THE INFLUENCE OF FOLIAR FERTILIZATION ON APPLE PRODUCTIVITY

INFLUENȚA FERTILIZĂRII FOLIARE ASUPRA PRODUCTIVITĂȚII LA MĂR

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Abstract. *Investigations of the development system foliar fertilization in apple was conducted through research methods and field stationary. As study material served apple trees aged 8 years old Golden Delicious and Idared varieties, grafted on rootstock M26. Distance planting 4 x 2 m. As a foliar fertilizer was used to Urea 46% in a concentration of from 0.4% to 1.2% in the various stages of fruit development, Poly-feed (N19 P19 K19) at a concentration of 0.1% calcium chloride $CaCl_2$ at a dose of from 0.5% to 0.7%. In average years of research on fertilized with urea 46% N stages of fruit development: the petals fall of 75%, 20 mm and 30 mm central fruit of the central fruit, fruit number was 172 units in version control and 211 units in variant V4.*
Key words: *apple tree, rootstock, urea, yield buds, variety.*

Rezumat. *Ca material biologic s-au folosit soiurile Golden Delicious şi Idared, altoite pe portaltoiul M26, vârsta pomilor find de 8 ani.. Distanța de plantare 4 x 2 m. Ca fertilizant foliar s-a utilizat Uree 46 % $_{s.a.}$ în concentrație de la 0,4 % pînă la 1,2% în diferite faze de dezvoltare a fructelor, Poly-feed (N_{19} P_{19} K_{19}) în concentrație de 0,1% şi clorură de calciu $CaCl_2$ în doze de la 0,5% la 0,7 procente. În anii de cercetare, în urma fertilizarii cu uree 46%N, în fazele de dezvoltare a fructelor: de la căderea a 75% din petale, la 20 mm a fructului central şi la 30 mm a fructului central, numărul mediu de fructe a fost de 172 buc/pom în varianta martor și 211 buc/pom în varianta V4.*
Cuvinte cheie: *măr, mugur floral, portaltoi, soi, uree.*

INTRODUCTION

Foliar fertilization in horticulture is particularly effective because it concentrates are used which use high purity technical elements and the nitrogen, phosphorus, potassium and other elements are combined into a desirable balance in the medium (Cimpoieş, 2013). By this method give a balanced fertilizer, which not only ensure the NPK but all trace elements and hormones of growth and development (Ghena *et al.,* 2004, Balan, 2009).

As a result, foliar fertilizers can influence the growth of shoots, fruit bud differentiation, flowering and fruit tying, low productivity and other

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characteristics of plant (Robinson and Lopez, 2012).

At the same time fruit crops need different amounts of nutrients in the vegetation phenophases (Balan and Vămăşescu, 2012). Therefore, the present time of application, equipment usage and environmental factors to be taken into account when applying foliar nutrients (De Angelis *et al.,* 2011; Klein, 2002).

MATERIAL AND METHOD

Investigations were effectuated in 2011- 2014 in the orchard of apple company "Zubreşti" SA, planted with trees grafted aged 1 year Zubreşti near the village, Straseni. Plantation was conducted in spring 2003 with Golden Delicious and Idared varieties grafted on rootstock M26. Distance 4 *x* 2 m planting trees. Trees were led by slim spindle-shaped crown.

Research is carried out by general methods of tree species experiences. Nitrogen is used in the form of urea to 46% $(NH2)_2CO$ consuming solution to each 1000 liters per hectare in the respective concentration. Spray solution pH was neutral weak acid. Poly-Feed is a high-quality NPK fertilizer, totally soluble in water, pH 5-6, free chlorine, heavy metals and other harmful elements.

Trace elements in the form of chelați: Mn, Cu, Zn, Fe, Mo Calcium is used in the form of calcium chloride $CaCl_2$. Alternatively witness trees served sprinkled with water (Tab. 1). Spraying was done in the morning when the wind is minimal and lower temperature on both sides of the leaves.

Table 1

Scheme applying apple foliar fertilizers

No.	The period of effect foliar fertilization	Foliage fertilizer concentration			
		V1	V2	V3	V4
Urea 46 % active substance					
1	after bloom (when the 75% where in bloom)	water	0.4	0.5	0.6
2	When the fruit is size one nuts(fruit have 10-12 mm in diameter)	water	0.7	0.8	0.9
3	When the fruit are in size one walnuts (fruit have 25-30mm in diameter)	water	1.0	1.1	1.2
Polyfeed (N19 : P19 : K19)					
4	When fruits are in the ripen stages(20-30 July)	water	0.1	0.1	0.1
Calcium chloride($CaCl_2$)					
5	With 20-30 days before harvest	water	0.5	0,6	0,7

The number of fruits, weight and production as a tree were determined 10 days before harvesting the fruit from the calculations 3 each variant.

RESULTS AND DISCUSSIONS

The number of fruit research years (2011-2014) by variety and concentration of fertilizer applied, Golden Delicious variety was from 100 pcs 223 pcs. In version control their number tends to increase by the year 2012 to 170

units, and again in 2014 to reach 100 pcs. In foliar fertilization variants fruit number varies depending on the applied concentration of urea 46% N.

In the variant V3 where the concentration of the fertilizer was 0.5%; 0.8%; 1.1%. The fruit number was from 169 units in 2011 to 204 units in 2014. The average for the years of research at the Golden Delicious variety fruit number was from 129 units in the control variant V1 to V4 variants 195 units applying a urea concentration of 46% N 0.6%; 0.9%; 1.2%.

The number of fruits at Idared variety in 2011 amounted to 155 units in the control variant V1 to V4 variants 195 units applied where the highest concentration of urea 46% N. In variant V2 where the concentration of urea 46% N was the lowest number was 170 units of fruit. In 2012 the number of fruits increased from the year 2011 and amounted to 184 units from 233 units in control variant in 2014. This increase in the number of fruit in fertilizer variants compared to the control is from 9.7% in variant V2 to 26.6% for the variant V4 (Tab. 2).

In the years 2013 -2014 fruit number was lower in 2013 due to deposit one small number of fruit buds in 2012 and amounted to 148 units in variant control or 20% less than in 2012-187 units or 22% less than in 2012. In 2014 the number of fruit in all variants investigated increased compared to 2013 and amounted to 200 units in the control variant V1 to V4 variant 227 units.

Table 2

Number of fruit trees apple on the application of foliar fertilization with mineral fertilizers, pcs.

(M26 rootstock, 4x2m planting distance, trees aged 8-11 years, SA "Zubreşti")

Variant	Years				Average (2011 – 2014)
	2011	2012	2013	2014	
Golden Delicious variety					
V_1	100	170	146	100	129
V_2	152	190	165	190	174
V_3	169	200	174	204	187
V_4	171	223	186	200	195
DL	2,55	5,41	1,93	3,17	-
Idared variety					
V_1	155	184	148	200	172
V_2	170	202	167	204	186
V_3	186	219	176	225	202
V_4	195	233	187	227	211
DL	3,28	4,19	3,30	2,27	-

In average years of research on fertilized with urea 46% N stages of fruit development: the petals fall of 75%, 20 mm and 30 mm central fruit of the central fruit, fruit number was 172 units in version control and 211 units in variant V4.

Another indicator studied is the weight of the fruit, which Golden Delicious variety in 2011 was from 114 g to 134 g. In 2012 the average weight of fruit increased in all variants (Tab. 3).

The largest fruit weight was recorded in the V4 variant with 171 g, and the lowest in control variant with 139 g of fruits such weight gain of control variant and fertilization variants amounted to 23%. In 2014 fruit weight remained at the same high level of control variant but fruit weight was greatly reduced at 70 g reaching a fruit. In average years of research at Golden Delicious variety of foliar fertilization using urea 46% based on N has increased the weight of the fruit depending on the concentration of fertilizer applied up to 31 percent.

Idared variety of research years (2011-2014), fruit weight recorded values of 99 g in the control, but in variants with foliar fertilization, this index made up of 108 g to 119 g. In the years 2012-2013 this increasing trend of average fruit weight was maintained indicating the largest fruit in the V4 version where foliar fertilizer dose based on urea 46% N was in various stages of fruit development from 0.6% to 1.2 %.

In 2014 and Golden Delicious variety fruit witness variant recorded average fruit weight of 63 g or less than 174% fruit weight in V4 version.

In average years of research (2011- 2014) 46% urea N applied in different phenophase of fruit development has made a positive impact on recorded values of fruit weight by 40% compared to the control.

Table 3

The weight of the fruit trees with foliar fertilization with mineral fertilizers application, g.

(M26 rootstock, 4x2m planting distance, trees aged 8-11 years, SA "Zubreşti")

Variant	Years				Average (2011 – 2014)
	2011	2012	2013	2014	
Golden Delicious variety					
V_1	134	139	120	70	116
V_2	114	154	129	164	140
V_3	133	167	136	167	151
V_4	134	171	144	160	152
DL	1,91	3,74	2,52	3,76	-
Idared variety					
V_1	99	130	127	63	105
V_2	108	152	130	140	133
V_3	108	142	129	169	137
V_4	119	158	136	173	147
DL	2,81	2,19	2,75	4,07	-

One of the most important indicators is studied fruit production.

Golden Delicious variety fruit harvest per hectare in 2011 was 28.8 t / ha in the control, but crop fertilization variants ranged from 32.8 t / ha in V2 and 33.3 t / ha in V3. In 2012 harvest in all variants has increased since 2011, reaching 47.7 t / ha in the variant with the highest concentration of urea 46% N applied (V4).

In 2013 fruit harvest decreased in all variants but just as in 2012 the largest harvest was in V4 with 32.0 t / ha (Tab. 4).

Table 4

Fruit production based application foliar fertilization with mineral fertilizers t / ha.
(M26 rootstock, 4x2m planting distance, trees aged 8-11 years, SA "Zubreşti")

Variant	Years				Average (2011 – 2014)
	2011	2012	2013	2014	
Golden Delicious variety					
V_1	28,8	46,6	29,4	8,7	28,3
V_2	32,8	36,6	29,5	42,6	35,3
V_3	33,3	40,0	30,1	39,9	35,8
V_4	32,9	47,7	32,0	40,0	38,2
DL	1,59	1,95	1,35	2,96	-
Idared variety					
V_1	19,2	29,9	23,4	15,8	22,0
V_2	22,9	38,4	27,3	39,3	31,9
V_3	25,1	38,9	28,3	43,1	33,8
V_4	29,0	46,0	32,2	49,1	39,0
DL	3,17	2,26	1,05	3,13	-

In 2014 fruit production in foliar fertilization variants constituted around 40 t / ha. In version control fruit harvest was only 8.7 t / ha this is due to a very weak deposits of fruit buds in 2013 against a backdrop of large harvests of fruit inhibited the process.

In average years of research (2011 - 2014) application of foliar fertilization Golden Delicious variety has a beneficial impact on a constant crop.

Idared variety during research (2011-2014) recorded productivity per hectare from 15.8 t / ha to 49.1 t / ha. In 2011 harvest per hectare was to 19.2 t / ha in control variant, and fertilization variants harvest is over 23 tons. As Golden Delicious variety in harvest of fruit in all variants was investigated over 38 tones. In the years 2014 harvest V3 and V4 variants, which received the largest amount of foliar fertilizer, fruit production per hectare was over 40 tones. In average years of research (2011 - 2014) highlights that we harvest the fruit is responsive Idared variety of applications such Urea 46% N harvest V4 version where the concentration was highest at 0.6%; 0.9%; 1.2% productivity was 39.0 tons per hectare.

CONCLUSIONS

1. In the variant V3 where the concentration of the fertilizer was 0.5%; 0.8%; 1.1%, fruit number was from 169 units in 2011 to 204 units in 2014. The average for the years of research at the Golden Delicious variety fruit number was from 129 units in the control variant V1 to V4 variant 195 units applying a urea concentration of 46% N 0.6%; 0.9%; 1.2%.

2. In average years of research (2011- 2014) 46% urea N applied in different phenological phases of fruit development has made a positive impact on recorded values of fruit weight by 40% compared to the control.

3. In average years of research (2011 - 2014) highlights that we harvest the fruit is responsive Idared variety of applications such Urea 46% N harvest V4 version where the concentration was highest at 0.6%; 0.9%; A 1.2% productivity was 39.0 tons per hectare.

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