertilpolina	6129	24516	14816	2977.0
	Humus Vita Stallatico	5758	23032	14582	2743.0
	Fertilpolina+Cropmax	6378	25512	15212	3373.0

Table 8

The influence of the soil fertilization system on the profit in 2017

Variety	Fertilization	Yield (kg/ha)	Production value	Profit	Difference to the control
Italian Riesling	Conventional (C)	12352	24704	15854	-
	Green manure	10576	31728	22328	6474.0
	Fertilpolina	10975	32925	23725	7871.0
	Humus Vita Stallatico	10720	32160	24210	8356.0
	Fertilpolina+Cropmax	11975	35925	26125	10271.0
Chardonnay	Conventional (C)	11275	22550	13700	-
	Green manure	9623	28869	19469	5769.0
	Fertilpolina	9752	29256	20056	6356.0
	Humus Vita Stallatico	9895	29685	21735	8035.0
	Fertilpolina+Cropmax	11023	33069	23269	9569.0
Feteasca neagra	Conventional (C)	10735	32205	23355	-
	Green manure	9130	36520	27120	3765.0
	Fertilpolina	9759	39036	29836	6481.0
	Humus Vita Stallatico	9521	38084	30134	6779.0
	Fertilpolina+Cropmax	10120	40480	30680	7325.0
Cabernet Sauvignon	Conventional (C)	10923	32769	23919	-
	Green manure	9375	37500	28100	4181.0
	Fertilpolina	10019	40076	30876	6957.0
	Humus Vita Stallatico	9746	38984	31034	7115.0
	Fertilpolina+Cropmax	10341	41364	31564	7645.0
Pinot noir	Conventional (C)	9572	28716	19866	-
	Green manure	7858	31432	22032	2166.0
	Fertilpolina	8632	34528	25328	5462.0
	Humus Vita Stallatico	8264	33056	25106	5240.0
	Fertilpolina+Cropmax	8881	35524	25724	5858.0

The conclusion of Johansen (2010) [15] after comparison of costs and returns of conventional and organic Cabernet Sauvignon was that conventional costs were higher than the organic, but the profitability is different from one vineyard to another. The efficiency ratings of conventional and organic grape farms from Catalonia (Spain), was analysed by Guesmi et al. (2012) [16] and the results show that organic vineyards are more efficient than conventional one (efficiency ratings ranging between 0.80 and 0.64, respectively).

Conclusions

Organic viticulture is starting to develop not only in Europe but also in Romania, reason for which the organic fertilization and a variety of organic fertilizers are more and more used. However, the variants of organic fertilization must be very well correlated with the ecological resources in the area, climate during growing season and with the agrobiological characteristics of the grape variety. The variants with organic fertilization could not exceed in any of the research years, the classic fertilization variant with chemical fertilizers. However, the grape yields, in some variants (ex Fertilpolina + Cropmax) were very close to the control at all grape varieties. For the grapes quality, the differences registered between the organic fertilization variants and the control variant was very close, but without higher values. Although the most of the organic fertilization options required additional costs which increased the total expenses and cost price, they recorded net profit values higher than the control due to the higher market value of grapes and wine. The profit obtained in the organic variants is much higher if the growing season is favourable for grape development. The demand for organic grapes and wines is growing in Romania, which is a proof of a constant consumers group, with an increasing rate on the market.

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