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RESEARCHES REGARDING THE APPLICATION OF FERTILIZERS FOR FRUIT TREES IN THE CONCEPT OF ENVIRONMENTAL PROTECTION AND OBTAINING COMPETITIVE HARVESTS IN THE FRUIT AREA OF BIHOR

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Abstract

During this research there were studied 7 variants, on a brown soil with silty texture, fertilized with various NPK doses, and control variant without fertilizers. The fruit tree fertilization with various doses of NPK influenced positively the contents of mobile P2O5 and K2O in the soil, with statistically ensured differences. The trunk growth in with was also positively influenced by the fertlizers' doses, where as the main importance belonged to the nitrogen alone, and less to the nitrogen combined with phosphorous and potassium. There is also noticed a tight connection between the leaves' content in NPK and the yield of fruit. The differences are statistically enured in the case of the nitrogen and potassium. The premature death is redoubled by the fertilzers doses, at an annual rhytm more and more reduced, as the trees grow older, and it fails completely.The various content of clay in the soil doesn't bring any important alterations regarding the premature death of the trees.

Keywords: fertilizer, crop, NPK content, soil.

INTRODUCTION

Obtaining high quality crops using fertilizers was and remains a priority for researchers and specialists in pomiculture, in continuous modernization. (Buta, 2017). Thus, once the modern pomiculture appeared, researches has also been intensified on establishing the scientific criteria (Bunea, 1979) meant to indicate optimal fertilization formulas depending on the type of soil, species, (Cepoiu et al., 2005). In this context, we mention the contributions made by numerous authors (Hera, Borlan, 1980, Mihut, 2005, Stanciu, 2006, Cociu et al, 1999, Chira, et al, 2005), that have established positive correlations between different fertilizer doses, soil content, nutrients, foliar diagnosis and harvest.

If, in the beginning years, the use of fertilizers was aimed to obtain the highest yields, over time the emphasis was placed on quality. (Berar V. 2012). So that in the last years it will be pursued to obtain high quality fruit, with reduced chemical interventions that will not influence the composition of the finished product concurrently with an efficient protection of the environment. (Bunea, 1985) . Nitrogen (N) and potassium (K) are closely related to orchard productivity, since they are usually found in higher

concentrations than others macronutrients in apple (Malus × domestica Borkh) fruits. (Venig, 2013). Fertilizers are commonly applied to improve the yield and quality in orchards. (Victor, 2003). But unbalanced fertilization negatively affects the nutrient contents of the fruit. (Venig, 2006). Fruit with low energy and high mineral and vitamin contents are significant foods for human nutrition and human health. (Danciu, Venig, 2003). Starting from these desires in the present paper we set out to lean more on some research results with fertilizers for apple and apricot trees, representative species in the North-Western part of the country.

MATERIAL AND METHOD

The experiences were located at apple trees, on sandy soil, modelled with an organic content below 1% and at apricot trees on a typical brown soil, in Oradea. The soil maintenance system was in the form of a field and the trees were driven and maintained with a free flattened crown. The observations and determinations consisted in measuring the growth of the trunk thickness and determining the production on each variant. On the ground, samples were collected on 0-20 cm and 20-40 cm depth, which were analyzed in terms of NPK content.

RESULTS AND DISCUSSION

Regarding the modifications of some soil properties following the application of the fertilizer doses presented in the tables below, we observe that all the studied variants led to the increase of the NPK content in the soil which influenced the level of the three leaves macro-elements. It is worth noting the graph in fig. 1, in which there is a positive correlation between the doses of nitrogen and its presence in the leaves at the apple trees with a statistically assured regression coefficient.

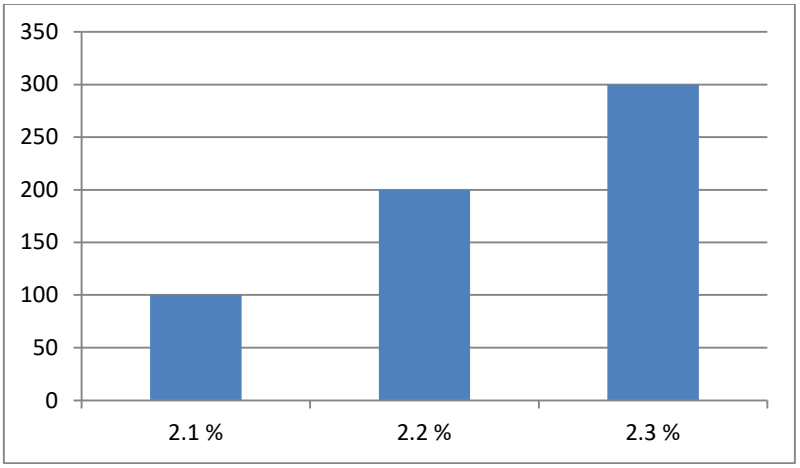

Fig. 1 Correlation between applied nitrogen doses and entire leaves' nitrogen content

A positive influence is observed also in the case of phosphorus and potassium where the doses applied to the soil are present and raise their content significantly and very significantly. It is worth noting the connection between P_2O_5 and K_2O from the soil and the content of the leaves in phosphorus and potassium more emphasized in the case of potassium and lower in the case of phosphorus fig. 2.

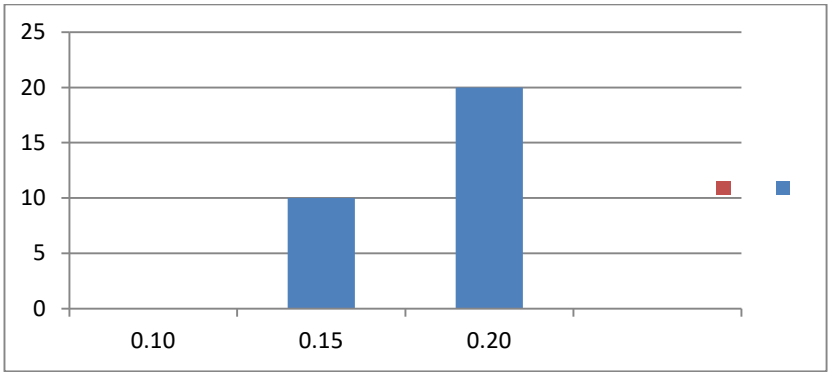

Fig. 2 Correlation between soil content in mobile phosphorous and leaves' entire phosphorous content

These connections between the elements applied to the soil and their content increase in the leaves to the optimum level allowed, justify the growing and fructification of the fruit trees by applying a careful and balanced fertilization.

The results regarding the increase in the thickness of the trunk and of the fruit production also know an ascending tendency, all the fertilized variants bring increase of growth and production in comparison with the witness unfertilized with chemical fertilizers.

Analyzing the production of apples according to the doses of fertilizers applied it is found that all the variants that received these inputs produced more fruits, on average realizing an annual increase between 1.1 t / ha in the case of fertilized trees with N_{100} and 8.8 t / ha at those fertilized with higher doses N_{200}, P_{100}, K_{200}.

The increase of the production but does not go progressively, with the harvest because especially in the first 5 years but also after 10 years of fructification there is a stagnation followed by a decrease of the level of production in the variants with the highest doses of NPK. This aspect is observed especially from the curve representing the average of the first 5 years of fructification, where the ceiling is realized when applying to the trees a moderate dose of 300 kg / ha (V3 N 100 P 100 K 100) and then to decrease as the doses of NPK increase.

Similarly, apricot is a species that is sensitive to pedoclimatic factors, but responds very well to the application of different doses of fertilizers.

In table nr. 1 where are shown the productions obtained on variants, we observe that they are modest but strongly influenced by the applied fertilizers.

Table 1

The influence of some NPK doses on apricot fruit production

Variant	Fruit years						Average of 9 years		
	1-3		4-6		7-10				
	t/ha	%	t/ha	%	t/ha	%	t/ha	Dif	%
V1=Mt	1.2	100	1.6	100	4.3	100	3.0	0.0	100
V2=N_{100}	1.8	120	4.5	280	7.2	167	4.3	1.3	143
V3=$N_{100}P_{80}$	2.0	166	5.7+	345	8.2+	191	5.3	2.3	177
V4=$N_{100}P_{80}K_{100}$	2.5+	208	5.0+	301	8.8+	200	5.4	2.4	180
V5=$N_{200}P_{80}K_{100}$	2.5+	208	5.0+	301	5.2	118	4.3	1.4	143
V6=$N_{200}P_{160}K_{100}$	2.3	190	4.5	280	6.6	160	4.5	1.5	150
V7=$N_{200}P_{160}K_{200}$	2.4+	200	4.4	274	7.5	171	4.4	1.4	147
V8=N_{200} annual* $P_{400}K_{500}$	2.4+	200	5.6	344	7.8	181	5.3	2.3	177
LSD 5%	1.20		3.45		3.76				

In the case of apricot, the best results were obtained at fertilized trees with moderate doses, if we consider that the highest production of 5.4 t / ha was obtained from trees fertilized with N100 P 80 K100 while at higher doses the crop level have been capped, even observing a decreasing trend. Analyzing the connections that result in the graphs and tables, it is

resembled the fact that the apple and apricot orchards represented in this research respond very well to the inputs represented by NPK fertilizers.

These researches force us to reflect carefully when making decisions regarding the application of the fertilization formula and to consider that the application of fertilizers is an important aspect in the technological chain, which must be applied balanced and complete.

Because if we look more closely at the apple in the unfertilized control we will see that here were also harvested from 11 t / ha to 31 t / ha depending on the years and the age of the trees, during the entire 10-year cycle obtaining research on average 19 t / ha. Reaching the level of over 20 t / ha in 5 years out of the 10 analyzed in trees without fertilization should not lead us to think about giving up fertilization of orchards as the important link in the technological chain that competes in reaching high performance parameters but at a more careful treatment of this problem.

This, especially at present, when the fruits that are consumed in a fresh state are required to be obtained as close to nature and with few interventions as friendly to nature.

This good purpose must take into account the value and potential of the fruit of the species and variety for the purpose of the harvest and for maintaining the fertility potential of the soil indefinitely.

All the more so if we consider that with the harvest, between 2.3 and 3.5 kg of nitrogen, 1.0-1.5 kg of phosphorus and 3.0-5.5 kg of potassium are extracted from the soil per ton of fruit, which periodically we will need to return to the soil.

CONCLUSIONS

From the researches with fertilizers carried out at apple and apricot including the first ten years of fructification , the following can be seen:

The fertilizers applied to the soil are found in accessible form to trees, the doses used have increased its content in phosphorus and potassium to an optimum level or close to the sandy soil that has a lower capacity to retain nutrients;

The reaction of the trees to the application of the fertilizers was positive, the research data showing a close connection between the content of the soil and the leaves in the applied nutrients;

The growth of the trees was positively influenced by the doses of fertilizers applied - all fertilized variants registering increases of thickening of the trees compared to the control;

fruit production followed the same trend as the other elements analyzed being in all the upper variants of the unfertilized control;

The highest fruit yields achieved by applying one kilogram of fertilizer to the active substance of 23 kg apples were obtained from fertilized trees with doses of $N_{100}P_{100}K_{100}$, this parameter decreasing as the fertilizer doses increase;

Regarding the results as a whole and in conjunction with the current trends in fruit growing, we can say that a good fruit harvest can be obtained by using moderate doses of fertilizers ($N_{100}P_{80\text{-}100}K_{100}$ kg / ha active substance) that take into account all known criteria including those related to environmental protection;

Nor the harvest made by the unfertilized apple of approximately 20 t / ha should not be observed especially if we consider that it was obtained on the poorest soils with very low clay;

When establishing a fertilization plan approved by the requirements of the trees and carrying out competitive harvests, it will have to take into account the research results and the indicators resulting from the pedological and agrochemical mapping of the soil and last but not least, the best environmental protection for an indefinite period.

REFERENCES

1. Berar V., 2012, Horticultură practică, Editura de Vest
2. Bunea A., 1979, Cercetări privind valorificarea nisipurilor și solurilor nisipoase din nord-vestul țării prin plantații intensive de măr, Teză de doctorat
3. Bunea A., 1985, The effect of chemical fertilizers on growth fruiting and premature decline of apricot under North-Western conditions of Romania, Acta Horticulturae, 192
4. Buta M., 2017, Pedologie. Material didactic, Editura Risoprint
5. Cepoiu N., C. Păun, V. Spiță, 2005, Pomicultură practică, Editura Ceres
6. Chira L., V. Chereji, M. Roman, 2005, Caisul și piersicul, Editura MAST
7. Chira A., L. Chira, F. Mateescu, 2005, Pomii fructiferi. Lucrări de înființare și întreținere a plantațiilor, Editura M.A.S.T., 2005
8. Chira L., I. Pașca, 2008, Cultura mărului, Editura M.A.S.T.
9. Cociu V., coordonator, 1999, Caisul, Editura Ceres, cap. 10, Fertilizarea plantațiilor de cais
10. Danciu V.M., A. Venig, 2003, Noțiuni și principii privind cultura pomilor și arbuștilor fructiferi pe suprafețe medii și mici, Editura Universității din Oradea
11. Ghena N., 1977, Pomicultură generală și specială, Editura Didactică și Pedagogică
12. Hera C., Z. Borlan, 1980, Ghid pentru alcătuirea plantărilor de fertilizare, Editura Ceres
13. Mihăiescu G., 2007, Pomicultura de la A la Z, Editura Asab
14. Mihuț E., 2005, Cultura pomilor fructiferi, Editura Comision Dic
15. Oprea R.C., 2013, Compendiu de pedologie, Editura Universitară
16. Stanciu Gh ., 2006, Horticultura României, Editura Cetatea de Scaun
17. Stănică F., N. Braniște, 2011, Ghid pentru pomicultori, Editura Ceres
18. Venig A., 2013, Îndrumător de lucrări practice în pomicultură, Editura Universității din Oradea
19. Venig A., 2006, Practicum de pomicultură generală, Editura Universității din Oradea
20. Victor I., 2003, Livada noastră, de la 2-3 pomi la sute, Editura Alex-Alex