Volume 15(2), 162- 166, 2011
JOURNAL of Horticulture, Forestry and Biotechnology

Researches concerning the impact of some soil maintenance systems upon fruits' quality of Generos apple tree variety

Micu Roxana Elena[1*], Iordănescu Olimpia[1]

[1]Banat's University of Agricultural Sciences and Veterinary Medicine Timişoara, Faculty of Horticulture and Forestry

*Corresponding author. Email: roxanna_micu@yahoo.com

Abstract Modern and durable fruit culture is based on improved technologies, for this purpose aiming at rational and systematic human intervention in the life of fruit species, during their entire period of growth and individual development.

In trees and shrubs culture technology, the choice of soil maintenance is an important operation because it must be done considering: the climatic conditions of the area of culture, the culture system, and biological peculiarities of the species, variety and rootstock, technical equipment. By choosing the best system maintenance, trees will not compete with weeds for nutrients absorption and thus will get constant fruit production and quality.

In this purpose, we established 10 variants of soil maintenance, in which we used both agrotechnical and chemical methods for controlling weeds, such as: mechanical and manual hoes on the tree rows and on the interval, manual hoes on the tree row combined with herbicides, while the interval was either seeded with grass mixture, either just mowed.

The best results concerning apples' quality were obtained in variant 9, where the interval was seeded with *Trifolium repens* and on the tree rows we applied herbicide Roundup 360 SL (3 l/ha).

Key words

Generos, apples, quality, soil maintaining systems

The main tasks of agrotechnique in fruit culture are: obtaining higher constant yields quantitatively, but especially quality, maintaining fruit species in good conditions and assuring their longevity concerning the productivity and also proper maintenance of orchards in order to reduce fruit ecosystem contamination with pollutants [3, 4].

Modern and durable fruit culture is based on improved technologies, for this purpose aiming at rational and systematic human intervention in the life of fruit species, during their entire period of growth and individual development [6].

In the intensive orchards, all efforts are directed towards ensuring optimal growth conditions of trees, soil and the following works to protect trees against pests and diseases is running flawlessly. Soil should always be kept clean of weeds and without crust, by hoeing on the interval and repeatedly on the tree rows [1].

The importance of apple culture comes from the fact that it has been cultivated since ancient periods, its ecological plasticity, yield and suitability of the most diverse varieties to different technologies, high capacity storage of fruit in winter and a large number of varieties with staggered ripening, the alimentary, dietetic and therapeutic importance of apples, its culture surface and yields obtained [5].

But as any culture apple culture has some disadvantages, such as: it is a demanding species for soil and moisture, is vulnerable to attack of pests and diseases, genetic predisposition to the alternation of fruition that tackle difficult and requires a lot of work especially for pruning, treatments and harvest [2].

Material and Method

The method of arranging the variants was incomplete blocks. The experimental technique of arranging variants is very used in fruit culture because it offers some special advantages: it allows a larger number of variants than other methods and can eliminate errors due to soils' less homogeneity.

The experiment is a monofactorial one, aiming at different soil maintenance systems that can positively or negatively influence the production and its quality of the three apple varieties: Generos, Jonathan and Pionier. The data collected has been calculated using the variance analyse method.

Ten experimental variants were set as follows: V1 – no herbicides, no mechanical or manual works –

control; V2 – Roundup 360 SL (3 l/ha) on the tree row, the interval mowed; V3 – Basta 14 SL (5 l/ha) on the tree row, the interval mowed; V4 – Gallant Super (1 l/ha) on the tree row, the interval mowed; V5 – mulching with mowed grass on the interval (cover crops on the interval mixture 1); V6 – Roundup 360 SL (3 l/ha) + 2 manual hoes on the tree row, cover crops on the interval; V7 – Basta 14 SL (5 l/ha) + 2 manual hoes on the tree row, cover crops on the interval; V8 – Gallant Super (1 l/ha) + 2 manual hoes on the tree row, cover crops on the interval; V9 – *Trifolium repens* on the interval + Roundup 360 SL (3 l/ha) on the tree row; V10 – 2 manual hoes + 2 mechanical hoes.

Apples' quality determination was done by different methods, such as: measuring the fruits, weighting them, chemical analyses in the laboratory for the determination of mineral substances (%), content of vitamin C (mg/100g fruits), dry substance (%), content of sugars (%), total acidity (g/l malic acid) and calculation of the sugar-acidity index.

Results and Discussions

In the present paper we present the average values for each quality parameter obtained in the period 2008-2010.

The size index of Generos apples did not surpass the value of 8.03 cm, value obtained in variant 7 (Basta 14 SL (5 l/ha) + 2 manual hoes on the tree row, cover crops on the interval), followed by variant 5 – mulching with mowed grass on the interval (cover crops on the interval mixture 1) with a size index of 8.02 cm. Even though the values were close, the lowest size index was obtained for the apples in variants 4 (Gallant Super (1 l/ha) on the tree row, the interval mowed), 1 (no herbicides, no mechanical or manual works – control) and 3 (Basta 14 SL (5 l/ha) on the tree row, the interval mowed). The rest of the variants had a size index between 7.87 cm and 7.95 cm (variant 2 – Roundup 360 SL (3 l/ha) on the tree row, the interval mowed) (figure 1).

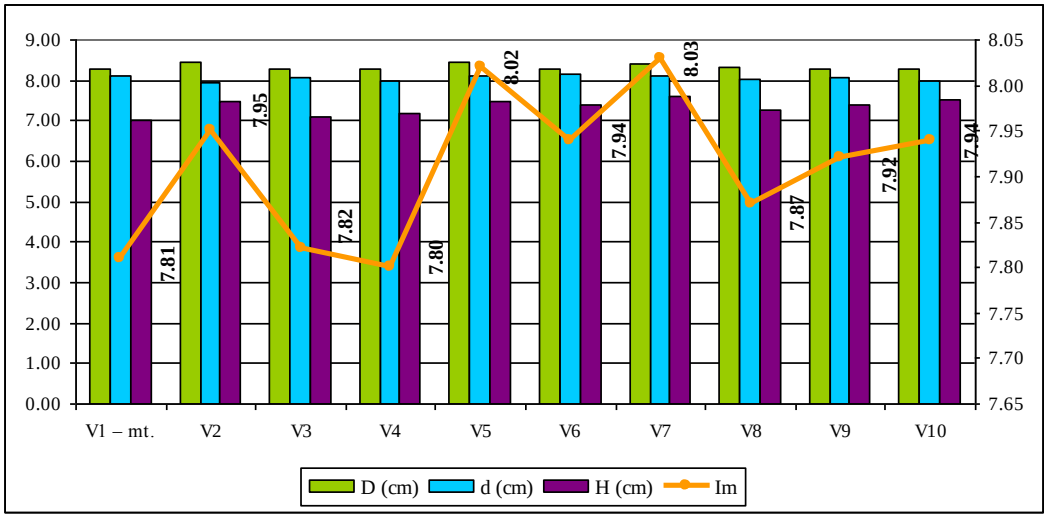

Fig.1. Generos variety apples' biometry, average of the years 2008 – 2010

The average weight of fruits obtained in the period 2008-2010 had values between 156.30 g (control variant) and 179.87 g (variant 6). Likewise variant 6, higher values were obtained in variant 9 (179.80 g), variant 7 (179.53 g) and variant 5 – mulching (178.77 g), all of them having very significant positive difference to the control variant. All of the other variants had an average weight higher than the one in the control variant but, excepting variant 8, which had distinct significant differences than the control variant (177,4 g), all of the other variants were not statistically assured (table 1).

Table 1

Average weight (g) of Generos variety fruits, average of the years 2008 – 2010

Variant	Average weight of apples (g)	Relative value (%)	Difference to the control (±g)	Significance
V_1 – no herbicides, no mechanical or manual works – control	156,30	100,00	0,00	mt.
V_2 – Roundup 360 SL (3 l/ha) on the tree row, the interval mowed	162,97	104,27	6,67	-
V_3 – Basta 14 SL (5 l/ha) on the tree row, the interval mowed	162,77	104,14	6,47	-
V_4 – Gallant Super (1 l/ha) on the tree row, the interval mowed	164,87	105,48	8,57	-
V_5 – mulching with mowed grass on the interval (cover crops on the interval mixture 1)	178,77	114,37	22,47	XXX
V_6 – Roundup 360 SL (3 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	179,87	115,08	23,57	XXX
V_7 – Basta 14 SL (5 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	179,53	114,86	23,23	XXX
V_8 – Gallant Super (1 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	177,40	113,50	21,10	XX
V_9 – *Trifolium repens* on the interval + Roundup 360 SL (3 l/ha) on the tree row	179,80	115,04	23,50	XXX
V_{10} – 2 manual hoes + 2 mechanical hoes	167,77	107,34	11,47	-

DL5%= 12,48 DL1%= 16,86 DL0,1%= 22,46

The average values of the chemical indexes from the period 2008-2010 show a high content of vitamin C – 8.02 mg/100g fruit and sugar-acidity index – 73.85% in variant 5 (mulching with mowed grass on the interval). We can also remark variant 9 – *Trifolium repens* on the interval + Roundup 360 SL (3 l/ha) on the tree row, where the apples had the highest refractometric dry substance (13.00%) and sugars (11.32%), a high sugar –acidity index of 79.42 and 7.80 mg/ 100 g fruit vitamin C. The highest acidity was obtained in variant 4 (Gallant Super (1 l/ha) on the tree row, the interval mowed) of 0.270 g/l malic acid. Concerning the vitamin C content, the values were between 7.06 mg/100g fruit in variant 2 and 8.02 mg/100 g fruit in variant 5. The percentage of minerals was low in the control variant (0.13%) and had the highest value (0.18%) in variant 5 – mulching (table 2).

Table 2

Generos variety fruits' chemical composition, average of the years 2008 – 2010

Variant	Minerals (%)	Vitamin C (mg/100 g fruit)	Dry substance (%)	Sugars (%)	Acidity (g/l malic acid)	Sugar-acidity index
V_1 – no herbicides, no mechanical or manual works – control	0,13	7,11	11,70	9,93	0,20	51,11
V_2 – Roundup 360 SL (3 l/ha) on the tree row, the interval mowed	0,14	7,06	12,17	10,43	0,20	51,92
V_3 – Basta 14 SL (5 l/ha) on the tree row, the interval mowed	0,17	7,40	12,50	10,78	0,20	55,16
V_4 – Gallant Super (1 l/ha) on the tree row, the interval mowed	0,15	7,31	12,53	10,82	0,27	41,55
V_5 – mulching with mowed grass on the interval (cover crops on the interval mixture 1)	0,18	8,02	12,30	10,57	0,15	73,85
V_6 – Roundup 360 SL (3 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	0,14	7,42	12,30	10,57	0,14	79,42
V_7 – Basta 14 SL (5 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	0,14	7,22	12,67	10,96	0,19	56,64
V_8 – Gallant Super (1 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	0,14	7,22	12,80	11,10	0,21	52,96
V_9 – *Trifolium repens* on the interval + Roundup 360 SL (3 l/ha) on the tree row	0,15	7,80	13,00	11,32	0,21	54,74
V_{10} – 2 manual hoes + 2 mechanical hoes	0,14	7,47	11,87	10,11	0,18	55,48

Concerning the content of metals in apples, the iron varied between 6.83 ppm in variant 9 and 8.44 ppm in variant 5, while the content of manganese varied between 0.76 ppm and 0.91 ppm in variant 8, where we combined chemical methods and agrotechnical methods of weed control. The zinc content varied between 1.94 ppm (variant 5) and 2.94 ppm (variant 2), while the copper content in apples had values between 2.61 ppm (control variant) and 3.07 ppm in variant 5 – mulching. For all the elements, the values obtained in each variant did not pass the maximum admissible limit (table 3, figure 2).

Table 3

Generos variety fruits' content of metals (ppm), average of the years 2008 – 2010

Variant	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
V_1 – no herbicides, no mechanical or manual works – control	6,89	0,76	2,83	2,61
V_2 – Roundup 360 SL (3 l/ha) on the tree row, the interval mowed	7,55	0,81	2,94	2,85
V_3 – Basta 14 SL (5 l/ha) on the tree row, the interval mowed	7,33	0,84	2,50	2,89
V_4 – Gallant Super (1 l/ha) on the tree row, the interval mowed	7,94	0,84	2,05	3,00
V_5 – mulching with mowed grass on the interval (cover crops on the interval mixture 1)	8,44	0,88	1,94	3,07
V_6 – Roundup 360 SL (3 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	8,27	0,82	2,05	3,00
V_7 – Basta 14 SL (5 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	8,05	0,87	2,33	2,55
V_8 – Gallant Super (1 l/ha) + 2 manual hoes on the tree row, cover crops on the interval	7,11	0,91	2,27	2,50
V_9 – *Trifolium repens* on the interval + Roundup 360 SL (3 l/ha) on the tree row	6,83	0,83	2,39	3,00
V_{10} – 2 manual hoes + 2 mechanical hoes	7,50	0,85	2,61	2,72

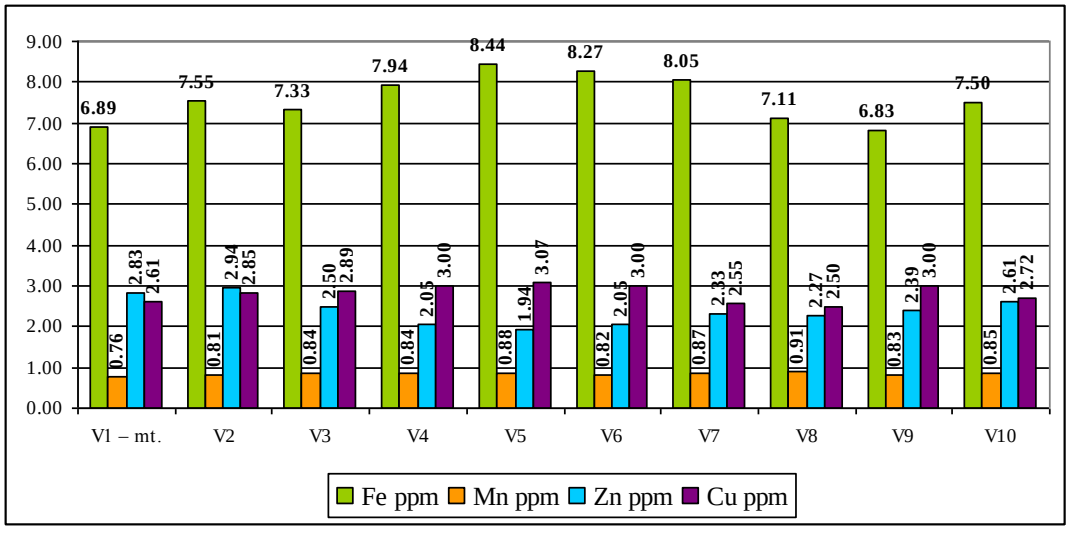

Fig.2. Generos variety fruits' content of metals (ppm), average of the years 2008 – 2010

Conclusions

In terms of fruit size index, the highest values were obtained in variants V5 (mulching with mowed grass on the interval, cover crops on the interval mixture 1) and V7 (Basta 14 SL (5 l/ha) + 2 manual hoes on the tree row, cover crops on the interval).

Concerning the fruit weight, it varied between 156.30 g (control variant) and 179.87 g (variant 6 – Roundup 360 SL (3 l/ha) + 2 manual hoes on the tree row, cover crops on the interval), higher values were also obtained in variant 9 (179.80 g), variant 7 (179.53 g) and variant 5 – mulching (178.77 g), all of them having very significant positive difference to the control variant.

All three years have been favourable in terms of climate for apple culture, mainly temperatures and light conditions, which have helped increase sugar content and decrease acidity of fruits. Among the variants there were not great differences on the chemical composition of the fruits, but we can observe variants 6 (herbicide Roundup 360 SL – 3 l/ha + 2 manual hoes), 5 (mulching) and 9 - white clover + herbicide Roundup 360 SL – 3 l/ha, as having the highest dry matter content and sugar and the highest sugar-acidity index, which was detrimental to low acidity. Fruits of variant 4 (herbicide Gallant Super - 1 l/ha) had the highest acidity.

Metal content of fruits during the average three-years study varied from one variant to another, but for each element there were not exceeded the maximum limits: zinc - 5.00 ppm and copper - 5.00 ppm, according to the *Order of the Ministry of Agriculture, Food and Forest. 293/640/2001-1/2002 on safety and quality requirements for fresh fruits and vegetables intended for human consumption*.

References

1.Ghena N., Branişte N., Stănică F., 2004, Pomicultură generală, Editura MatrixRom, Bucureşti.

2.Grădinariu G., 2002, Pomicultură specială, Ed. Ion Ionescu de la Brad, Iaşi.

3.Iordănescu Olimpia Alina, Micu Roxana Elena, 2010, Researches concerning the use of some herbicides in apple orchards in conditions of the Didactic Station Timişoara, Journal of Horticulture, Forestry and Biotechnology, vol. 14, pp. 113-116, ISSN 2066-1797, Timişoara.

4.Lazureanu A., 2002, Agrotehnica si herbologie, Agroprint Publisher, Timişoara.

5.Lee Susan, 1990, Metals in foods. A literature survey, No.12, The British Food Manufacturing Industries Research Association, Surrey, Marea Britanie.

6.Micu Roxana Elena, 2011, Parametrizarea influenței unor lucrări agrotehnice de întreținere a solului în plantațiile de măr asupra caracterelor fizico-chimice ale fructelor în condițiile Stațiunii Didactice Timişoara, Teză de doctorat, U.S.A.M.V.B. Timişoara.