

THINNING AND FOLIAR FERTILIZATION INFLUENCE ON THE YIELD OF IDARED APPLE CULTIVAR

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Abstract

The research was conducted during 2010 - 2013 in an apple orchard planted in 2003 with 'Idared' cultivar grafted on M26 rootstock, at distance of 4x2 m. The trees are ruled by thin spindle-shaped crown. We studied the interaction between foliar fertilization and fruit thinning as the main determinants of the quantity and quality of apple fruit. The highest production (49.1 t/ha) was realized at application of 46% urea N in a concentration of 0.6% - when the 75% of the flowers while they fall, 0.9% - when the central fruit blossom has 10 to 12 mm, 1.2% - when the fruits are 25-30 mm in diameter and thinning of fruits by chemical preparation Bioprzerzedzac SL 060, at a concentration of 0.075% when the diameter of the central fruit blossom is 10 - 12 mm.

Key words: foliar fertilization, chemical and manual fruit thinning

INTRODUCTION

Thinning species of fruit trees that tends to overload with fruits it becomes a common technological measure. Using chemicals for thinning of fruits are doing in order to obtain quality fruits and to increase the overall yield (Richard, 1998). The effect of thinning depends by climate and growing conditions of the species tree. (Sally, 1991; Black, 1995; Stopar, 1999, 2001).

The foliar fertilization, chemical and manual fruit thinning, all represent significant contribution to maintain the physiological balance between growth and fruiting and increasing the quantity and quality of fruit. Obtaining high quality productions in terms of size, color, etc. increases the fruit quality, and the price, increases labor productivity in collecting, sorting and packing, because of the smaller fruits number, prevents the breakage and the split of the branches, keeping production volume of the crown for the coming years and prevents alternation of fruitfulness, increases the resistance to disease and frost trees due to store a sufficient amount of reserve substances, ensuring the formation of annual shoots that will form bearing formations for years (Stopar, 2001; Balan, 2009). The argumentation and refine the use of chemicals

to obtain quantitative and qualitative fruits production represent a problem of great value to modern orchards (Babuc, 2012; Cimpoieș, 2012).

A prerequisite for a harvest of high quality is an adequate number of flowers and fruit trees so that their chemical thinning is a common measure in commercial apple orchards (Wertheim, 2000; Greene, 2002).

MATERIALS AND METHODS

We studied the influence of foliar fertilization and fruit load on growth processes and standardization of fruit during the years 2010-2013 in the apple orchard "Zubresti" Strășeni. It was studied 'Idared' apple cultivar grafted on rootstock M 26, planted in 2003, at a distance of 4 x 2 m. The trees are ruled by thin spindle-shaped crown, treatments applied with Urea 46% N concentration of 0.4% 1.2%. Each variant consists of four replications of three trees, each representative arranged by randomized block system. The chemical fruit thinning was performed when central fruit is 10-12 mm in diameter (Table 2) the 060SL Bioprzerzedzac preparation in a concentration of 0.075%, and 1000 liters of solution per hectare. The fruit thinning is performed manually by physiological fall in June. The

manually thinning is done when fruits are at a distance less than 10-15 cm. The small fruits, distorted, attacked by diseases are removed first and then the normal ones.

Table 1. Scheme applying foliar fertilizers for 'Idared'

No.	The period of foliar fertilization	Foliage fertilizer concentration			
		V1f	V2f	V3f	V4f
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 harvest moment for each variant was chosen individually by weighing the fruits from 12 trees. The average weight of the fruit is determined by weighing electronically of 100 fruits.

Table 2. Metod of fruit thinning

Variant	Metod of thinning
V1r	Control
V 2r (Chemical thinning)	Management of chemicals when the central fruit diameter of 10-12 mm is blossoms Bioprzerzedzac 060 SL preparation in a concentration of 0.075%.
V 3r (Chemical thinning + manual)	Administration of chemicals when the central fruit diameter of 10-12 mm is blossoms Bioprzerzedzac 060 SL preparation in a concentration of 0.075% + manual fruit thinning.
V 4r (Manual thinning)	Manual thinning is carried out after the fall of physiological fruit when the fruit reaches 16-18 mm in diameter.

The experiment was installed in accordance with the method of organizing experiences factorial (foliar fertilizer, chemical and manually fruit thinning) and includes variants with the following scheme: V1 (V1f + V1r),

V2 (V1f + V2r), V3 (V1f + V3r), V4 (V1f + V4r), V5 (V2f + V1r), V6 (V2f + V2r), V7 (V2f + V3r), V8 (V2f + V4r), V9 (V3f + V1r), V10 (V3f + V2r), V11 (V3f + V3r), rV12 (V3f + V4r), V13 (V4f + V1r), V14 (V4f + V2r), V15 (V4f + V3r), V16 (V4f + V4r).

RESULTS AND DISCUSSION

In 2010 the number of fruits per trees without foliar fertilization was from 164 at V2 to 180 per tree at V4 variant. The smallest number of fruits was observed in variant V11 (130 fruits/tree) and the highest in the variant V13 with 195 fruits/tree.

Thus leading to a high number of fruits, variants with chemical fruit thinning was as follows: 186 frutis/tree - variant V9; 178 fruits/tree in V10 and 184 fruits/tree at V14 variant.

In 2011, the number of fruits at 'Idared' cultivar increased in most variants but with a larger emphasis to the thinning variants without fertilization V2 (202 fruits) and 204 fruits in V3 trees. The fertilization variants without fruit thinning were remarked as an increase in the number of fruits but compared to the previous year 2010 growth was lower constituting up to 223 frutis/tree (V13).

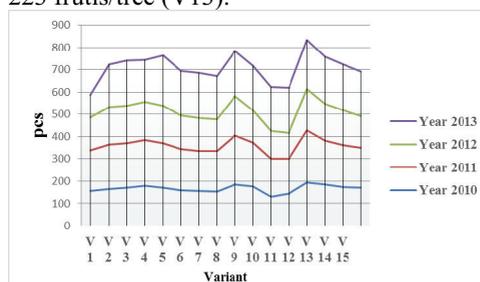


Figure 1. The number of fruits after fruit thinning and foliar fertilization application with mineral fertilizers of 'Idared' cultivar (fruits/tree) on M26 rootstock, planted at distances of 4x2 m in S.A. 'Zubresti' (2010-2013)

2012 was a critical year in terms of weather, the fruits number decreased. The smallest numbers of fruits were in the variant control V1 148 frutis/ tree and most fruits were gathered from V13 variant with 187 fruits. Among the variants with foliar fertilization and thinning and without thinning and fertilization variants we notice a slight increasing in the number of fruits depending on the concentration of urea

46% N applied to rich an average of 10 frutis/tree compared to the variants without fertilization.

2013 compared to previous years (2010-2012) is the year with biggest number of fruits, but in control V1 the number in 2010 was of 100 frutis/tree because of an insufficient number of fruit buds that had to be made in year 2012. In the variants with fertilization and thinning it was noted that the number of fruit is slightly smaller than the variants only fertilized (V5 204 frutis/tree) compared to V6 variants - 194 frutis/tree and V8 variant with 188 frutis/tree where was applied manual fruit thinning.

The fruit weight is an indicator that provides a good crop of fruit in 2010. The 'Idared' cultivar registered the smallest fruits in V1 with an average fruit weight of 99 g, and the largest fruits are remarked in the variant V16 with an average weight of 200 g.

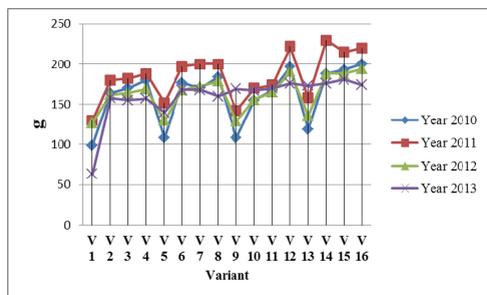


Figure 2. The fruit weight by fruit thinning application and foliar fertilization with mineral fertilizers - 'Idared' cultivar/M26 (2010-2013)

In the variants with different methods of thinning, the mean fruit weight varied from 164 g to 180 g (slow manual fruit thinning, V4). The application of different concentrations of foliar fertilization based on Urea 46% N increases the fruit weight. In the variant V13 fruit weight increased to 119 g with 46% N Urea application at a concentration of 0.6%, 0.9%, 1.2%. However, the biggest fruits weight where remarked in the variants with foliar fertilization applied and fruit thinning. Thus, the largest fruits were recorded in variants with chemical fruits thinning.

In 2011, the fruit weight increased in all cases, the highest average fruit weight was recorded in variant V14 with 230 g. Comparing with 2010, in 2011 the variants with foliar fertilizer

recorded the highest growth. From 31% to 40 % variant V9 and V5.

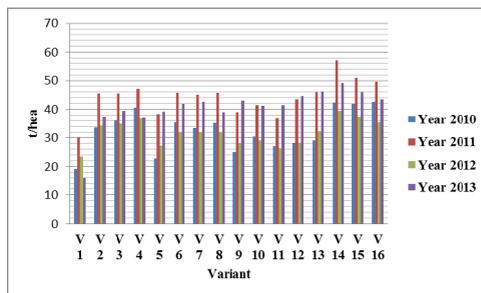


Figure 3. Yield obtained with fruit thinning and foliar fertilization application at 'Idared'/M26 (t/ha) (2010-2013)

In 2012 with some complicated climatic conditions, the fruit weight suffered. However, foliar fertilization variants only recorded difference of 16%.

In 2013 the lowest fruit weight was recorded in control (V1) with 63 g. In V2f where the concentration of Urea 46 % N was 0.4 %, 0.7 % and 1.0 % + thinning fruit weight according to the scheme experience was lower than or equal to 2011, from 140 g (V5) 168 g (V6). In the V3f foliar fertilization variants (Table 1) harvest was higher than in 2012. The chemical thinning variants (V10) and manual thinning (V11) weighing 170 g.

In 2010, the 'Idared' fruit production was of 19.2 t/ha at the control. In the V5 variant which concentration applied was of 0.4 % - 1.0 % yield was 22.9 t/ha and the V13 variant with Urea 46 % N concentration of 0.6 % - 1.2% yield was 29.0 t/ha .

The variants with fruit thinning and without fertilization, the fruits production riched to 33.6 t/ha; in V2 with chemical thinning to 40.5 t/ha; in the variant V4 with manual fruit thinning.

In variants with combined application of foliar fertilization of the crop and fruit thinning production varied between 27.1 t/ha in the variant V11, 42.5 t/ha with the V16 variant in the case of foliar fertilization application concentration of 0.6 to 1 2% 46 % Urea N and manual fruit thinning.

In 2011, fruit production reached to 50 tons per hectare with combined application of foliar fertilization and standardization load.

In 2012 fruits harvested per hectare recorded up to 23.4 t/ha in variant V14. Compared to

the 2010 -2012 harvest, the yield is with 30.3 % lower.

In 2013, production increased in all variants except the control variant (V1) which has been harvested from 15.8 t/ha. Decrease of the V1 harvest was due to insufficient deposition of fruit buds. The fertilization variants as in the 2010 - 2012 harvest was influenced by the concentration of Urea 46 % N applied. Thus, in the variant where the concentration of the fertilizer V5 was 0.4 %, 0.7 % and 1.9 % fruits yield was of 39.3 t/ha. But V14 solution where the concentration of the fertilizer applied was of 0.6 %, 0.9 %, 1.2 % fruit production was higher (49.1 t/ha).

CONCLUSIONS

The largest number of the fruits was recorded in the variant V13 (without thinning fruit and fertilization where the concentration of fertilizer applied was 0.6% - a 75% fall petals 0.9 % - when the central fruit blossom has a diameter of 10-12 mm, 1.2% - while the central fruit diameter is 25-30 cm).

The fruit weight in the studied period (2010 - 2013) recorded maximum value with foliar fertilization, concentration of 0.6%, 0.9%, 1.2% and chemical fruit thinning.

In the 2010 - 2013 production was influenced by the concentration of Urea 46% N. In the variant V5 the fertilizer was 0.4%, 0.7% and 1.0% fruit yield was of 39.3 t/ha. But in the

V13 variant the concentration of fertilizer applied was 0.6% - at 75% fall petals, 0.9% - while the central fruit blossom has a diameter of 10-12 mm, 1.2% - when the central of fruit diameter 25-30 cm plus fruit thinning fruit harvest was 49.1 t / ha.

REFERENCES

- Babuc V., 2012. Pomicultura. Chişinău: Tipografia Centrală.
- Balan V., 2009. Sisteme de cultură în pomicultură. Randamentul producţiei de fructe. Academos, Chişinău, nr 4 (15), p. 82-90.
- Cimpoieş Gh., 2012. Cultura mărului. Chişinău: Bonus Offices.
- Greene D.W., 2002. Chemicals, timing, and environmental factors involved in thinner efficacy on apple. HORTSCIENCE 37 (3), p. 477-481.
- Wertheim S.J., 2000. Developments in the chemical thinning of apple and pear. plant growth regulation. 31, p. 85-100.
- Black B.L., Bukovac M.J., Hull J., 1995. Effect of spray volume and time of NAA application on fruit size and cropping of Redchief 'Delicious' apple. Science Horticulturae 64, p. 253-264.
- Richard P.M., 1998. Apple thinning in 1998 Virginia fruit notes, January Vol 18, No 2.
- Sally A.B., Jones K.M., Koen, T.B., Oakford, M.J. 1991. The thinning effect of benzyladenine on red 'Fuji' apple trees. Journal Hort. Science . 66, p. 789-794.
- Stopar M., 1999. Delovanje NAA in BA na redčenje plodičev jablane sorte Zlati delišes. Sad 10, 7-8, p. 10-12
- Stopar M., Zadavec P., 2001. New apple thinning agents and their combination evaluated on cultivar Gala. Sodobno kmetijstvo 34, p. 154-158.