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The Infuence of Foliar Managed Fertilizers in Apple Growth Leaf Area

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Abstract. We studied the leaf surface of apple varieties Golden Delicious, Idared and Florina, grafted on M26 rootstock aged 6-8 years. The distance of planting trees is 4 x 2 m. The trees are driven by free forms Slanke spill. There were given foliar fertilizers: Urea 46% a. s. $(NH_2)_2CO$, Poly-Feed (NPK 19:19:19 + Mg, Mn, Cu, Zn, Fe, Mo), calcium chloride ($CaCl_2$). The leaf area recorded the highest values in trees with extra root fertilization where urea solution at a concentration of 0.5% was applied, while 75% of flowers have fallen, 0.8% - when fruits have a diameter 10-12 mm and 1.1% when fruits are 25-30 mm in diameter and that the concentration of 0.6%, 0.9%, 1.2% (V4) supplemented with Poly-Feed applications with a concentration of 0.1% when fruits are able to ripe and calcium chloride ($CaCl_2$) in concentrations of 0.6% (V3) and 0.7% (V4) 4 weeks before harvesting the fruit.

Keywords: apple, variety, leaf area, fertilizers, foliar index

INTRODUCTION

In modern fruit growing mineral and organic fertilizers are applied in soil, soil or plant to complete soil nutrient reserves and ensure normal plant growth. Foliar fertilization is the method by which nutritional deficiency is corrected and can be used in complex treatment plant. By this method we obtain to achieve a balanced fertilizer, which not only ensures the NPK, but all trace elements and hormones that contribute to growth and shoot growth, fruit bud differentiation, flowering and fruit linking the level of productivity and other characteristics of plants (Ghena *et al.*, 2004; Roşca and Diaconiuc, 2005; Babuc, 2012; Cimpoieş, 2012).

Foliar fertilization is particularly effective because it are use, concentrates with high technical purity elements and in witch the NPK and other elements are combined in a desired balance, in a controlled environment. At the same time fruit crops need different amounts of both nutrients for growth and for building upon the entire growing season. Therefore, it s important to study foliar fertilizers applied on growth in apple leaf area in different phases of vegetation.

MATERIALS AND METHODS

The investigations were effectuated in the 2008 - 2010 years in apple orchard established in spring 2003 with varieties Golden Delicious, Idared and Florina, grafted on M26 rootstock. Distance of planting trees is 4x2 m. Trees are driven by free forms Slanke spill.

Nitrogen is used as Urea 46% the active $(NH_2)_2CO$ consuming solution it is 1000 per hectare in that concentration. Spray solution pH was slightly acid-neutral. Poly-Feed NPK 19:19:19 fertilizer use is a high quality and form of cheated trace elements: Mg, Mn, Cu, Zn, Fe, Mo totally soluble in water at pH 5-6, free chlorine, heavy metals and other harmful

elements. Calcium is used as calcium chloride ($CaCl_2$). Alternatively witness trees served sprinkled with water (Tab. 1). Spraying was effectuated the morning when the wind is minimal and the temperature is lower on both sides of leaves. Leaf area of trees was determined at the end of vegetation period three typical trees, in each variant by the gravimetric and calculation method (Balan, 2010). Leaf area index (F) is the ratio of leaf surface over of soil surface (Cimpoieş, 2000).

Tab. 1

Type of fertilizers, concentration and performance during foliar treatments

No.	Foliar treatments during performance	Variant, nutrient concentration, %			
		V1 witness	V2	V3	V4
Urea 46% s.a. $(NH_2)_2CO$					
1	When the flowers have fallen 75%	water	0,4	0,5	0,6
2	When the fruits have a diameter of 10-12 mm	water	0,7	0,8	0,9
3	When the fruits have a diameter of 25-30 mm	water	1,0	1,1	1,2
Poly- Feed (NPK 19:19:19 + Mg, Mn, Cu, Zn, Fe, Mo)					
4	When the fruit is ripe stage	water	0,1	0,1	0,1
Calcium chloride ($CaCl_2$)					
5	May 4 days before harvesting the fruit	water	0,5	0,6	0,7

RESULTS AND DISCUSSION

Forming of leaves surface in trees during the growing season is correlated with increased intensity shoots and rosettes of leaves, which in many studies to values of 20 -30 000 m^2/ha (Balan and Cimpoieş, 2009; Balan and Vămăşescu, 2011; Babuc, 2012).

The analysis of experimental data results (Fig. 1) that the leaf area per hectare, of all variants studied, increases with the tree age. For example, the variety Golden Delicious trees in leaf area in 2008 was 14.19 to 19.39 thousand m^2/ha, in 2009 – 16.69 - 20.61 thousands m^2/ha and in 2010 -21.45 to 27.23 thousands m^2/ha. The growth rate of leaf area in version control was in 2009, compared with 2008, 17.6% higher in 2010 and increased leaf area, compared with 2009 by 28.5%. This latter situation can be explained by the fact that trees aged 7-8 years have not achieved growth potential continues to increase and intensify garnishing branches of fruit formation.

The leaf area carried out in three years is based on vegetation and pomological variety. In 2008 the variety Idared leaf surface is significantly lower than the index of the variety Golden Delicious and Florina. In the 2009-2010 years studied varieties do not differ significantly with a tree leaf area.

The leaf area of trees was differentiated according to foliar fertilization. The variety Golden Delicious leaf area recorded the highest values in trees with fertilizer applied extra root where urea solution concentration of 0.5%, while 75% of flowers have fallen 0.8% - when fruits are in diameter 10 -12 mm and 1.1% when fruits are 25-30 mm in diameter and that the concentration of 0.6%, 0.9%, 1.2% (V4) supplemented with Poly-Feed applications with a concentration of 0 , 1% when fruits are in a stage of ripening and calcium chloride concentration of 0.6% (V3) and 0.7% (V4) 4 weeks before harvesting the fruit. The variety Idared and Florina leaf area experienced the same distinction as with Golden Delicious

variety. The highest values of leaf area had trees using Urea 46% N solution concentration of 0.5%, 0.8%, 1.1% (V3) and 0.6%, 0,9%, 1.2% (V4) in excess of crucial witness.

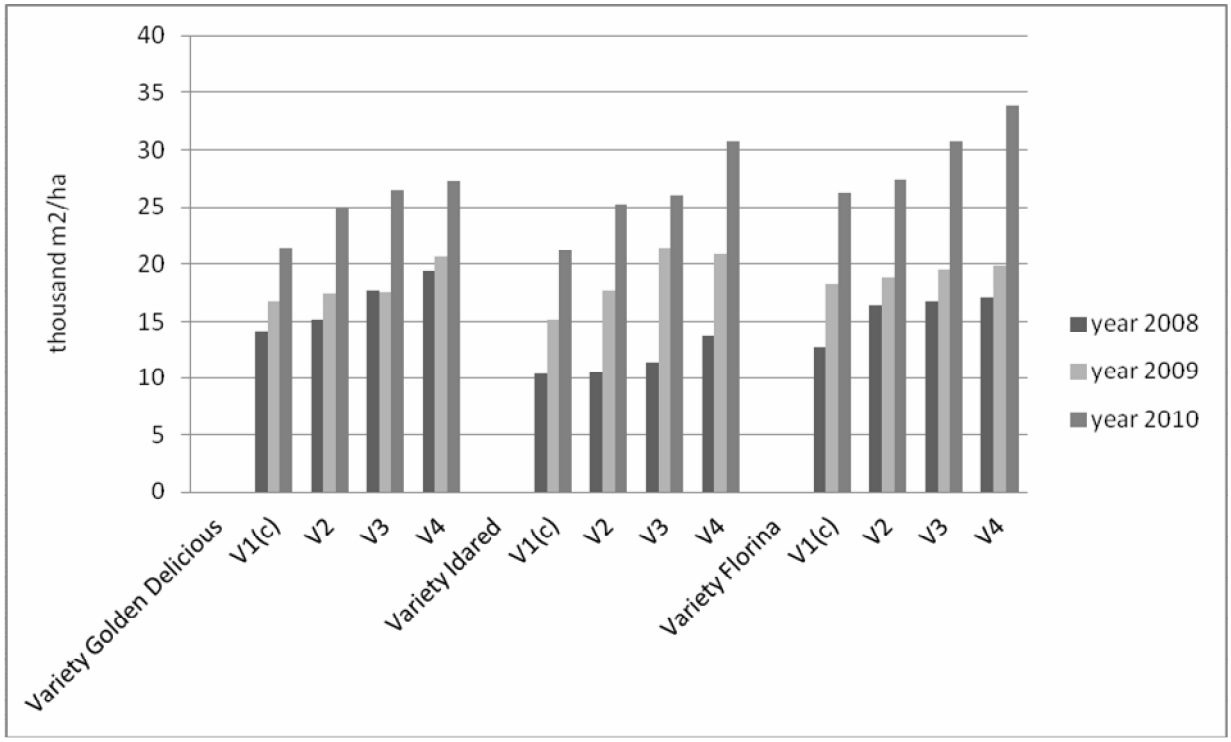

Fig. 1. Leaf area per hectare depending on the variety and foliar fertilizers

Comparing the doses of mineral fertilizers used in the vegetation within the same cultivar and phenophase, we see that extra root fertilization with urea concentration of 0.6%, 0.9%, 1.2% provided a leaf surface higher than fertilization with the concentration of 0.5%, 0.8%, 1.1%. This suggests us that the leaf area in orchards is directly proportional to amount of nitrogen used extra root dose.

For a brief elucidation of the leaf area depending on type and concentration of foliar fertilizers used and it is proposed to analyze and indicated the leaf area index among trees and between rows, is the total area (F1) and covered (F2) of the canopy (Cimpoieş, 2000; Balan, 2010).

In the results of the investigations (Tab. 2) we found that the index has been growing foliage during the years 2008-2010 in all studied varieties. This is due to the fact that the varieties Golden Delicious, Idared and Florina are in the growth and fruiting period. Leaf varieties of value in the study range from 1.42 up to 3.38 are affected by tree age, variety and biological features of different concentrations applied of Urea 46% N.

The variety Golden Delicious during the study index increased while foliar fertilizer dose and ranges from 1.42 to 1.94 in 2008 reaching values from 2.14 to 2.72 in 2010.

Depending on the variety Idared foliar fertilizers applied at the end of research period foliage index reaches 3.10. The foliage index for the covered and non covered area by the projection of all vegetation is the variety Golden Delicious from 1.42 to 2.72, 1.10 to 3.10 the variety Idared and 1.27 to 3.38 in Florina variety.

Depending on the concentration of foliar fertilizers the foliage index for the covered and none covered by area the projection of all vegetative changes analog leaf area per hectare. The variants studied can be divided into the following increasing order: V1, V2, V3 and V4. For example, the variety Florina foliage index in trees treated with water (V1) is 1.27 -2.62,

the value of this index of trees with fertilization extra root concentration of 0.5%, 0.8%, 1.1 % (V3) and 0.6%, 0.9%, 1.2% (V4) in different phenophases of vegetation, was respectively 1.6 and 1.71 to 3.38 -3.10.

Tab. 2

Foliage index depending on variety and concentration of fertilizers
(M26 rootstock, the distance of planting trees is 4 x 2 m, SA "Zubresti", 2008 -2010)

Variant	Year					
	2008		2009		2010	
	F1*	F2**	F1	F2	F1	F2
Variety Golden Delicious						
V1 witness	1,42	2,18	1,67	3,71	2,14	4,10
V2	1,51	2,51	1,74	3,73	2,50	4,91
V3	1,77	2,44	1,75	3,58	2,64	4,84
V4	1,94	2,52	2,10	3,22	2,72	4,73
Variety Idared						
V1 witness	1,10	1,80	1,52	3,38	2,12	4,71
V2	1,10	1,63	1,77	3,54	2,52	5,30
V3	1,13	1,80	2,14	4,07	2,61	5,35
V4	1,31	1,74	2,15	3,58	3,10	5,90
Variety Florina						
V1 witness	1,27	2,82	1,83	3,25	2,62	4,19
V2	1,63	3,52	1,89	3,28	2,73	4,07
V3	1,67	3,34	1,96	3,13	3,10	4,59
V4	1,71	3,25	1,98	3,17	3,38	4,22

Note: F1 * - is a measure of the leaf area per square meter of ground area allocated in the orchard. F2 ** - is the leaf area of a tree is divided by ground area occupied of the canopy.

The foliage index for the whole projection area covered by vegetation changes depending on tree age, vigor variety and strength foliar fertilizers. Thus, if the variety Golden Delicious foliage index was the 6-th year after planting trees from 2.18 to 2.52, the value of this index in the 8-th year - was 4.10 to 4.73. This stage was registries to the varieties Idared and Florina, but we can mention that the index leaf growth in Florina variety is higher than the varieties Golden Delicious and Idared. For example, in 6-th year after planting trees, the cultivar Florina foliage index was 2.82 to 3.52 and the varieties Golden Delicious and Idared was respectively 2.18 to 2.52 and 1.63 to 1.80. This difference is reduced with age of trees, and in the eight year after planting trees in the orchard the foliage index was 4.10 to 4.91 the variety Golden Delicious, 4.71 to 5.90 the variety Idared and from to 4.07 to 4.59 the variety Florina. This is explained by the fact that trees in the eight year after planting by cutting maintenance and fruition, it is maintaining to the expected parameters of planting distance and shape of crown.

After the surface of leaves made in the eight year by planting trees per hectare (21.25 to 33.81 thousand m^2/ha) and the foliage index (4.10 to 5.90) for the whole area occupied by vegetative orchard can be considered as agrofitocenoz medium productivity (Cimpoieș, 2000).

CONCLUSIONS

Leaf area during growth and fruition of apple trees proved to be closely related to the particular biological variety, constituting 14.19 to 27,23 thousand m^2/ha the Golden Delicious variety, from 10.29 to 30.76 thousand m^2/ha the variety Idared and from 12.69 to 33.81 thousand m^2/ha the Florina variety.

Micro and macro extra root fertilization is a very important system of fertilization increased leaf area contributing significantly to the plantation. The leaf area recorded the highest values in trees with extra root fertilization where urea solution is applied a concentration of 0.5%, while 75% of flowers have fallen, 0.8% - when fruits have a diameter 10-12 mm and 1.1% when fruits are 25-30 mm in diameter and respectively the concentration of 0.6%, 0.9%, 1.2% (V4) supplemented with Poly-Feed applications with a concentration of 0.1% when fruits are able to ripening and calcium chloride ($CaCl_2$) in concentrations of 0.6% (V3) and 0.7% (V4) 4 weeks before harvesting the fruit

REFERENCES

1. Balan, V. and Gh. Cimpoies (2009). Culture System of Trees. Fruit Production Efficiency in Relation to Light as an Output Influencing Factor. Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Horticulture. vol. 66 (1):120-125.
2. Balan, V. (2010). Methods of Foliar Surface Determination along the Ontogenetic Cycle on Apple Trees. Notulae Botanicae Horti Agrobotanici Cluj-Napoca. vol. 38(3): 219-222.
3. Balan, V. and S. Vămăşescu (2011). Apple foliar surfaces în function of foliar fertilizer application. Mnagement, economic engineering in agriculture and rural development. Bucureşti. vol. 11(1):5-8.
4. Babuc, V. (2012). Fruit. Chişinău: Tipografia Centrală (in Romanian).
5. Cimpoieş, Gh. (2000). Management and cutting trees. Chişinău (in Romanian).
6. Cimpoieş, Gh. (2012). Apple culture. Chişinău: Bonus Offices (in Romanian).
7. Ghena, N., N. Branişte and F. Stănică (2004). Fruit general. Bucureşti: Matrix Rom (in Romanian).
8. Roşca, C. and V. Diaconiuc (2005). Fertilizarea foliară la măr în condiţiile ecosistemului pomicol Hîrlău-judeţul Iaşi. Lucrări ştiinţifice ale Universităţii de Ştiinţe Agricole şi Medicină veterinară Iaşi, Anul XLVIII, Seria Horticultură, Iaşi:Ion Ionescu de la Brad, , vol. I (48):125-128 (in Romanian).