# RESEARCH REGARDING THE CHEMICAL FERTILIZATION OF THE WINE GROWING PLANTATION IN A LONG TERM TRIAL

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***Abstract***

*The paper based on the research carried out in a long term trial (2002-2012) placed in Biharia, Bihor county. The cultivar used: Fetească Regală*

*The long term application of the chemical fertilizers has led to an increase crop towards the non fertilized soils only if the yearly N150, P150 and K150 mixture was used or only if N 100 has been exclusively used, while huge doses of fertilizers have led to a lack of Fe and K, in the case of the nitrogen fertilization, to a lack of N and Zn in the case of the phosphorus fertilization and to a lack of Mg in the case of the potassium fertilization. These fertilizers have diminished the vigor, the fruit bearing, the resistance quality and the longevity of the vines.*

*The reaction, in time, of the grape vine to a long term application of chemical fertilizers has always been favorable at the NPK mixture and at the N element applied exclusively. Through the exclusive application of the phosphorus the reaction was favorable only in the first 4 years, through the potassium application the reaction was favorable in the first 6 years, when the crop was superior to the crop realized by nitrogen application. The exclusive application of the nitrogen has led to a crop cease after 9years.The exclusive application of the phosphorus and of the potassium has led to a progressive decrease of the crop far below the crop obtained on the non fertilized soil, after 8 years of utilization.*

**Key words** : chemical fertilization , wine growing plantations

## INTRODUCTION

In order to obtain a superior production, both in quantity as well as in quality, on the intensive type of wine growing production, in conditions of high economic efficiency, it is necessary to adopt a rational system of soil maintenance, a system which is able to eliminate the risk of environment pollution and the risk of wine growing pollution.

The research upon the chemical fertilization has been done over a period of 10 years.

The experience related to the long term appliance of the chemical fertilizer with N, P, K has been surveyed between the years 2002-2012 on an area having Fetească Regală, clon 21 planted on it, grafted on Kober 5BB. The plantation has been set up in 1993, at a distance of 2x1.2 meters so there were 4167 vines on a whole hectare.

The long term application of thr chemical fertilizers has led to an increase crop towards the non fertilized soils only if the yearly N150, P150 and K150 mixture was used or only if N 100 has been exclusively used.

**MATERIAL AND METHOD**

The experience related to the long term appliance of the chemical fertilizer with N, P, K has been surveyed between the years 2002-2012 in Biharia an area having Fetească Regală, clon 21 planted on it, grafted on Kober 5BB. The plantation has been set up in 1993, at a distance of 2x1,2 meters so there were 4167 vines on a whole hectare.

Tabel 1

The experimentation chart had 20 alternatives as it follows:

| | | | |
|---|---|---|---|
| V1 - N50 | V6 - N300 | V11 – P250 | V16 – K200 |
| V2 - N100 | V7 – P50 | V12 - P300 | V17 – K250 |
| V3 – N150 | V8 – P100 | V13 –K50 | V18 – K300 |
| V4 – N200 | V9 – P150 | V14 – K100 | V19 – N150, P150, K150 |
| V5 –N250 | V10 – P200 | V15 – K150 | V20 – N0, P0, K0 |

V is the Romanian for alternative.

The disposal of the alternatives in the field has been done in a Latin rectangle with 4 repetitions. The chemical fertilizers have been applied at a depth of 16 -18 cm in the same time when the spring ploughing was done.

The observations, determinations and analyses referred to the: water stability of the aggregates from the soil; to the soil humidity; to the pH in watery extract; to the humus; to the N, P, K, from the system soil-plant; to the number of bacteria and fungi from the soil; to the herbicide remains from the soil and plant; to the vigor and the longevity of the vines; to the production of grapes and its quality (sugar and acid aspect of the must), etc.

**Experimentation conditions**

During the experimentation period, the rain chart has registered superior values versus the normal value over a period of 50 years. The distribution of the rains and the frequency of the years with optimum conditions for natural grassing is presented in *Table 2*

*Table 2*

Distribution of the rains and the frequency of the years with optimum conditions for covering cultures during the experimental period.

| Period | Average rains mm | Variation limits mm | Frequency of the years with optimum conditions % |
|---|---|---|---|
| Yearly | 698 | 473 -1000 | 50 |
| Vegetation period | 465 | 248 -735 | 40 |
| Spring | 182 | 83 -393 | 30 |
| Summer | 227 | 70 -369 | 20 |
| Autumn –winter | 289 | 157 -528 | 60 |

During the vegetation period 66% of the yearly rains have fallen. In spring time 25% of the rains have been registered, 35% in summer and 40% in autumn, out of the total yearly rains.

The soil from the experimented lot is brown-red, with a content of 1,9% of humus.

**RESULTS AND DISCUSSIONS**

The effect determined by the long term application of chemical fertilizers with N, P, K, on wine growing plantations are shown in Table 3.

*Table 3*

Effects determined by the long term application of chemical fertilizers with N, P, K, on wine growing plantations (the Fetească Regală sort, clon 21, 2002-2012)

| Determination | Non fertilized soil | N300 | P300 | K300 |
|---|---|---|---|---|
| Physics and chemistry of the soil | | | | |
| Water stability of the soil aggregates at a: | | | | |
| Depth of 0-10cm | 79 | 88 | 80 | 72 |
| Depth of 0-60cm | 80 | 81 | 81 | 79 |
| pH in the water | 7.9 | 7.6 | 7.8 | 7.7 |
| Humus % | 1.8 | 2.0 | 1.6 | 1.9 |
| N-NH4 (mg/100g of soil) | 0.5 | 1.2 | 0.5 | 0.4 |
| N-NO3 (mg/100g of soil) | 0.6 | 5.3 | 0.4 | 0.6 |
| N-NH4NO3 (mg/100g of soil) | 1.1 | 6.5 | 0.9 | 1.0 |
| PAL (mg/100g of soil) | 9.0 | 6.0 | 84.0 | 16.0 |
| KAL (mg/100g of soil) | 20.0 | 13.0 | 21.0 | 66.0 |
| Microbiology of the soil | | | | |
| Bacteria (106 /g of dried soil) | 287 | 321 | 147 | 234 |
| Fungi (103 /g of dried soil) | 88 | 290 | 136 | 118 |
| N remains (mg/100g of soil) | - | 5 | - | - |
| P remains ( mg/100g of soil) | - | - | 75 | - |
| K remains (mg/100g of soil) | - | - | - | 43 |
| Intensity and quality of the mineral nutrition | | | | |
| N, totalized % from the organs of the vine | 4.03 | 6.91 | 2.52 | 3.77 |
| P, totalized % from the organs of the vine | 0.84 | 0.56 | 1.24 | 0.61 |
| K, totalized % from the organs of the vine | 7.84 | 5.68 | 8.64 | 8.71 |
| Totalized global nourishment | 12.71 | 13.15 | 12.40 | 13.09 |
| Vigor, fruit bearing resistance and longevity of the vines | | | | |
| Fresh phyto weight of wood and leaves (kg/vine) | 0.6 | 1.3 | 0.5 | 1.1 |
| Grape production (tons/hectare) | 13.2 | 15.4 | 11.5 | 14.9 |
| Relative production towards the non fertilized soil | 100 | 116 | 88 | 105 |
| Must sugar (g /l | 206 | 181 | 211 | 217 |
| Must acidity (g/ l of H2SO4 ) | 4.1 | 4.6 | 4.1 | 4.2 |
| Frequency of the vines with flouring attack (%) | - | Fe | Zn | Mg |
| Gaps from the plantation at the age of 25 years (%) | 3 | 11 | 7 | 4 |

The N fertilizers and to a lower extent the P ones, have increased the water stability of the soil, whereas the K fertilizers have deteriorated it.

The reaction of the soil has been diminished to a certain extent by applying huge doses of N.

When the P fertilizers were applied the humus content from the soil decreased. The N and K fertilizers have led, in time, to a certain increase of the humus content in the soil.

The number of bacteria and fungi from the soil was bigger when the N and K fertilizers were used.

The remains of the chemical fertilizers resulted after a long term application of the fertilizers in maximum doses (300 grams/hectare), have been of 5 mg of N, 75 mg of P and 45 mg of K for 100 grams of soil. These fertilizers have negatively influenced the resistance, the quality of the wine growing plantation and the longevity of the vines. These fertilizers also led to a lack of Fe during the nitrogen fertilization, to a lack of Zn during the phosphorus fertilization and to a lack of Mg during the potassium fertilization when the respective fertilizers have been applied in huge, exaggerated doses.

The chemical fertilizers have specifically influenced the intensity and the quality of the mineral nutrition with nitrogen, phosphorus and potassium. The global nourishment has been dominated by N in what the nitrogen fertilizers were concerned, by P for the phosphorus fertilizers and by K for the potassium ones.

The chemical fertilizers with N and K have positively influenced the vigor of the vines and the grape production, while the P fertilizers have diminished them. The content of the sugar in the must has been superior at the alternatives fertilized with P and especially to those fertilized with K.

The synthesis of the production results registered under the influence of the long term application of the chemical fertilizers (2002-2012) is presented in Table 4.

*Table 4*

Synthesis of the production results registered under the influence of the long term application of the chemical fertilizers (The Fetească Regală sort, clon 21, 2002-2012)

| Alternative | Grape production Tons/hectare | Relative production towards the non fertilized soil | **Statistical signification** |
|---|---|---|---|
| N50 | 15.2 | 114.8 | |
| N100 | 17.2 | 129.7 | ** |
| N150 | 17.0 | 128.4 | ** |
| N200 | 16.9 | 128.1 | ** |
| N250 | 16.0 | 120.8 | * |
| N300 | 15.4 | 116.4 | |
| P50 | 14.3 | 107.8 | |
| P100 | 12.7 | 95.9 | |
| P150 | 11.8 | 89.3 | |
| P200 | 11.7 | 88.5 | |
| P250 | 11.6 | 88.0 | |
| P300 | 11.5 | 87.7 | |
| K50 | 11.4 | 85.9 | |
| K100 | 12.3 | 92.5 | |
| K150 | 12.9 | 97.4 | |
| K200 | 13.4 | 101.0 | |
| K250 | 13.5 | 101.4 | |
| K300 | 13.9 | 105.3 | |
| N150 P150 K150 | 18.8 | 141.6 | *** |
| Non fertilized soil | 13.2 | 100.0 | |
| X* | 14.1 | 106.4 | |

LSD 5% = 2.6 tones/hectare; LSD 1% = 3.4 tones/hectare; LSD 0,1% = 4.3 tones/hectare

A high level of crop was obtained for the types N150, P 150, K150 with an increase of 41.6 %, a very significant increase, followed by the N 100 type with an increase of 29.7 %, distinctively significant towards the non fertilized soil. Low increases of production, insignificant ones, have been obtained for P 150 and for K150-300.

Only the NPK and the N fertilizers have ensured the rise of the grape production and its maintenance at a high level during the experimentation period.

After 10 years of exclusive application, the N fertilizers have led to a cease of the grape production. The P and K fertilizers led to a production superior to the production realized with the help of the N fertilizers in the first 4 – 5 years of application; still, after 10 years of application, the grape production for the respective alternatives was situated under the production obtained on the non fertilized soils.

**CONCLUSIONS**

The long term application of the chemical fertilizers has led to an increase crop towards the non fertilized soils only if the yearly N150, P150 and K150 mixture was used or only if N 100 has been exclusively used, while huge doses of fertilizers have led to a lack of Fe and K, in the case of the nitrogen fertilization, to a lack of N and Zn in the case of the phosphorus fertilization and to a lack of Mg in the case of the potassium fertilization. These fertilizers have diminished the vigor, the fruit bearing, the resistance quality and the longevity of the vines.

The reaction, in time, of the grape vine to a long term application of chemical fertilizers has always been favorable at the NPK mixture and at the N element applied exclusively. Through the exclusive application of the phosphorus the reaction was favorable only in the first 4 years, through the potassium application the reaction was favorable in the first 6 years, when the crop was superior to the crop realized by nitrogen application. The exclusive application of the nitrogen has led to a crop cease after 9years.The exclusive application of the phosphorus and of the potassium has led to a progressive decrease of the crop far below the crop obtained on the non fertilized soil, after 8 years of utilization.

A correct evaluation of the effects determined by a long term practice of the different chemical fertilization systems of the soil on wine growing plantations (10 years)and a correct evaluation of the possibilities and of the limits of exclusive applications of the soil works, of the herbicides, of grassing, and of fertilization with potassium and phosphorus needs a systematic use, in an ecological concept, of the different technical solutions which the intensive type wine growing has.

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