DETERMINATION AND ANALYSIS OF THE TOTAL FORMS OF NUTRIENTS FROM THE PLANT MATERIAL OF THE VARIETY ALIGOTE, INTO AN EXPERIENCE STATIONARY WITH FERTILIZERS, IN THE CONDITIONS OF THE VINEYARD IASI

DOZAREA ŞI ANALIZA FORMELOR TOTALE DE ELEMENTE NUTRITIVE DIN MATERIALUL VEGETAL LA SOIUL ALIGOTE, ÎNTR-O EXPERIENȚĂ STAȚIONARĂ CU ÎNGRĂŞĂMINTE, ÎN CONDIȚIILE PODGORIEI IAŞI

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Abstract: *Foliar diagnosis of nutrition by chemical analyses is an extended method, by which are analyzed some vegetative parts (especially leave, but also nervures, petiole, young buds, or branches of one year old), determinate the feeding stage of the analyzed plants with nutrition elements, to see the existence of excess or lack situations, to predict the lacks of nutrition during vegetation period, to establish the fertilization recommendations, to evaluate the exports of nutritive elements with yield and to keep the soils' fertility and also for yields prediction. The paper presents the results obtained by the foliar diagnosis, at the leaves of vines of the variety Aligote, of the content of macroelements, in the three moments of vegetation, using a scheme of fertilization specify. Use of doses minimum of fertilizers manages to attract a proper content of NPK in the plant material, which confirm the need for optimization of doses of fertilizers and also the choice assortment of these fertilizers. This practice, can converge to a steady nutritional optimal, with the avoidance of any excesses, evidenced by the emergence of diseases of nutrition, default by lowering the yields*.
Key words: diagnosis foliar, nutrition, macroelements

Rezumat*: Diagnoza foliară a nutriției prin analize chimice este o metodă extinsă, prin care sunt analizate unele organe vegetative (în special frunze dar şi nervuri, peţiol, lăstari tineri sau mai mari de un an ca vârstă), determinându-se alimentarea cu elemente nutritive în anumite fenofaze a plantelor analizate, pentru a investiga existența exceselor sau carențelor, pentru previzionarea dereglărilor de nutriție în timpul perioadei de vegetație, pentru stabilirea recomandărilor de fertilizare, pentru evaluarea exporturilor nutritive o dată cu recoltele şi pentru menținerea stării de fertilitate a solurilor şi deasemenea pentru prognozarea recoltelor. Lucrarea prezintă rezultatele obținute prin diagnostic foliar, la frunzele de viță de vie a soiului Aligote, a conținutului de macroelemente, în trei momente de vegetație, folosindu-se o schemă de fertilizare specifică. Utilizarea dozelor minime de fertilizanți, reuşeşte să atragă un conținut adecvat NPK în materialul vegetal, ceea ce confirmă necesitatea optimizării dozelor de îngrăşăminte dar şi alegerii sortimentului de fertilizanți.*

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Această practică, poate converge către un echilibru nutriţional optim, evitându-se eventualele excese, materializate prin apariţia bolilor de nutriţie, implicit prin scăderea producţiilor.

Cuvinte cheie: diagnoză foliară, nutriţie, macroelemente

INTRODUCTION

Diagnosis by chemical analyze of nutritive elements (classic diagnosis) reflects the accumulation and supplying of the plant during the whole vegetation period, from its starting till harvest moment of the sample and less the momentum stage of supplying (Davidescu, 1980) This diagnosis method is the most used one to confirm or infirm the nutrition malfunctions and to correct fertilization system. Also, this type of diagnosis is very good for researches of nutritive elements accumulation dynamics in plants during vegetation period, case in which are analyzed those elements in each moment.(Volf, 2004) From this point of view, plants' chemical analyses serves also to monitor different types of fertilization and also to establish fertilizations recommendations, in according with soil analyses on samples from the same placement, with climatic conditions, with phyto-sanitary stage of the crop and with information regarding the used technology.

So, the prognosis of possible modifications of the nutrition stage in negative way (lacks, excesses, un-balance) by foliar diagnosis, offers the possibility of reviewing and adapting of integrated fertilization system in time and on pheno-phases, for a good supplying of nutritive elements in soil-plant system. At the level of the obtained results and on the line of capitalization of the results of this experience could be made some conclusions for a good practice of the farmers.

MATERIAL AND METHOD

Experience took place on a there years period, in the Copou-Şorogari vineyard, Iaşi county, Romania and the experimental polygon belonged to the private owners. Geographically, the studied area is placed in the Jijia-Bahlui depression, taking in study the *Aligote* kind, grafting on port-graft *Berlandieri* × *Riparia Kober 5 BB*, planting distance being 2.20 × 1.10. Vine stocks presents uniform cut of 17 eyes/m^2 (41 eyes/vine stock). *Aligote* kind is included in the cultivars of 61 vineyards from 10 counties and is on the "recommended kind" position in 29 areas (including in the vineyards of Iaşi County). This sot of grape is for dry wines, which function of the area and years' climatic conditions, could be placed in the ordinary wines category (usual consumption) or in the category of superior quality. In some areas (Iaşi for example), *Aligote* wines could reach the quality level of the ones with origin denomination (D.O.C.).

The experimental scheme focused the establish of a bi-factorial experience, the method of placement in field, being the one of sub-divided plots, in four repetitions, and the graduation of the variable factors being the following:

Factor A – fertilizers dose (kg a. s/ha)	*Factor B – combination of fertilizers elements*
a_0 – un-fertilized (control)	b_0 – NPK – control
a_1 – 0.5 dose	b_1 – N
a_2 – 1.0 dose	b_2 – P
a_3 – 1.5 dose	b_3 – K
	b_4 – NP
	b_5 – NK
	b_6 – PK

In the present paper are proposed three levels of fertilization as regarding the dose and 7 levels of usage of the fertilizers elements' combination. Function of the predicted yield, production ways and soils' fertility stage was established:

- level 0.5 dose
  - 50 kg/ha a. s N
  - 25 kg/ha a. s P_2O_5
  - 90 kg/ha a. s K_2O
- level 1 dose
  - 100 kg/ha a. s N
  - 50 kg/ha a. s P_2O_5
  - 180 kg/ha a. s K_2O
- level 1.5 dose
  - 150 kg/ha a. s N
  - 75 kg/ha a. s P_2O_5
  - 270 kg/ha a. s K_2O

Fertilizers elements were singular administrated or in combination so in this way resulted *7 levels of fertilization.*

- fertilization exclusive with nitrogen (N)
- fertilization exclusive with phosphorous (P)
- fertilization exclusive with potassium (K)
- fertilization binary nitrogen + phosphorous (NP)
- fertilization binary nitrogen + potassium (NK)
- fertilization binary phosphorous + potassium (PK)
- fertilization ternary nitrogen + phosphorous + potassium (NPK).

Were used as chemical fertilizers, simple chemical fertilizers such as *ammonium azotize,* NH_4NO_3, with 34.5% a. s, as nutrition source of nitrogen. As phosphorous source we propose the usage of *concentrate super-phosphate* $Ca(H_2PO_4)_2$ H_2O, with 50% a. s. Potassium was administrated as fertilizers under the form of *potassium salt* 50%. Organic fertilization was assured by administration of manure in a norm of 40 t/ha. For tracking the elements' mobility, their movement from soil to plant and the dynamics of the their accumulation during vegetation, for foliar diagnosis were taken leave samples at three moments – budding, flowering and maturation – from each experimental variants, from the control vine stocks. The working methods were in according with the ones elaborated by I.C.P.A. Romania for agrochemical analyses.

Were made the following determinations:

- dosage of total nitrogen, variant mineralized with sulfuric acid, distillation and titration with H_2SO_4;
- dosage of total phosphorous – mineralization on wet way, with ammonium molibdate and reduction with stanium colure, colorimetric dosage (after Nicolov, 1976);
- dosage of total potassium, by mineralization with a mixture of sulfuric acid and percloric acid and dosage by flame photometry.

RESULTS AND DISCUSSIONS

The influence of interaction dose × combination of fertilizers elements, on the evolution of total nitrogen from plant (Nt, %)

Interaction of the factors dose × combination of fertilizers elements on the evolution of total nitrogen content in plant shows the following situations. In the budding phenol-phase, fertilization variant 165 kg a. s NPK, assures to the vineyard a content in total nitrogen of 3.91% N_t (very significant), with a difference face to the un-fertilized control of 0.27% N_t, smaller that at the ternary variant in optimal doses (330 kg a. s NPK) with only 0.09% N_t and with only 0.1% smaller than the ternary variant in maximal doses (495 kg a. s NPK).

At flowering, could be observed on years average, that the minimal doses no matter what was the combination of used fertilizers element, did not succeed in statistical assuring of supply with nitrogen of vineyard, but the values of this index are in the optimal interval of supplying (2.2-2.6%) as the correct values of optimal and maximal doses.

At grapes maturation, supplying with total nitrogen is optimal for vineyard by using the variant 165 kg a. s NPK (1.52% N_t – value distinct significant). Face to the variant 330 kg a. s NPK (optimal doses, ternary combination), variant 165 kg a. s NPK is smaller with only 0.06% Nt and face to variant 495 kg a. s NPK (maximal doses, combination ternary) with only 0.16% N_t.

Figure 1 put in light the variation of total nitrogen from plants under the impact of using the three levels of doses, in different combinations with fertilizers elements. At the three moments of vegetation, the top for total nitrogen supply in small doses, is recorded at variant 165 kg a. s NPK, very close to the top for total nitrogen supply in optimal doses (variant 330 kg a. s NPK).

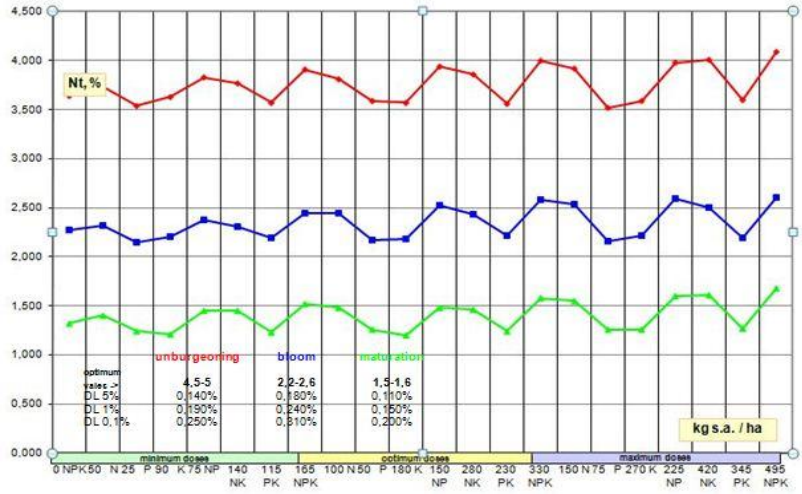

Fig. 1 The influence of fertilizers combination x measure interaction towards the evolution of total nitrogen (Nt %) in leaves at Aligote in 3 phenological phases: unburgeoning, bloom, maturation of grapes

The influence of interaction dose × combination of fertilizers elements, on the evolution of total phosphorous from plant (Pt, %)

In the budding pheno-phase, variants "minimal doses" in combinations P, NP, PK and NPK offers to the vineyard a stage of optimal supply with phosphorous (optimal interval of supplying 0.30-0.43% P_t). Variant 165 kg/ha a. s NPK realized in plant a supply of 0.354 % P_t, superior to the un-fertilized control with 0.045% P_t (distinct significant).

In flowering phenol-phase, variant 165 NPK on the average of the years taken in study, shows that the values of this index are not statistic assured, superior to the control and in the optimal interval, recording for this variant a content of 0.207% P_t.

At grapes maturation, variant "minimal doses", and combination ternary – 165 NPK – realized in leave a level of 0.120% P_t, value superior to the control with 0.023% P_t (significant). Variant 330 NPK (optimal dose, combination ternary) realized an accumulation of 0.135% P_t in leave, only with 0.015% P_t more that at the previous cited variant.

Figure 2 express suggestive that at the level of all three moments of vegetation, the usage of minimal doses drives to accumulations of total phosphorous in leave at optimal parameters (variants 165 NPK, 115 PK, 75 NP and 25 P). Variant 495 NPK (maximal dose, combination ternary) leads for flowering and grapes maturation, at over-passing of the optimal doses of phosphorous in leave.

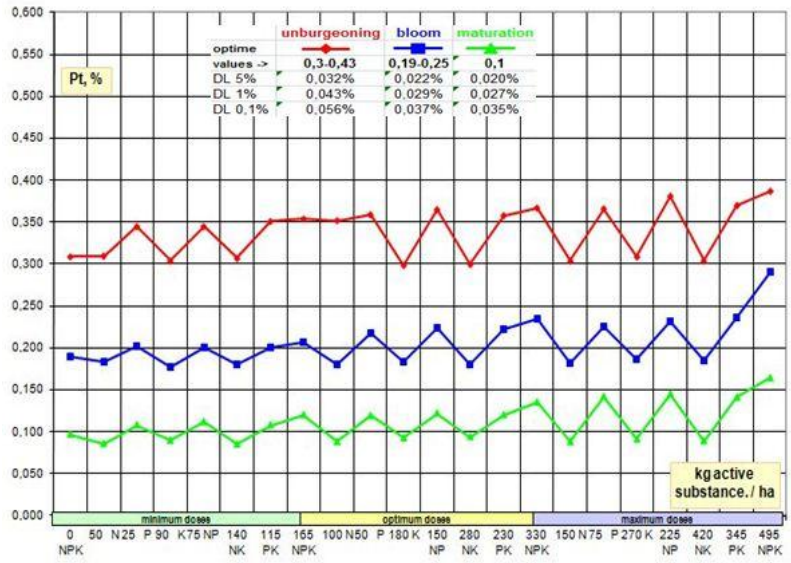

Fig. 2 The influence of fertilizers combination x measure interaction towards phosphorus mobile forms' evolution (Pt %) in leaves at Aligote in 3 phenological phases: unburgeoning, bloom, maturation of grapes

The influence of interaction dose × combination of fertilizers elements, on the evolution of total potassium from plant (Kt, %)

In budding phenol-phase, the minimal doses in binary and ternary combinations assure a very good content of leave in total potassium (fig.3).

Variant 115 kg a. s K realized 1.30% K_t, variant 90 kg a. s K realized 1.32% K_t, variant 140 kg a. s NK realized 1.33% K_t, all statistic assured, significant. Variant ternary in minimal doses - 165 kg a. s NPK, realized in plants an accumulation of 1.40% K_t (very good supply), value superior to the control with 0.19% K_t (very significant). Variant 330 kg a. s NPK realized 1.53% K_t, more above the optimum and only 0.13% K_t face to the variant 165 kg a. s NPK.

At flowering, variant 165 kg a. s NPK, even if it is statistic assured – significant – is very close to reach the optimal for this phenol-phase, records for this variant the value of 0.899% K_t. Variants 330 kg a. s NPK ands 495 kg a. s NPK reaches optimal values of the total potassium respectively 0.917% K_t and 0.954% K_t (very significant).

In maturation pheno-phase, even if are reached levels of a very good supply with total potassium in plant (> 0.6% K_t) at all the levels of dosage and in all combinations of fertilizers elements, only at the level of maximal doses (1.5 dose) values are statistical assured. Could be observed that the variant 495 NPK realized 0.801% K_t, with 0.2% K_t above optimum, being considered "luxury consumption", exist the possibility of manifestation of the excess stage, by appearing external signs.

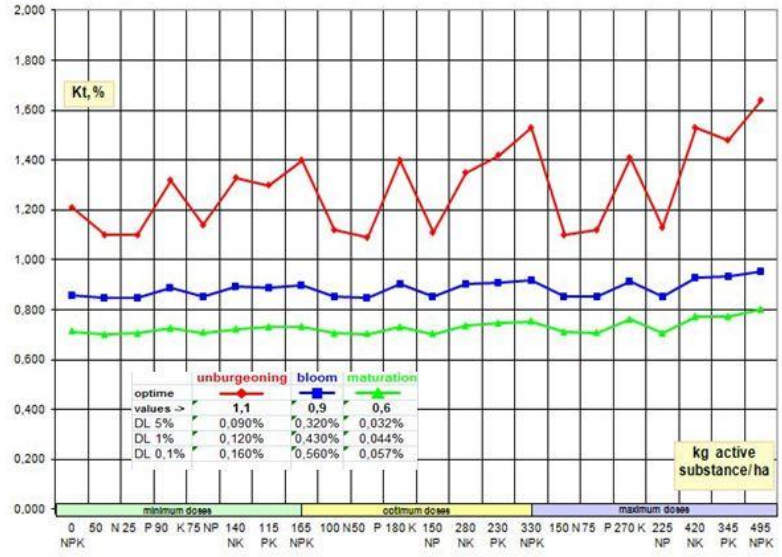

Fig. 3 The influence of fertilizers combination x measure interaction towards potassium mobile forms' evolution (Kt %) in leaves at Aligote in 3 phenological phases: unburgeoning, bloom, maturation of grapes

CONCLUSIONS

As a result of chemical fertilizers could be observed in a significant manner, the cumulative effect of the interaction of the studied factors and from this point of view the following things are observed:

1. Variant 165 NPK assures accumulation in N_t superior to un-fertilized control, for all the three pheno-phases analyzed, placed as being a little bit sub-optimal at budding (3.91% N_t), optimal for flowering (2.44% N_t) and maturation (1.52% N_t); doubling or tripling the administrated doses in ternary complex (variants 330 NPK and 495 NPK) did not solve the supplying in optimum with N_t of plants at budding (values < 4.5% N_t), are at optimal at flowering (interval 2.2-2.6% N_t) and optimal to an easy excess at maturation (1.58% N_t and respectively >1.6% N_t).

2. The rhythm of absorption and accumulation of the forms of total phosphorous is specific to the studied pheno-phases and are different in range with the fertilized variants: at budding variants 25 P, 75 NP, 115 PK and 165 NPK realized optimal accumulations of P_t (values > 0.30% P_t, assured statistic), in flowering pheno-phase the same variants accumulates optimal quantities of P_t (values in interval 0.19-0.25% P_t, un-assured statistic), and at the grapes' maturation, only variant 165 NPK to realize an optimal stage of P_t accumulation (value > 0.10% Pt, significant); usage of maximal doses applied in tertiary complex, variant 495 NPK leads to optimal accumulation of P_t at budding and over-optimal at flowering and grapes' maturation, showing the probability of appearance of phosphorous excess, but not manifested physiologic.

3. Analytical dates regarding the total potassium content in plant (K_t %) shows a clear influence of NPK relation on the evolution of this indicator: at budding, variant 165 NPK realized an accumulation over optimal in K_t (value > 1.1% K_t), optimal in flowering pheno-phase (0.9% K_t) and also over-optimal in maturation pheno-phase (values > 0.6% K_t).

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