RESEARCHES CONCERNING THE MODIFICATION OF SOME AGROCHEMICAL QUALITIES OF VINE-PLANTED SOILS UNDER THE INFLUENCE OF AGROTECHNICAL LINKS

CERCETĂRI PRIVIND MODIFICAREA UNOR ÎNSUŞIRI AGROCHIMICE ALE SOLURILOR DIN PLANTAȚIILE VITICOLE, SUB INFLUENȚA LUCRĂRILOR AGROTEHNICE

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Abstract. *Among the agrotechnical measures applied to vines, soil fertilization and maintenance play an important role in establishing an equilibrium between vegetative growths and vine fertile capacity, with the purpose of producing a high-quality crop. Fertilizer efficiency is determined by the quantities used and the equilibrium between the different nutrients corresponding to plant requests and soil qualities, so that modifications in the soil substance general dynamics be favourable to the plants.*

The increase of grapes production on surface unit represents an objective necessity which can't be achieved without chemical or organic fertilization. Soil maintenance system from viticulture plantations must ensure nutrient reserve permanent supplement, the improvement of soil structure and its physical, chemical and biological qualities.

METHOD AND MATERIAL

Researches were performed at the Bujoru Research Station for Viticulture and Wine Production in the Galatz County. The study has been done on the Muscat of Hamburg 1978, grafted on the Berlandierix Riparia Kober 5 BB stock. The soil on the experimental plot is a chernisol , chernozem type whose general morphology is presented by a series of layers Am-AC-Cca-D, formed on the loess clays to be found on the Dealurile Bujorului viticulture plantation. The good potassium and moderate phosphorous supply conditions ,easily accessible to plants, as well as the almost satisfactory humus content make the soil under analysis correspond to an optimum growth of the vine. The experiment was performed in the field in subdivided plots, with three repetitions. Every year, 0-40 cm soil samples have been taken to analyze the dynamics of humidity and nutrients. The study took the following variants into account:

- witness (without fertilization0
- mineral fertilization
- manure fertilization
- spring/ green fodder fertilization
- black field
- herbicide treatment.

For mineral fertilization the following fertilizers have been used: ammonium nitrate (50, 75,100 kg/ ha), in spring, potassium salt (60 kg/ ha), and simple superphosphate (40 kg/ha), during autumn plowing. As green fodder we used autumn vetch, every two intervals, which has been mown during vegetation period and after drying, it was incorporated in the soil. The black field was achieved by two basic treatments (spring and autumn plowing) and 2-3 superficial treatments during vegetation. The herbicides used were simadon (preemergent) =8kg/ha and Roundup during vegetation period on weed-covered areas.

Soil analyses and determinations were done after ICPA methodology. The observations and analyses comprised:

- the water input degree through the dynamics of soil water;
- nutrient dynamics in soil;
- organic matter balance produced by green fodder.

RESULTS AND DISCUSSIONS

1. Soil Humidity Dynamics

During the experiment, soil samples have been taken in order to determine the dynamics of humidity between 0-60 cm. We conclude that the water supply varies according to rainfalls and the upkeep system. From Table 1 we see that in July, August and even September soil humidity go under 50% in IU.A, but without reaching the withering coefficient, values that coincide with the minimum rainfall values. During drought periods, humidity values in depth were low. For herbicide variants a slight rise in humidity can be seen due to slower evaporation. Green fodder, even if it was mown in June, has reduced soil humidity as a result of plant fight for water. Manure has ensured a higher humidity as compared to mineral fertilization.

Table 1

The Dynamics of Soil Humidity during Vegetation Periods under the Influence of Upkeep and Fertilization Systems

Treatment Type	Month						Average	% of I.U.A.
	IV	V	VI	VII	VIII	IX		
Unfertilized black field	14,2	14,2	12,9	8,9	8,2	8,5	11,1	52,0
Black field+ mineral fertilization	14,8	14,6	13,5	9,4	8,4	8,8	11,6	54,2
Black field+ manure	16,2	15,0	13,5	10,3	8,7	9,0	12,1	56,7
Black field+green fodder	13,6	13,2	12,6	9,8	8,3	8,7	11,0	51,6
Herbicides+ unfertilized	14,6	14,5	13,2	9,4	8,6	8,9	11,5	53,9
Herbicides+ mineral fertilization	15,2	14,8	13,6	9,9	8,8	8,9	11,8	55,7
Herbicides+ manure	15,7	15,7	14,0	10,6	9,1	9,3	12,4	58,2
Herbicides+green fodder	14,6	14,5	13,1	10,3	8,7	9,1	11,7	54,8

2. Soil Agrochemical Changes

At the beginning, soil samples from the experimental plot were taken in order to determine the degree of organic matter and nutrient supply in soil and fertilizer amounts to be administered yearly and periodically (manure).

Every year, soil samples (0-60 cm) were taken at the end of blossoming and when they are ripe to watch the evolution of soil supply with fertilizers.

A. Organic Matter in Soil

If a soil is to keep up its fertility, its humus reserve must be enriched with organic matter. If the humus reserve is low, efforts must be made to either preserve it or even enhancing it up to reaching a maximum productivity.Soil humus is not stable, it turns into minerals 1-2% yearly, which represents a loss of 1,000-1,500 kg humus annually (D.Davidescu, 1992). Part of this loss is being compensated by using manure, fertilizers or composted vine leaves and weeds which are incorporated in the soil.

In this experiment, soil supply with organic matter has substantially increased when manure and green fodder fertilization were used, and less in case of mineral fertilization. (Table 2.)

Table 2

The Effect of Fertilizers upon the Humus Content in Soil (%)

Depth cm	Variant					
	Unfertilized	$N_{50}P_{40}K_{60}$	$N_{75}P_{40}K_{60}$	$N_{100}P_{40}K_{60}$	Manure	Green Fodder
0-20	1,567	2,128	2,131	2,279	2,452	2,286
20-40	0,930	1,299	1,352	1,947	1,974	1,645
40-60	0,508	0,822	0,871	0,871	1,379	1,080

The manure used was 40t/ha. Its characteristics are shown in Table 3.

Table 3.

Manure Composition used in Organic Fertilization (40t/ha)

Dry Substance		Total Nitrogen		P_2O_5		K_2O	
Kg/ha	%	Kg/ha	%	Kg/ha	%	Kg/ha	%
10200	25,5	183,6	1,8	102	1,0	81,6	0,8

The humus quantity resulted from the manure administered, at an average isohumic coefficient of 0.4 and an average of dry substance of 25.5% is, in the end, 4,080 kg/ ha annually. Soil quality is improved by applying manure with its organic matter introduced which keeps desintegrating in the soil , part of it changing into humus, another part – into minerals. The humus resulted from manure biodegradation increases the content of colloidal substances which determine the increase in cationic change, the increase of soil tamponing for microorganisms .

Nitric and carbonic acid resulted from manure mineralization process accentuates hydrolysis and solubilization of some mineral compounds which contain phosphorous, potassium and other elements. Organic fertilizers behave like enthropic factors that change to a certain extent the general direction of chemical reactions whici develop spontaneously into the soil with loss of energy, contributing to soil fertility increase. (Lixandru Gh. ,1990)

Green Fodder Biomass

Green fodder biomasss and its content in N P K is determined by the plant we cultivate and the rainfall regime during the experiment. The green fodder used was The Hungarian vetch made up of pea and oats. It was sown in early spring and it was mown when the pea was in blossom. After mowing, it was left as mixtures on the soil until drying (2-3 weeks), being incorporated into the soil. The height and the weight of plants was not characteristic to cultivated plants because they were influenced by the drought that occured during the years of experimentation. In Table 5, there is the quantity of green, dry mass we got from each ha we put seed into (2,500 m2).

The pea offered 1,362 kg green stems on ha and 310 kg roots, while oats represented 1,280 kg stems nd 365 kg roots, the pea dry mass being 389 stems and 138 kg roots , but also 402 kg stems and 120 kg roots for oats. The highest content of organic matter (92.6%) is to be found in oats stems, while the lowest in the oats roots (Table 4).The highest nutrient level (N P K) is found in pea stems.

Annually, the green fertilizers improve the soil nutritive potential from 1 ha with 39.9 kg nitrogen, 4.13 kg phosphorous and 30.27 kg potassium through their stems and 4.32 kg nitrogen, 5.81 kg phosphorous and 5.19 kg potassium through roots (Tables 5,6).

Table 4

Green Fodder Quantity

The Plant	Stems		Roots	
	Kg/m^2	Kg/ha	Kg/m^2	Kg/ha
a. Fresh mass				
Pea	0,545	1332	0,124	310
Oats	0,512	1280	0,146	365
b. Dry mass				
Pea	0,156	389	0,055	138
Oats	0,161	402	0,048	120

Table 5

Green Fodder Organic Matter and NPK Content

Plant	Organ	Organic Matter (%)	N %	P %	K %
Peas	stems	85,6	2,88	0,25	1,82
	roots	86,4	1,39	1,72	1,53
Oats	stems	92,6	1,68	0,32	2,26
	roots	54,9	0,90	1,82	1,64

Table 6

Green Fodder Organic Matter and NPK Input

Plant	Kg/ha							
	Organic Matter		N		P		P	
	stems	roots	stems	roots	stems	roots	tulpini	roots
Peas	1167	268	33,59	3,73	2,94	4,61	21,8	4,11
Oats	1185	66	6,31	0,59	1,19	1,20	8,47	1,08

B. The Dynamics of Nutrients in Soil

The efficiency of fertilizers is determined by the quantity and by the equilibrium between various elements corresponding to plant requirements and soil quality so that the modifications of substances in soil should be favourable to plants. The biological inclusion of fertilizers due to microorganisms is only temporary and makes up the reserve of nutrients which ultimately, through the biochemical change , ensures the elements accessible to plants. Plant needs are given by plant-soil interaction , but when the nutrients accessible are sufficient , plants assimilate them with less effort. When they are in insufficient, they are assimilated with bigger efforts, with a higher energy consumption which is taken by the living cell during cellular bioxydation in the process of respiration , in other words assimilation takes place with a small efficiency – and so the plants will grow badly. A richer crop is given by the fertilizers because they modify the relation soil-plant, ensures a food supplement, modifies the process of solubilization and substance upkeep in the soil, the ratio between various solluble substances and the adsorbtion which influences root absorbtion of some nutrients.

The data reffering to the dynamics of nutrients in soil are shown in Table 7 .

Table 7

NPK Content Variation in Soil (Mobile Forms) under the Influence of Fertilizers Applied to Soils (ppm)

Variant	Soil Upkeep as Black Field						Soil Upkeep through Herbicide Treatment					
	N*		P*		K*		N*		P*		K*	
	I	P	I	P	I	P	I	P	I	P	I	P
Unfertilized	74,7	41,0	38,9	20,5	172,7	106,3	87,4	43,7	40,2	21,3	180,9	117,3
N50P40K60	141,4	73,0	49,4	30,3	189,6	116,8	160,2	80,7	51,7	28,3	202,5	131,0
N75P40K60	166,0	85,2	53,9	34,0	205,7	125,0	179,0	90,4	55,1	35,6	211,7	151,9
N100P40K60	196,5	100,5	55,6	28,9	210,1	141,3	197,9	101,2	60,8	37,6	225,0	150,4
Manure	213,2	110,2	40,1	20,2	200,8	139,5	220,7	111,0	41,9	25,5	235,9	159,1
Green Fodder	154,0	81,5	58,8	25,4	243,3	139,8	144,5	81,5	61,3	26,4	251,3	157,8

Where: I= In bloom; R= Ripe

Fertilizer application has changed the content and the equilibrium between soil nutrients due to the quantities and the type of fertilizers under use. By applying nitrogen as ammonia nitrate for 5 consecutive years, there occurred an accumulation of ammoniacal and nitric nitrogen. This accumulation was evident in the 0-40 cm layers and it preserved this high level up to 60 cm in depth as compared to the witness variant. On vegetation stages , higher values have been noticed during blossoming. The herbicides have acted upon the assimilable nitrogen on soil profile, which by weed extermination, have increased nitrogen accesibility and absorbtion by vine roots.

The periodic application of manure (40t/ha) improved soil mobile nitrogen content.

The use of green fertilizers for viticulture plantations as replacement for the manure which is scanty seems to be an encouraging solution if we see the influence upon soil properties in terms of nutrient upkeep. This method proved restrictive for areas with under 500 mm yearly rainfalls. The superphosphate used for mineral fertilization led to a limited phosphorous leaching (levigation) in depth as compared to nitrogen.Stronger accumulations of this element were noticed in years 3-4 after application, on superior levels, particularly in the black field. This accumulation may be explained by the scarce rainfalls during the experiment. As a result, this element must be introduced at depths bigger than 20 cm (Arutunian and Kadish, 1964 quoted by Pituc, 1975).

The assimilable potassium registered the same dynamics of going in depth just like the assimilable phosphorous, but to a more accentuated way with a tendency of leaching in depth by the end of the vegetation period. Green fodder ensures a better distribution of the phosphorous and potassium on soil profile through the improvement of its hydrophysical qualities.

CONCLUSIONS

1. Soil supply with organic matter has increased substantially in case of manure and green fodder fertilization.

2. Soil fertilization with larger nitrogen doses on a phosphorous and potassium fertilization have ensured a NPK good level all along the vegetation period as compared to the unfertilized witness.

3. The herbicides under use have contributed to a better weed control, which ensured a better vine nutrition.

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