RESEARCHES CONCERNING ECOLOGICAL FERTILIZATION IN VITICULTURE PLANTATIONS

CERCETARI PRIVIND FERTILIZAREA ECOLOGICA A PLANTATIILOR VITICOLE

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Abstract: *At the Bujoru Viticulture Research Station there was studied an ecological fertilizer for the Muscat Hamburg variety cultivated on sandy-loam chernozem. Other experimental fertilizing variants are: manure, green fertilizer and husks of grapes. Practicing an ecological viticulture is involving to improve and to preserve the soil fertility. Having in view this purpose it became imperious necessary to establish new viticultural ecotechnique, links which can allow to maintain and to perpetuate the state of soil pretability for vine culture. Organic fertilizers improve soil physical, chemical and biological properties and they reduce the compaction phenomenon by reducing the number of soil processing activities.*

Soil biological activity depends on the climatic conditions and its technological management. This research aims at the dynamics of soil microorganisms which ensure the nitrogen circuit and enzymatic activity during one year with green fertilizers added to the soil.

The results of this research may stand as background for certain conclusions of practical importance.

INTRODUCTION

Vine lives on the same place for a long period of time and therefore it is necessary that soil should be rich enough to allow an optimum development of plants. Traditional viticulture, by its technologies, led to the appearance of negative phenomena, such as: soil compactness, erosion, organic matter deprivation.

At present, the topic of keeping up an equilibrum for protecting the environment is a must. Ecological viticulture is based on raising the amount of organic matter in soil by using natural organic fertilizers.

We must point out that organic fertilizers bring their optimum contribution to crop growth only if they belong to a well-organized technological measure system, while the required doses should be in correlation with the plant itself, the soil, climatic factors and the crop type.

MATERIALS AND METHODS

Researches have been performed at the Bujoru Vinification and Viticulture Research Station during 1992-1996 on a chernozem type soil characterized by a moderate-to-satisfactory humus content. The experiment occurred on a plot after the subplot method with three repetitions on a Muscat Hamburg variety. Every year soil samples have been taken at 0-60cm depth for chemical and biological analyses.

Our study took into account the following variants:

- unfertilized
- manure fertilization
- green fertilization
- grapes husk fertilization

As green fertilizer, the spring vetch sown every two intervals has been used and which was incorporated in the soil after mowing and drying.

Biological determinations were done after methods used in the labs of the Faculty of Biology in Jassy, while chemical analyses after I.C.P.A.

RESULTS AND DISCUSSIONS

1.Pedological characterization of soils on the experimental plot

From data written in Table 1 (a, b) we conclude that the soil has a moderate-to-satisfactory humus content in the superior horizon, but it diminishes on the profile. The soil presents a weak alkaline reaction due to the presence of carbonates from soil surface downwards. The total nitrogen in the soil corresponds to the humus percentage in it. Because of its sandy-loam texture, the soil presents a low capacity of cationic exchange, an integral base saturation degree, due to the presence of carbonates and an index of chlorosis power (Table1c). Middle-to-good potassium input conditions and moderate phosphorous ones, as well as the almost satisfactory humus quantity show that the soil from the experimental plot suits the vine requirements for better crops.

Table 1

Pedological Characterization of Soil of the Experimental Plot

a) Physical Properties

b)

Type of soil	Horizon succession (cm)	Profile depth (cm)	Granulometric fractions (% of soil mineral mass)			
			fine sand	coarse sand	dust	clay
Chernozem	Am	0-40	71,31	7,79	9,98	10,91
	AC	41-68	56,37	9,52	20,00	15,19
	C/Ca	69-119	63,38	7,84	14,90	14,09
	D	>119	60,41	6,81	13,50	15,o2

b) Chemical Properties

Profile	Depth (cm)	Carbonates %	pH	Humus %	N total %	P_{AL} %	K_{AL} %
1	0-100	4,77	7,10	1,344	0,072	15,16	218,0
2	0-100	3,44	7,40	1,218	0,068	29,60	186,8
3	0-100	15,76	8,17	1,282	0,066	22,47	278,o
Average	0-100	7,99	7,55	1,278	0,066	22,41	227,6

2. Manure fertilization

The use of manure as a fertilizer is an old method employed by the ancient civilizations of the Middle East, China, India. Manure composition is determined by the quality of animal food, of their shelter or species. By using manure, the soil improves its qualities, due to the composition of the organic matter (Table 2).. The humus resulted from manure biodegradation increases the colloidal substance content which has as effect the increase of cationic exchange capacity, soil tamponing capacity, being a source of organic matter which can be mineralized more easily than by micro-organisms.

Table 2

Manure Composition Used in Soil Fertilization

Nutritive Element	Total Input at 20t/ha (kg)
Nitrogen	100
Phosphorous	50
Potassium	90
Calcium	100
Magnesium	30
Organic Substances	4500

3. Green fertilization

Green fertilizers are vegetable cultures (particularly vegetables and graminaceae mixes) with short vegetation period and strong spread, cultivated to be incorporated in the soil to increase fertility. Green fertilization acts like a large quantity of manure. Green fertilizers generate an extra amount of nitrogen and a minus in phosphorous and potassium.

By incorporating them into the soil, nutritive substances are fixed by the humus and they are no longer lost. Spring fodder (vetch), made up of pea and oats sown very early in spring, has been used in this study. The chemical composition of the cultivated plants is shown in Tables 3a and 3b. From the analysis of these data we notice that they bring into the soil important quantities of organic matter and nutritive elements absorbed by the vine.

Table 3a

Green Fertilizer Composition

Cultivated Plant	Analyzed Organ	Organic Matter %	N%	P%	K%
Pea	Stems	85	2,90	0,25	1,80
	Roots	86	1,40	1,70	1,50
Oats	Stems	93	1,70	0,30	2,20
	Roots	55	0,90	1,80	1,60

Table 3b

Green Fertilizers Organic Matter and NPK Amount

Cultivated Plant	Organic Matter Kg/ha		N%		P%		K%	
	Stems	Roots	Stems	Roots	Stems	Roots	Stems	Roots
Pea	1170	270	33,6	3,75	2,95	4,65	22,0	4,15
Oats	1190	70	6,5	O,65	1,25	1,22	8,51	1,10

4. Fertilization with composted grapes husk

The grapes husk is a subproduct resulted from grapes processing and it contains clusters, peels and seeds. We use composted grapes husk for fertilization. It is not to be used fresh because it has an acid reaction and may change soil reaction. Researches have shown that the grapes husk resulted from red grapes vinification may have a phytotoxic effect due to its high polyphenol content. The composted grapes husks used as fertilizer improves soil structure and increases its nutritive element content. In grapes husk composition, nitrogen and phosphorous were most important within our experiment (Table 4).

Table 4

Composted Grapes Husk Composition (related to dry substance)

Nutritive Element	Quantity kg (for 20t/ha)
Nitrogen	2,0
Phosphorous	0,8
Potassium	3,0
Calcium	1,1

5. Soil humidity dynamics

In order to determine humidity dynamics, every year have been taken soil samples at depths of 0-60 cm during vegetation period. Soil humidity influences both microorganism activity and nutritive element dynamics in the relation plant-soil. It is basically influenced by rainfalls and the applied technology.

The data shown in Table 5 demonstrate that in August and September a decrease in humidity occurred because rainfalls couldn't ensure the optimum water level in soil. The variants with manure and husk fertilization have ensured an increase in humidity as compared to unfertilized and green fertilization .

Table 5

Soil Humidity Dynamics during vegetation period

Variant	Month						Average
	IV	V	VI	VII	VIII	IX	
Unfertilized	14,2	14,2	12,9	8,9	8,2	8,5	11,1
Manure fertilization	16,2	15,0	13,5	10,3	8,7	9,0	12,1
Green fertilization	13,6	13,2	12,6	9,8	8,3	8,7	11,0
Grapes husk fertilization	14,8	14,6	13,5	9,4	8,4	8,8	11,6

6. The dynamics of soil nutritive elements

Plant needs are conditioned by soil-plant interaction.

Crop efficiency is determined by fertilizers because they modify soil-plant relation, ensures a food supplement, modifies the solubilization process and substance retain in the soil. Both in grapes husk and manure fertilization, we notice a substantial increase of the humus, nitrogen, phosphorous and potassium contents.

At the same time, a slight decrease of pH values from weakly- alkaline- to- neuter takes place (Table 6). The use of green fertilizers for viticulture plantations is a valid solution, if we think that soil quality is being improved with nutritive elements. This method somehow restrictive for areas with less than 500 ml annual rainfalls or with no irrigation at all.

Table 6

Soil Nutritive Elements Dynamics

Variant	Depth cm	Humus%	P_{AL} ppm	K_{AL} ppm	pH in H_2O
Unfertilized	0-20	1,80	51,53	110	7,79
	20-40	0,80	15,80	100	7,64
	40-60	0,73	14,36	87	7,62
	Average	1,11	27,23	99	7,68
Manure Fertilization	0-20	1,98	41,45	133	7,44
	20-40	1,44	7,98	80	7,43
	40-60	1,06	12,31	73	7,85
	Average	1,49	20,58	95	7,57
Grapes Husk Fertilization	0-20	2,00	32,36	140	7,85
	20-40	1,22	15,70	120	7,46
	40-60	0,82	12,79	113	7,55
	Average	1,34	20,28	124	7,62
Green Fertilization	0-20	1,98	11,02	107	8,18
	20-40	1,10	16,94	77	8,14
	40-60	0,82	7,82	76	7,87
	Average	0,68	11,92	86	8,06

7. Soil nitro-microorganisms

Soil fertilization have produced changes concerning water and nutrient input degree and they influenced its microflora. Data presented in Table 7 show that the amount of nitro-microorganisms in the soil varies according to the moment of determinations. Total microflora is weakly represented at the beginning of the vegetation period (May 5) compared to that during the vegetation (July 30). Aerobic and anaerobic microorganisms which fix the nitrogen into the soil are well represented at green fertilizers variants. Ammonification was stronger at organic fertilization variants. Manure and green fertilizers stimulate soil microbian activity. The activity of denitrificators is reduced due to low soil humidity during vegetation period in all the years of experimentation.

Table 7

Fertilizer Influence and Soil Upkeep over Nitro-microorganisms Activity (the average of 1992-1996)

Microorganisms /1g soil	Unfertilized	Manure	Grapes husk	Green fertilizers
May 5				
Total microflora	$25x10^{12}$	$25x10^{13}$	$70x10^{12}$	$45x10^{14}$
Aerobic nitrofixers	45	95	125	250
Anaerobic nitrofixers	25	5	15	25
Ammonificators	$25x10^{4}$	$95x10^{5}$	$65x10^{4}$	$75x10^{5}$
Nitros	45	50	75	75
Nitrics	55	75	120	150
Denitrificators	0,5	0,8	0	0,5
July 30				
Total microflora	$45x10^{14}$	$95x10^{6}$	$95x10^{14}$	$95x10^{16}$
Aerobic nitrofixers	65	150	145	2500
Anaerobic nitrofixers	45	75	95	150
Ammonificators	$45x10^{5}$	$95x10^{6}$	$55x10^{5}$	$95x10^{6}$
Nitros	65	100	80	150
Nitrics	95	250	130	450
Denitrificators	75	90	60	80

8. Grapes production

The values concerning grapes production show us a positive relation between production and fertilization (Table 8). All these three methods of fertilization have ensured productions superior to the non-fertilized witness.

Table 8

The Muscat Hamburg Variety Production

Variant	Average Production Kg/vine	Calculated Production t/ha	Sugar content g/l	Acidity g/l H_2SO_4
Non-fertilized Witness	3,140	12,6	185	4,5
Green Fertilizers	3,340	13,4	181	4,6
Manure	3,880	15,5	174	4,7
Grapes Husks	3,610	14,4	179	4,7

CONCLUSIONS

Green fertilizers improve soil physical, chemical and biological properties and they reduce the compaction phenomenon by reducing the number of soil processing activities.

By using manure, the soil increases its humus content and micro-organism activity.

Composted grapes husks optimize soil structure and enrich its nutritive element content.

Soil biological activity is influenced by climatic conditions and microorganism activity is stimulated by organic fertilizers.

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